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IN SEARCH OF THE WATER-WISE MEGACITY

Assessing current and future challenges for sustainable water management in the city of Toronto

MASTER'S THESIS PROJECT

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LIST OF ABBREVIATIONS

BCI	Blue City Index
CA	Conservation Authority
CBF	City Blueprint Performance Framework
CC	Climate Change
CSO	Combined sewer overflow
ERO	Environmental Registry of Ontario
ES	Ecosystem Services
FUNqyWATER	Functional quality of urban surface water (project name)
GCF	Governance Capacity Framework
GCI	Governance Capacity Index
GTA	Greater Toronto Area
GWP	Global Water Partnership
IBC	Insurance Bureau of Canada
IPCC	Intergovernmental Panel for Climate Change
IWRM	Integrated Water Resources Management
LID	Low Impact Development
MECP	Ministry of Environment Conservation and Parks
NGO	Non-Governmental Organisations
OWRA	Ontario Water Resources Act.
RAP	Remedial Action Plan
SD	Sustainable Development
SDG	Sustainable Development Goals
SQ	(Research) Sub-Question
SUWM	Sustainable Urban Water Management
TPF	Trends and Pressures Framework
TPI	Trends and Pressures Index
TRCA	Toronto Region Conservation Authority
TW	Toronto Water
UNEP	United Nation Environment Programme
WUE	Water Use Efficiency
WTP	(Drinking) Water Treatment Plant
WWFP	Toronto Wet Weather Flow Master Plan
WWT	Wastewater Treatment
WWTP	Wastewater Treatment Plant



ABSTRACT

Increasing water challenges are threatening urban regions across the world. Cities in developed countries face the paradox of having universal basic water and sanitation services while experiencing water issues that are as daunting as in developing regions. Such is the case of the city of Toronto in Canada that appears as a region with privileged geographic, economic, and political conditions as well as abundant availability of freshwater. However, the city has historically faced a myriad of water issues that are likely to intensify in the future. Toronto experienced rapid urbanization in the last century which will continue in the upcoming years through population growth and infrastructure development. Climate change comprises another issue that will create extra pressure into the water system. Additionally, water management in the region has been presented as a complicated matter due to the high degree of fragmentation of related institutions, creating challenges of integration and coordination. However, a comprehensive assessment of the actual performance of the city's water management is lacking. In this regard, the main objective of this research is to assess the sustainability of water resources management and the IWRM performance at the city level, as well as the governance capacity to cope with increasing water challenges. It also aims to identify the system's strengths and weaknesses and enable the comparison with other urban areas in a qualitative and a quantitative manner. For these purposes, two assessment methods are considered. First, The FUNqyWATER-project serves as an introductory approach that aims to qualitatively assess the current demands for a wide range of human water use functions as well as the underlying drivers that may lead to changes in future demands. Second, The City Blueprint Approach aims to facilitate the assessment of IWRM by (i) identifying the external pressures and conditions that affects the water system, (ii) determining the current performance of IWRM and (iii) assessing the city's governance capacity to cope with a set of key water challenges. As expected, the results reflect positive results in areas such as provision of basic drinking water and sanitation services, preparedness against water risks, and financing capabilities. However, many weak points were revealed that are not evident, such as insufficient tertiary water treatment, the lack of nutrient recovery or the limited influence on decision-making by the community. The results were compared with other cities around the world but especially with those in the North American region. The integration of the two assessment methods is a potential tool that might be replicated in other cities. Cross-city learning is crucial in the transition towards sustainability of water resources and sound water governance in urban areas.

KEYWORDS:

urban water, water management, multifunctional water use, water governance, water challenges, IWRM

PREFACE

This thesis report has been written as the final step before graduating from the master Water Science and Management at Utrecht University. The research was first conducted in Toronto from November 2019 until March 2020, through an internship for Wageningen University. It was planned to continue the research process in Utrecht, but given the Coronavirus crisis I had to do it from my home country, Chile. Nevertheless, I manage to finalize the job by having online meetings with my supervisors and all the relevant actors involved. This research started with the aim to support the FUNqyWATER project in Toronto, but it turned out to be much more in the end by including the City Blueprint Approach. I am proud to state that this final document is my own original work. It has been a long journey full of gratifying and nice experiences, despite the unstable times we are all currently living. This research opportunity not only increased my expertise on water management, but it also allowed me to learn from different cultures and work in different environments.

I would like to thank my supervisor at UU, Carel Dieperink, for his support and cooperation during the process as well as his continuous constructive feedback on the drafts. Also, thanks to my supervisors at Wageningen University, Suzanne van der Meulen and Pim de Jager, for the internship opportunity and for all their help during my time in Toronto. Many thanks to Kees van Leeuwen for his priceless feedback on the City Blueprint approach and the opportunity to use these methods. I would also like to thank all the people that participated in this research as interviewees for their valuable contributions and for freeing up time on their agenda.

Special thanks to my fellow classmates of the master programme and to all the people I met during my time as a student at UU and during the research in Toronto, who contributed in some way to make this research and my graduation possible. Finally, thanks to all my friends and family for their support during this wonderful time as a master's student.

Santiago, Chile, June 2020
Sebastian Rivadeneira

1. INTRODUCTION

1.1. The challenges of urban water management

Urban water management around the world is being challenged with rapid urbanization, population growth, aging infrastructure and climate change pressures (World Economic Forum 2016; Koop and Van Leeuwen 2016). The United Nations projects that 6 billion people, around 68% of the total population, will be living in urban areas by 2050 (UN, 2019) and urban water systems will face higher demands since human needs related to different uses of water will increase. (OECD 2018; UN Water 2018). The infrastructure to meet those needs is already seriously stressed and therefore the sustainability of large cities is a challenge (Johns, 2019). During the last 50 years, the provision of water and wastewater service has been taken for granted in large cities of developed countries, but these systems could be seriously tested over the next decades. Urban regions are especially vulnerable to flooding events, which will become more frequent and higher in magnitude (EEA, 2012). Additionally, water bodies around large cities are facing serious pollution problems due to insufficient wastewater treatment and solid waste dumping (Koop et al., 2017).

When it comes to water management for sustainable cities, water quality and quantity emerge as key factors, especially in large urban areas where there is a growing water demand for traditional uses, like drinking water or heating, but also for others such as urban farming, recreation and so on (Brauman et al., 2014; Sadiq & Karney, 2015). Population growth and demographic changes act as pressures in urban water systems and limit their ability

to supply multiple services (OECD 2018; UN Water, 2018). In addition, more extreme weather events are expected as a result of climate change (Vörösmarty et al., 2000). With more intense rainfall events and longer dry periods, water management becomes a more complex and delicate matter.

Particularly, Canadian cities are struggling with water management issues and exhibit difficulties in adapting to new events and challenges, such as those related to climate change (GOVCA, 2009; Burgess 2012; Johns, 2018). Water management in Canada and particularly in Ontario is described as complex, given the highly fragmented network of institutions related to water governance (Bakker & Cook 2011; Cook, 2014; Worte, 2016). However, it remains uncertain how this institutional fragmentation at the federal and provincial level affects water management at the urban level for a city like Toronto, given the lack of a qualitative or quantitative assessment that enables comparison with other urban regions.

Thus, the main objective of this research is to assess the sustainability of water management in the city of Toronto in a holistic way, identifying its strengths and weaknesses. Particularly, the research looks to measure the degree of water governance integration and its capabilities to address future water challenges in an effective and efficient way. Furthermore, it is intended to determine how well the city is prepared to face changes in water demands that will occur as a consequence of population growth, infrastructure development and climate change.

1.2. Conceptualising sustainability and IWRM

When promoting sustainable water management in an urban context, the concept of sustainability must firstly be clarified. In order to sustainably use water, this resource should not be compromised for future generations, nor the services that are provided by it, for both social and environmental benefit. This, according to the most widely accepted definition of sustainable development (SD): “development that meets the needs of the present without compromising the ability of future generations to meet their own

needs” (Brundtland Report, 1987). Urban resilience is an important tool to avoid compromising water resources in cities. The concept of resilience can be defined as “the capacity of a system to return to a desirable state after being subjected to a disturbance” (Folke, 2006). It therefore plays an important role in sustainability. Urban resilience in the context of water management can thus be understood as the capacity of a city to cope with water challenges and maintain the current and future benefits that the society gets from the natural and built environment. Additionally, sustainable urban water management should be robust but flexible at the same time, in order to succeed under different future scenarios and being able to adapt to unforeseen, uncertain and sudden changes (Haasnoot et al., 2013; Koop et al., 2017).

On the other hand, Integrated Water Resources Management (IWRM) is defined as “a process which promotes the coordinated development and management of water, land and related resources in order to maximise economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems and the environment” (GWP, 2000). This concept has gained recognition in recent decades and is widely proposed as a fundamental tool to reach SD and to cope with water related challenges (Burton, 2003; UNEP, 2018). Moreover, within the framework of Sustainable Development Goals (SDG), UNEP has declared SDG 6.5 as “... by 2030, implement integrated water resources management at all levels ...” (UNEP, 2018). Thus, this SDG explicitly advocates for IWRM as an essential means to move towards SD. It does so by assessing the (i) the actor and institutions; (ii) the degree of enabling environment; (iii) the management instruments; (iv) and financial aspects of the water system.

A concept that naturally emerges as a consequence of seeking and promoting IWRM in cities is the sustainable urban water management (SUWM), which is intended to provide responses to the challenges related with rapidly growing urban population, environmental degradation and the consequences of climate changes in cities (Brown et al., 2009). However, to avoid the excessive use of different concepts, “IWRM in urban context”, or simply IWRM, will be preferred instead of SUWM, as they are considered equivalent for the purposes of this research.

Finally, the concept of water governance must be explained. The definition provided by the Organization for Economic Cooperation and Development OECD, also adopted by the GWP and the World Bank, states that “Water governance is the range of political, social, economic, and administrative systems that are in place to develop and manage water resources, and to deliver water services at different levels of society” (OECD, 2011). In this regard, inadequate governance is likely the biggest barrier on the way to IWRM as “water crises are primarily governance crises” (Pahl-Wostl 2009; OECD 2015b).

1.3. Problem definition and context

Water management in Canada is a complicated task, not only because of the vast territory, but also due to the fact that this country has one of the most decentralized approaches to environmental and water governance, with a high degree of fragmentation within the federal state (Bakker & Cook 2011). This approach has created challenges for coordination, integration, and data availability especially when dealing with new issues (Bakker & Cook, 2011). For example, in the last UNEP report related to progress on Integrated Water Resources Management (IWRM) for SDG 6.5, the country faced serious difficulties for data collection and finally failed to submit its self-assessment (UNEP, 2018). When it comes to Ontario specifically, integrated water management has become a multi-agency environment that has hindered effective management during last decades (Worte, 2016). Implementation of water plans in Ontario is described as challenging, as the governance structure is fragmented and lacks a thorough water management strategy at the provincial level (Worte, 2016).



The Greater Toronto Area (GTA) represents the most economically vital city in Canada. This region has gone through intense demographic shifts in the past decades due to rapid population growth, migration and urban merging and expansion. Although at a slower pace, it is expected that this situation will continue in the upcoming years (Wang et al., 2015a), turning Toronto into a megacity over the following decades (Vaz and Bowman, 2013; Vaz & Arsanjani, 2015). Therefore, some major water challenges are expected due to demographic change and intense infrastructure development (Vaz and Bowman, 2013; Vaz & Arsanjani, 2015). These challenges relate to the capacity of water distribution systems, wastewater management, and flood protection. Additionally, climate change emerges as another driver that stresses the water system. As human-induced climate change is not expected to be uniform across the globe, there are some particularities when it comes to Toronto (Wang et al., 2016). Several studies have been conducted to analyse the local impact due to climate change. All of them agree that average temperatures will increase (Brown et al. 2015; Wang et al., 2015b; Wang et al., 2016; Sadiq & Karney 2015) with Brown et al. suggesting an average increase of 1.9 °C causing issues in the urban area. An increase in the intensity of rainfall storms is also likely to occur with an expected variation of +10% by 2050 (Wang et al., 2015b). Although total annual rainfall will not vary significantly, it is very likely that the interannual distribution will be altered, with a decrease in water availability for summer periods (Li et al., 2016). Then, adaptation strategies should be undertaken to face these issues and urban planners need to consider climate change scenarios for future projects and water supply systems (Sadiq & Karney 2015).

Toronto appears as a city that has historically faced serious problems related to managing water quantity and quality. Despite being fortunate to have abundant freshwater reserves due to the proximity of Lake Ontario, the city has been threatened in certain periods due to poor water quality, water shortages and accessibility issues related to deficiencies in the distribution water system. Moreover, decades of population expansion and urban development have reconfigured the natural environment of this region (Vaz & Arsanjani, 2015; TRCA, 2016; Worte, 2016). Thus, in 1986 the city was declared as an area of concern (AOC) due to the degradation of water quality and several environmental problems (GOVCA, 2017). The Remedial Action Plan (RAP) for Toronto and the region was implemented in 1987 aiming to restore the water quality and habitats (TRCA, 2016). Since then, there have been improvements in this regard, but it is still not enough to declassify the city as an AOC (TRCA, 2016; SPC, 2015).

Currently, Toronto is going through a period of intense infrastructure development, especially in the downtown area. Alongside intensified challenges to water distribution for different uses, the management of stormwater and wastewater presents serious challenges with some systems working at maximum capacity. Flooding in this city is a well-known issue, especially due to historical catastrophic events as the hurricane Hazel in 1954, which had devastating effects. However, the flood protection infrastructure is quite outdated and there is no certainty about how major works may be financed. For wastewater infrastructure, policymakers face the dilemma of either expanding the current systems or opting for more innovative solutions. On the one hand, the expansion of centralized wastewater collection and drinking water provision services is the typical solution for large cities but it is always costly and limited. On the other hand, decentralized solutions are also costly but present several benefits as the reuse of nutrients, water savings, efficient treatment, savings on energy, less impact on the environment and so on.

1.4. Knowledge gap

Given the high degree of institutional fragmentation at the country and provincial level, it is worth asking how these governance barriers affect Toronto's water management in practice. When reviewing the available literature, no studies were found that accurately and exhaustively evaluated how sound or sustainable water management is in the city. There is not a quantifiable assessment that enables measuring the degree of water management integration either. Therefore, there is great uncertainty about how Toronto's water governance may cope with future water challenges and projected changes in water demands as a consequence of climate change, population growth and other drivers.

The concepts of IWRM and Adaptive Management (AM) have emerged as good tools for a better understanding of water issues in a more holistic manner. However, and despite the contributions of these concepts, both have proven difficult to implement in practice, due to the lack of concrete guidelines. They tend to focus only on the technical aspects of the problems and thus have failed to deliver concrete and effective solutions (Koop et al., 2017). In this regard, The City Blueprint Approach aims to provide an integrated and concrete assessment of the water management performance at the city level. The three stages of this approach comprise a coherent framework that can be used in this research for an empirical understanding of water management and governance processes in Toronto (Koop & Van Leeuwen, 2015a). The results obtained by applying these methods may be comparable and transferable to other cases.

On the other hand, assessment frameworks in the existing literature do not consider all possible water services. Typically, researchers focus on traditional uses such as drinking water or other provisioning functions. Therefore, they are of limited assistance in a comprehensive evaluation of the urban water system. In this regard, the FUNqyWATER approach “aims to develop an assessment framework that enables identification of the potential for multifunctional use of urban surface water and of water management options to optimize potential for multifunctional use” (Van der Meulen, 2017). This research will use specific tools from this approach to assess the current and future demand for different urban water uses in Toronto and the underlying drivers of change.

Overall, this research aims to address the current knowledge gaps relating to Toronto's water management performance, and its governance capacity to address future water challenges and changes in demands by different water services. Filling those gaps may create coordination and integration opportunities for policymakers, especially given the urgency in decision-making and planning for the future. Furthermore, it enables comparison with other regions and facilitates cross-city learning. The integration of different frameworks and the analytical processes of this research are also potential tools that might be replicated in other cities.

1.5. About this report

This report is the final result of the master's thesis research conducted between November 2019 and May 2020 about the Toronto's water system and its governance capacity.

Section 2 presents the research objectives and questions as well as the research framework. Section 3 provides the theoretical background in which the two main research approaches are described, the FUNqyWATER and the City Blueprint. Section 4 describes the methodology that was used through the process and the research strategy. Section 5 presents the main results for both the FUNqyWATER and City Blueprint approaches. Section 6 focuses on the key discussion aspects derived from the results and the research process. It also presents the limitations and opportunities for further research. Section 7 provides the final conclusions of the research.

2. RESEARCH OBJECTIVE

The main objective of this research is to assess the governance capacity of Toronto to cope with current and future water challenges in the city. For this purpose, the two previously described approaches will be used. On the one hand, the FUNqyWATER approach assists in evaluating the current and future uses of water by use function as well as the drivers related to changes in future water demand. On the other hand, the City Blueprint approach is used to concisely assess the overall IWRM performance in the city.

2.1. Research questions

Thus, the main research question is:

RQ: To what extent is current water governance capacity able to address future water challenges in Toronto?

To analyse the capacity of the water management system in Toronto, it is first necessary to study the main physical components of the current water system and its political, financial, social and regulatory dimensions. Then, the first sub-question that arise is:

SQ1: What are the main components of the Toronto's water system and who are the major stakeholders?

Subsequently, The FUNqyWATER approach is applied to assess the current urban water uses by different use functions.

SQ2: What are the current uses of water in the city?

Climate and demographic change have been already presented as major drivers of change for Toronto's water system. However, some others could be derived from the analysis of the interviews, as well as pressures resulted from these drivers that are not easily noticeable. Once the main drivers have been identified, the literature review and expert interviews will assist in identifying the future trends for water demand. Then, the following sub-question is:

SQ3: What are the future trends for water demand by use function and what are the major drivers related to the changes?

To provide a complete picture of the current performance of water management in Toronto, the indicators for the TPF and the CBF will be calculated. Then, the next question can be answered.

SQ4: What is the current Water Management Performance of Toronto and how does this compare to other cities

The results of these indicators for Toronto can be compared with that obtained for other cities around the world, but also specifically with other cities in North America (Feingold et al., 2017).

In this stage of the research, the GCF will be used to assess the Toronto's water governance capacity. As a result of this analysis, future water management challenges will be identified. To provide recommendations and strategic advice to assist water managers, it will be necessary to answer the last sub-question:

SQ5: What is the actual governance capacity in Toronto?

2.2. Research framework

The schematic diagram presented below illustrates the logical sequence followed by this research:

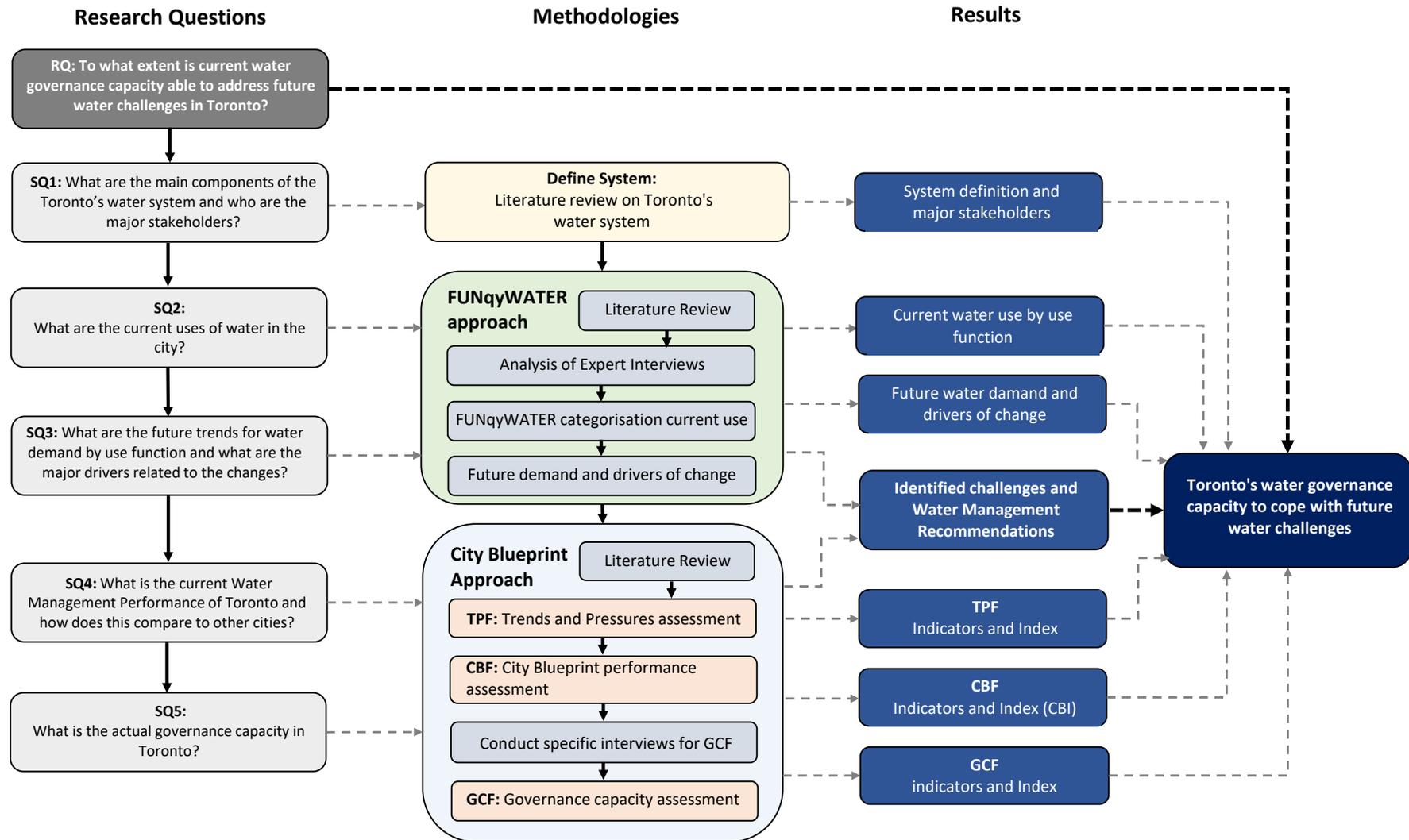


FIGURE 1: RESEARCH FRAMEWORK

3. ANALYTICAL FRAMEWORK

As stated before, two assessment frameworks are intended to be combined within this research. The FUNqyWATER and the City Blueprint approaches.

3.1. The FUNqyWATER assessment framework

An important goal of water management is to achieve a sound balance between supply and demand for each water use function. Projection of water demands is crucial for the sound performance of existing supply systems and the future urban planning. (Sadiq & Karney 2015). Then, the evaluation and control of water demand and quality for multiple use functions is an issue that needs to be considered by water managers. In this regard, the FUNqyWATER project aims to develop an exhaustive assessment framework that enables identification of different human use functions for urban surface water and optimize the potential for multifunctional uses (Van der Meulen, 2017). The acronym stands for functional urban water quality.

FUNqyWATER also looks for the underlying drivers of change. As the Earth system has entered an increased water scarcity phase, it becomes urgent to know and understand the factors that control water demands. This necessity is evident at a global scale, but particularly at the level of urban centres that concentrate large numbers of people in relatively small territories. In this regard, academic efforts have focused on studying the drivers of water demand mainly for extraction purposes, considering meteorological, demographical, socioeconomical, behavioural and political variables. Thus, this project also aims to identify the drivers for the whole range of use functions.

Two important aspects of the approach in relation to this research are worth to mention at this point. First, FUNqyWATER is an ongoing research, therefore the assessment framework is not yet finalized. The cities of Toronto and Amsterdam are being used as “as living labs” for developing and testing the framework. However, this research will use the first phase of the project as it is considered relevant for its purpose. This relates to the identification and evaluation of current uses and future demands of urban water for different use functions, as well as the underlying drivers of change. Second, this approach focuses on urban surface waters, which consider waters from Lake Ontario, the rivers, ponds, creeks, and other surface water bodies. However, since most uses are provided by surface water in Toronto, given its location next to Lake Ontario, in this research the term “urban surface water” will be replaced by urban water or simply water.

FUNqyWATER aims to identify a broad variety of water use functions and their future trends. Thirty-three use function are established into different categories in a similar manner as the classification proposed by the ecosystem services literature (CICES, 2018). However, FUNqyWATER goes one step further by including a fourth category related to the use of the space provided by water. (i) The first category consists of provisioning use functions. This relates to products and goods that we can retrieve from the surface water system. Examples of functions on this category are drinking water and fishing. (ii) The second category is related with regulation and maintenance use functions, as surface water system can be used to manage water quality and quantity but also to regulate the climate. (iii) The third category is about cultural functions. Many of these functions are related to recreation but it also considers cultural and religious functions. (iv) The last category is composed by different uses that are related to using the space that is provided by water, as transport or building on water (Van der Meulen, 2017). Table 1 (Van der Meulen et al, submitted) shows the whole list of use function within this framework.

Looking at the whole picture of the diverse functions related to water use, the different interactions among them, and how they could change in the future, could provide a better understanding for decision makers and a basis for adaptation to climate and demographic change.

TABLE 1: THE 33 USE FUNCTIONS OF THE FUNQYWATER FRAMEWORK

Section 1/4 provisioning use functions		
CATEGORY	CODE	USE FUNCTION
Nutrition	U1-1	Fishing for consumption purposes
	U1-2	Catch of other surface water related animals for consumption
	U1-3	Harvest of aquatic plants or algae for consumption
	U1-4	Surface water extractions for drinking water production
Materials; water extractions for non-drinking purposes	U1-5	For irrigation of crops, livestock watering
	U1-6	For irrigation of other vegetation
	U1-7	For industrial process water
	U1-8	For fire fighting
	U1-9	For filling ponds
	U1-10	For other non-drinking purposes
Other materials	U1-11	Extraction of biomass for non-food purposes
	U1-12	Extraction of abiotic materials
Energy	U1-13	Thermal energy extraction
	U1-14	Energy production by using the salinity gradient in water
	U1-15	Energy production by using kinetic energy of water
Section 2/4 regulation and maintenance use functions		
CATEGORY	CODE	USE FUNCTION
Mediation of waste, toxics and other nuisances	U2-1	Managing water quality
Mediation of flows	U2-2	Managing water quantity
Maintenance of physical, chemical, biological conditions	U2-3	Global climate regulation by reduction of greenhouse gas concentrations
	U2-4	Local climate regulation
Section 3/4 Cultural use functions		
CATEGORY	CODE	USE FUNCTION
Physical and intellectual interactions	U3-1	Primary contact recreation
	U3-2	Secondary contact recreation
	U3-3	Recreational boating without water-body contact
	U3-4	Recreational fishing
	U3-5	Hunting aquatic animals
	U3-6	Enjoying a landscape characterized by surface water
	U3-7	Ice-skating
Spiritual, symbolic interactions (...)	U3-8	Designation of cultural heritage value
	U3-8	Religious use
Section 4/4 Space		
	CODE	USE FUNCTION
	U4-1	Building on water
	U4-2	Under water storage
	U4-3	Transporting goods
	U4-4	Transporting persons
	U4-5	Using water as a barrier

3.2. The City Blueprint Approach

The City Blueprint Approach (Koop & Van Leeuwen, 2015a), is a promising tool that may reveal the water governance strengths and weaknesses to achieve IWRM and to cope with future urban water challenges. In the case of this research, it will be used to better know and understand the current Toronto's water management system. The main objective of this approach is to act as a baseline for the assessment of IWRM at the city level in order to provide strategic planning to water managers. It assists them to develop and implement measures and actions to transform towards more adaptive cities by increasing awareness about sustainability issues related to the use of water (Koop & Van Leeuwen, 2015b). The City Blueprint Approach consists of three complementary frameworks, as shown in Figure 2. (i) the Trends and Pressures Framework (TPF) presents the major challenges related to water management; (ii) The City Blueprint Performance Framework (CBF) assesses the cities performance of water cycle management; finally (iii) the Governance Capacity Framework (GCF) provide an understanding of how and where cities may enhance their water governance (Koop et al., 2017).

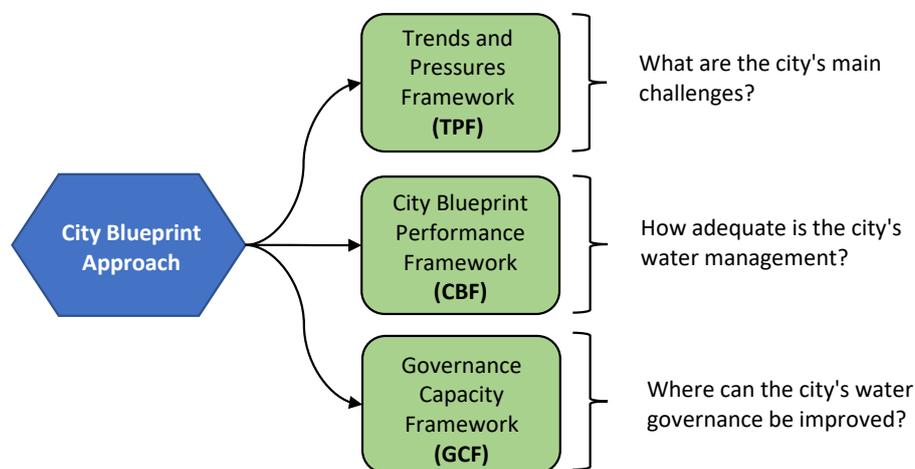


FIGURE 2: CITY BLUEPRINT APPROACH

(ADAPTED FROM KOOP ET AL., 2017 APPENDIX INDICATORS OF THE WATER GOVERNANCE CAPACITY FRAMEWORK)

3.2.1. Trends and Pressures Framework (TPF)

The TPF is used to provide the context about the climatic, and socio-economic conditions of this city on which decision makers have no influence. This framework is supplementary to the CBF and GCF and show the most relevant issues that may hinder or present opportunities to improve performance towards an IWRM (Koop & Van Leeuwen, 2015a). The TPF is composed of 24 indicators that scores from 0 to 10, from no to great degree of concern, according to Table 2. The result is also a spider diagram showing the score of each indicator and the Trends and Pressure Index (TPI), which is the average of all the indicators. Those indicators are divided into 4 categories. (i) The first category being social pressures and includes urbanization rate, burden of diseases, education rate and political instability. (ii) The second category corresponds to environmental pressures and includes flooding, water scarcity, water quality, heat risk and air quality (iii) The third category is related to financial pressures and includes economic pressure, unemployment rate, poverty rate and inflation rate and (iv) The last category relates to governance and includes accountability, political stability, government effectiveness, regulatory quality, rule of law and control of corruption (Koop & Van Leeuwen, 2015b).

TABLE 2: TPF SCORING SCALE

TPF indicator score	Degree of concern
0 – 2	no concern
2 – 4	little concern
4 – 6	medium concern
6 – 8	concern
8 – 10	great concern

3.2.2. City Blueprint Performance Framework (CBF)

The CBF is used as baseline and first attempt to assess the actual IWRM performance of a specific city. It aims to be a first step for water managers to develop strategic water planning. It also allows for comparison with other already assessed cities and therefore might promote inter-city learning. The CBF is made up of 24 indicators that are scores from 0 to 10 (from low to high performance). These indicators are divided over seven broad categories. The result is a spider diagram showing the score of each indicator and the Blue City Index® (BCI), which is the average of the 24 scores. The categories are 1) Basic water services, 2) Water quality, 3) Wastewater treatment, 4) Water Infrastructure, 6) Solid Waste, 6) Climate adaptation and 7) Plans and actions. Detailed information about the rationale of the method can be consulted in Koop and Van Leeuwen (2015a).

The scoring scale for the CBF is presented in Table 3

TABLE 3: CBF SCORING SCALE

CBF indicator score	Performance
0 – 2	Poor
2 – 4	Low
4 – 6	Medium
6 – 8	High
8 – 10	Excellent

3.2.3. Governance Capacity Framework (GCF)

Finally, The GCF aims for a better understanding of the underlying conditions that determine the capacity of cities related to water governance. It does so through an integrated and empirical approach which allows to address water governance challenges on a continuous basis and enable the comparison of cities to facilitate decisions-making processes by water managers. The authors argue that to get the governance capacity that can provide effective changes, a well-balanced set of conditions are required. Nine conditions are identified within the framework, each of them with three indicator that must be assessed and scored. These conditions are (i) awareness, (ii) useful knowledge, (iii) continuous learning, (iv) stakeholder engagement, (v) management ambition, (vi) agents of change, (vii) multi-level network, (viii) financial viability and (ix) implement capacity. In this way, this framework focuses on different urban water challenges, such as water scarcity, flood risk, wastewater treatment, solid waste treatment and urban heat islands (Koop et al., 2017). Thus, water governance capacity is defined as “the key set of governance conditions that should be developed to enable change that will be effective in finding dynamic solutions for governance challenges of water, waste, and climate change in cities” (Koop et al., 2017).

The next table shows the scoring scale used for the GCF.

TABLE 4: GCF SCORING SCALE

GCF score	Interpretation	Numeric score
--	Very Limiting	0
-	Limiting	1
0	Moderate	2
+	Encouraging	3
++	Very Encouraging	4

The GCF uses a sign scoring scale (-; -; 0; +; ++) from very limiting to very encouraging. This table shows the numerical conversion used in this research in order to average the participants' responses.

3.2.4. Score calculations

The information collected in the literature review was mainly used. In some cases, the missing information was supplemented with the responses of the different interviews analysed and conducted for this research. Then, for the calculation of all the TPF, CBF and GCG scores, the authors' guides from the City Blueprint Approach were used (EC, 2015).

A repository for all documentation on the CBF, TPF and GCF calculation methods and rationale can be found on the website of the European Innovation Partnership on Water (EC, 2015).

4. METHODOLOGY

4.1. Research strategy

Regarding SQ1, a detailed in-situ observation was conducted first to gain a deep understanding of the Toronto's water system. Then, a literature review was conducted in order to get valuable information related to the physical components. This information relates to the main water streams, the most relevant water infrastructure, the major stakeholders involved and the responsibility of different authorities. After these introductory activities, the necessary information to evaluate the indicators that are part of the TPF and CBF were gathered. This latter was made by following the guidelines proposed by the authors.

To address SQ2, policy and planning documents were reviewed to assess the current demand by use function but also the analysis of the specific interviews conducted for the FUNQyWATER project assisted in this regard.

For SQ3, it was necessary to process and analyse the information and textual data about future water demands for different uses and their drivers of change, from the corresponding interviews. This task was performed with ATLAS.ti software. Then, the interviews data was compared with existing literature on drivers of change in order to assess the future demand by use function.

Related to SQ4, the current water management performance of the city was assessed through the application of both the CBF and the TPF. The outcome of these methods are spider diagrams that shows the score for each of the indicators and the TPI and CBI. The results obtained will be compared with other cities around the world, but also specifically with other cities in North America that has been analysed with the same methodology.

To address SQ5, ten interviews were conducted amongst different stakeholders about water governance and the most relevant water challenges. Then, the indicators and index for GCF were evaluated and calculated. This task was made by following the author's proposed guideline, as the same way as for TPF and CBF. The challenges that naturally emerged after this process were identified at this point. Then, strategic recommendations for sound water management will be provided in the discussion section, based on validated literature and the interviews.

4.2. Literature review

An extensive literature research was conducted to assess each of the aspects of the present research. Firstly, a broad review was carried out on the water system reviewing academic papers as well as local documentation. At this stage, the focus was related to gain (i) a general overview of the urban water system of Toronto and infrastructure; (ii) the riverine system and the natural surface water system; (iii) the main stakeholders that have influence on water management in the city; (iv) the different regulations, bylaws and guidelines that are related to water management. Secondly, a dataset from the FUNQyWATER-project was used to get insight on how the community interacts with this resource. The dataset includes information on the different human uses of the water currently taking place. The drivers of change that will determine the future demand for those use functions were obtained by analysing interview transcripts provided by the FUNQyWATER-project. Such research was carried out specifically for the city of Toronto but also in a global context, resulting in **Appendix V** of this thesis report. Finally, in the case of the research that relates to the City Blueprint Approach, for both TPF and CBF, the guidelines proposed by the authors were used when looking for information. In this sense, the suggested literature was consulted first. However, for most of the indicators there was no information

for Toronto or Canada, so local documents and other specific literature had to be used. A more detailed explanation will be provided in the results section of this thesis report.

4.3. Expert interviews

In the context of the research to assess the water uses according to the FUNqyWATER categorization, 5 interview transcripts were analysed to get information on current use, future demands and drivers of change. It is worth mentioning that these interviews were conducted by researcher Suzanne Van der Meulen. The contribution of this study, as part of a research internship for Wageningen University, was to analyse the results and encode each of the responses with ATLAS.ti software. Basically, the interviews went through each of the use functions of the FUNqyWATER categorization, asking respondents about how surface water is currently used in the city, how they think demands will change in the future and what are the drivers of change related to those changes. The interviewees represent different organizations that are involved in the planning and management of water resources. These institutions are (i) Toronto Water (TW), (ii) The Ministry of Environment Conservation and Parks (MECP), (iii) Toronto Region Conservation Authority (TRCA) and (iv) the City of Toronto. To protect the identity of the interviewees, some data was anonymised. Analysis of interviews data using ATLAS.ti is provided in **Appendix IV**. Raw interview transcripts are available for review upon request. To facilitate the citation in this document, each interview was titled with “FW” and a number from 1 to 5, resulting in the codification: FW1; FW2; FW3; FW4; FW5.

In the case of the city Blueprint Approach, specifically about the GCF, 10 interviews were conducted specifically to assess this framework. Based on a preliminary evaluation, it was determined through the respondents' own consultation, that the water challenges of water scarcity and urban heat island are not an important issue in the city and are not on the top of people's minds either. Therefore, they were not considered for the interviews. On the other hand, the waste management strays too far from the research core, so it was also decided to exclude it from the interviews. This is how 3 aspects or challenges were considered to address the interviews. These are flood risk, wastewater management and a general assessment of the city's governance capacity which focused specially on IWRM aspects, as made by Munkhshuld et al., for the city Ulaanbaatar, Mongolia (2020). In this sense, each of the participants answered about one or some of these aspects, based on their own expertise, vision and experience. Again, the interviewees represent different organizations or institutions that are involved in water management. Thus, the group of ten people is made up of two (2) persons working in TW, (2) persons working on the MECP, one (1) person working on TRCA, one (1) representative of the Federal Ministry of the Environment and Climate Change Canada, one (1) representative of the private sector, specifically on water infrastructure, and finally three (3) professor and researches on water resources and water management. Some data was anonymised as well, to protect the identity of the interviewees. The Interviews transcripts for the GCF assessment are provided in **Appendix III**. Each interview is titled with a specific code: TGP-1; TGP-2; TGP-3; TGM-1; TGM-2; TGF-1; TI-1; TA-1; TA-2; TA-3.

4.4. Urban water events

As part of the research process, I participated in two events that took place in the city of Toronto during January 2020, which covered topics related to urban water. First, a workshop that was a focus group discussion conducted as follow up of the FUNqyWATER interviews and it was therefore useful to gather additional qualitative data. And second, a symposium that was a collection of sixteen presentations related to urban water, covering topics such as new treatment technologies, contaminants of emerging concern, water governance, water infrastructure, and so on.

5. RESULTS

This section presents the results following the sequence of the research questions. Section 5.1 addresses sub-question SQ1, describing the main components of the Toronto's water system as well as the major stakeholders related to water management. Section 5.2 shows the results related to the FUNqyWATER approach, regarding current and future demands for different uses and the corresponding drivers of change, to respond sub-questions SQ2 and SQ3. Section 5.3 presents the results for the City Blueprint Approach, related to the actual water management performance and the water governance capacity of the city, revealing the answers for sub-questions SQ4 and SQ5.

5.1. System background

5.1.1. The Toronto's water system

The Great Toronto Area (GTA) is the metropolitan area formed by the central city of Toronto and the regional municipalities of Halton, Peel, York and Durham. The water system in the GTA is directly influenced by the presence of the Lake Ontario located to the south of the city. Across the shoreline of this lake, nine watersheds drain into it in a predominantly south-easterly direction. From the west to the east these watersheds are Etobicoke Creek, Mimico Creek, Humber River, Don River, Highland Creek, Rouge River, Duffins Creek, Petticoat Creek, and Carruthers Creek (Figure 3). All these watersheds are river watersheds, except for the waterfront which drains directly into Lake Ontario (TRCA, 2018a). The major rivers are the Humber, the Don and the Rouge. All of them are considered shallow rivers as their depths are less than 1 m.

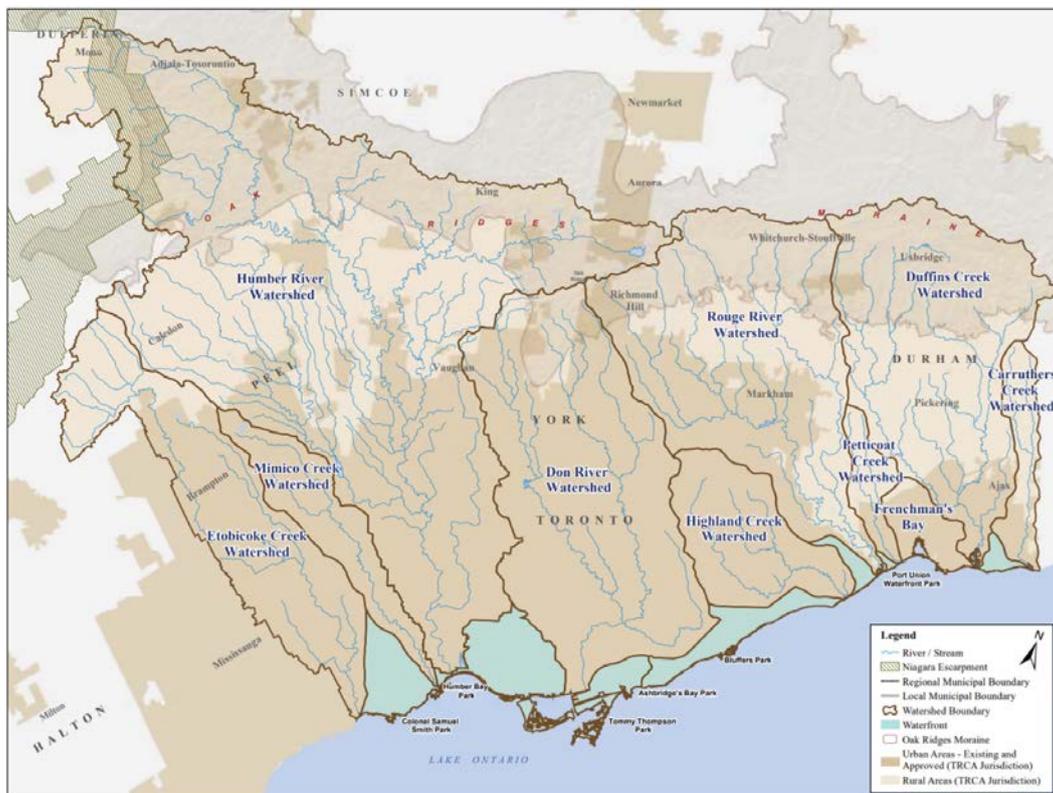


FIGURE 3: CITY WATERSHEDS IN THE GTA
Source: Watson et al., 2019

The Humber represents the larger river and the biggest basin with 903 km². Its source is the Huber Spring Pond. It was designated a Canadian Heritage River on 1999 for its recreational and cultural values. It collects from several tributaries and creeks in a fan-shaped area located to the north of Toronto. The main branch of the river runs for approximately 100 kilometres from the northwest. Another major branch (the East Humber River) starts at Lake St. George in the northeast of the watershed. Those two branches join north of the city and then flow into the Lake Ontario in a mainly south-easterly direction. The mouth of the river is surrounded by Humber Bay Park East and Sir Casimir Gzowski Park. The average flow of the Humber is 8 m³/s.

The Don river basin is 360 km² and its source is the Oak Ridge Moraine. It is formed of two main branches, the East and West ones, that join about 7 kilometres north of Lake Ontario while flowing into the lake in a southward direction. The areas above the confluence is known as the upper Don, while the area below as the lower Don. The Don Valley is well known for its deep wide valley in the lower part because of its glacial origins. The river has low base flows, but peak discharges are very high in comparison, due to the high degree of urbanization. The average flow of the Don is 4 m³/s. The river discharge into the lake at the north east corner of the Toronto Harbour.

The Rouge River basin is 336 km² and its source is the Oak Ridge Moraine. Its average flow is 1.76 m³/s. The river flows to Lake Ontario at the eastern border of Toronto and its mouth is the location of Rouge Park, the only national park in Canada within a municipality. The southern third of the watershed is protected by Rouge National Urban Park, with just one area of urban development located to the west of the park.

The ravine system is one of the most distinguishing features of the Toronto's geography (Figure 4). It is a complex network of deep ravines forming a large forest that runs throughout much of the region. The ravines are largely undeveloped and most of them are protected and designated as parkland. There are four major groups of ravines, and many smaller groups scattered throughout the city.

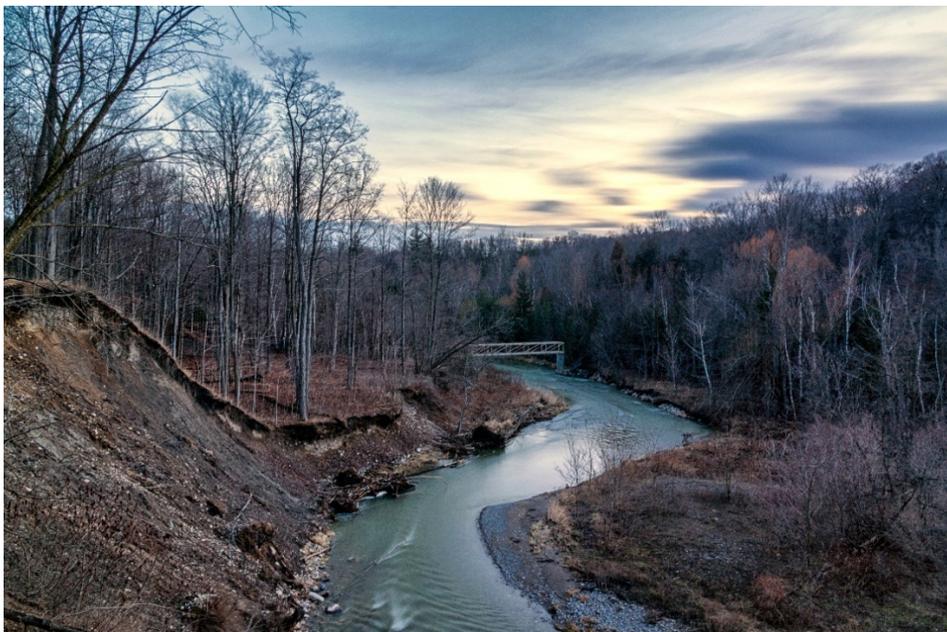


FIGURE 4: RAVINE LANDSCAPE IN THE ROUGE RIVER

Source: <https://commons.wikimedia.org/> Attribution-Share Alike 4.0 International license.
Original Title: Rouge river creek view on top of one of the parks bluffs. author: Thanujan24.

In 1986 the city was declared as an area of concern (AOC) due to the degradation of water quality and several environmental issues. The Remedial Action Plan (RAP) for Toronto and the region was implemented in 1987 aiming to restore the water quality and habitats. Since then, there have been improvements, but it is still not enough to declassify the city as an AOC. The Humber and the Rouge watersheds have the best water quality within TRCA's jurisdiction, while the Don and Mimico watersheds have the worst. The water quality condition is directly related to the degree of urbanization. The largest contributors to poor water quality are nonpoint sources of pollution from urbanization, such as sediment, nutrients and chemicals. Total phosphorus has decreased over the past 20 years while chloride show an increasing trend. This is mainly due to the use of road salts which are used as de-icing during winter road maintenance. All the watersheds are classified with poor or very poor grades for stormwater management, except for the Rouge and Carruthers. Only 35% of the developed urban areas of the region have stormwater management controls (for the year 2013). This ranges from 77% in the Rouge to 9% in the Highland (TRCA, 2018b).

23% of the city has combined sewer localized especially in the older parts, while in the new neighbourhoods it is separated. There are 4 drinking water plants along the shoreline as well as 4 WWTP's, discharging into Lake Ontario and Don River (Figure 7). To reduce combined sewer overflow and bypasses, there are tunnels, tanks and storm water ponds to store storm water. These ponds collect runoff from rain and melted snow, stormwater management reducing localized flooding and erosion and improving water quality.

5.1.2. Relevant stakeholders

Table 5 shows the stakeholders that are considered the most relevant for the Toronto's water system. They were selected through key criteria, as (i) their role in water management and policies, (ii) dependence on the use functions provided by the water system and (iii) other criteria such as interest, knowledge, expertise and scientific research.

TABLE 5: AN ASSORTMENT OF RELEVANT STAKEHOLDERS WITHIN TORONTO REGION

Type	Stakeholder Name
Political-Institutional	Federal Government and Ministries
	Ontario Provincial Government and Ministries
	TRCA (Sub-provincial)
	Toronto city council
	Toronto Water
Socio-economic	Tourism (Hotels, Restaurants)
	Companies (e.g. Golf courses, Enwave)
	Fishing/Boating Associations
Civil Society	Local Communities
	First Nations (Indigenous groups)
	NGO's
	Academia (Ryerson, University of Toronto)
	Experts

Part of the criticism to IWRM in Canada relates to the jurisdictional fragmentation due to different scales of government overseeing water management at all levels: the federal, provincial, sub-provincial and municipal. Fragmentation occurs as responsibilities are allocated amongst multiple actors with little coordination and no transparency about how decisions are made (Bakker and Cook, 2011). Moreover, First Nations (the name given to aboriginal people in Canada) and transboundary issues add more complexity to the equation.

At the Ontario's provincial level, one clear example of water governance fragmentation is illustrated by Baker and Cook (2011) by analysing the water quality management issues in Lake Ontario. (i) First, The Canadian government is implicated as this lake is an important country asset for fishery and navigation. Thus, there are many federal agencies with water-related responsibilities as Environment Canada, Natural Resources Canada and Fisheries and Oceans Canada, all of which are ministries at the federal level. (ii) Second, the government of Ontario is also implicated due to its responsibility for natural resources within the province. Three provincial ministries are considered key actors: Ministry of Agriculture, The Ministry of Natural Resources and the Ministry of the Environment Conservation and Parks (MECP). (iii) Third, there are several Conservation Authorities (TRCA among them) that are responsible for source water protection, stormwater management and preventing flooding (Figure 5). (iv) Fourth, municipalities play a role by their location in the waterfront and their responsibility for storm and wastewater management. (v) Fifth, Key industrial sector, such as power and water providers, are also involved, as well as many NGO's and First Nations representors. (vi) On top of everything, there are also intergovernmental agencies and mandates that play a role when managing water quality, since Lake Ontario is located in the Great Lake basin, which is a transboundary territory between Canada and United States.



FIGURE 5: CONSERVATION AUTHORITIES IN ONTARIO
Source: Watson et al., 2019

When it comes to water governance in the urban context of Toronto, institutional fragmentation can also be observed. Perhaps the only level that does not have a significant role is the Federal government, as it only plays a part in fishery and navigation for Lake Ontario (TA-2). Beyond that, all the actors presented in the previous paragraph are highly implicated in different degrees. The Provincial Government of Ontario is involved given its responsibility for natural resources through many of its ministries. Maybe

the most visible is the MECP, which play a role in conservation of water bodies, environmental permissions, climate change actions plans and source water protection, among other issues.

Then TRCA, is the Conservation Authority with jurisdictional responsibility over the city's geographic area (see Figure 5 and Figure 6). Conservation Authorities are sub-provincial agencies that acts at the watershed level that started in 1946 as a post war program for natural resource protection in the southern Ontario (Watson et al., 2019). Because of their catchment-based nature, Conservation Authorities are maybe the institutions that play a more significant role when it comes to IWRM. Thus, TRCA is responsible for source water protection, but also has responsibilities over stormwater management and flood protection in the area defined by the watersheds presented in Figure 6. As this figure shows, the city boundary is contained into the TRCA boundary and intersect many of the watersheds.

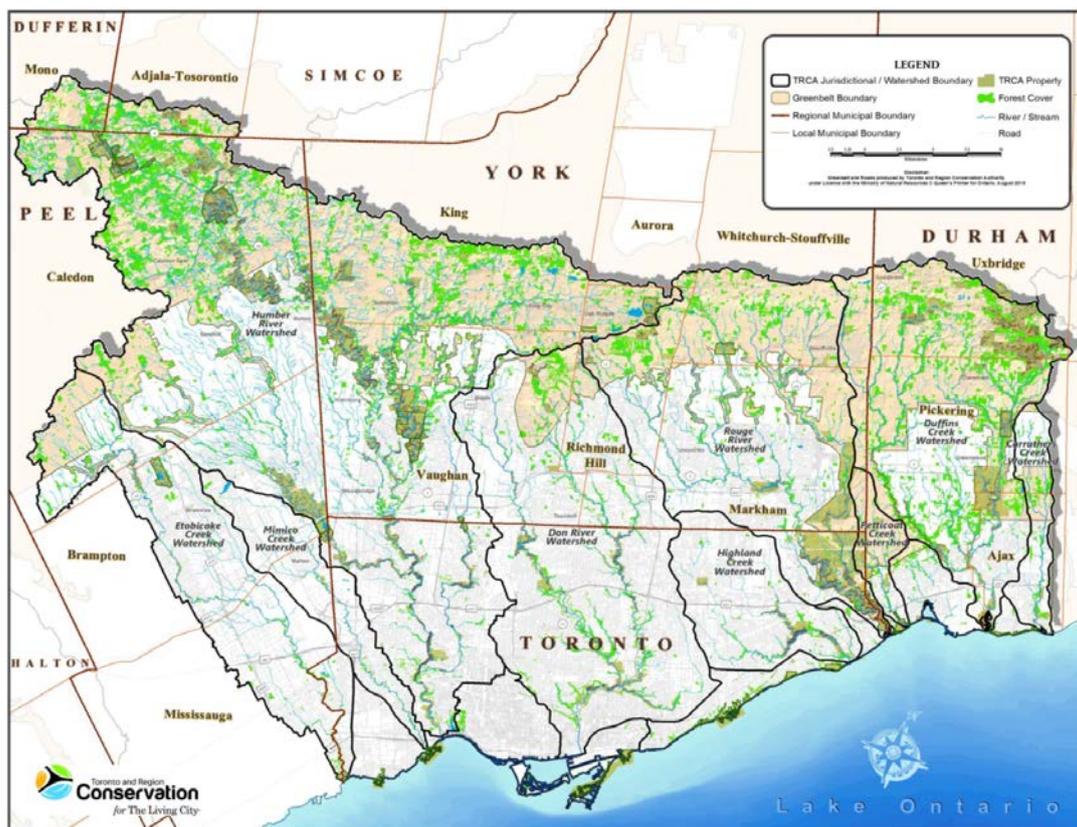


FIGURE 6: TRCA JURISDICTIONAL BOUNDARY
(Source: TRCA, 2017)

At the municipal level, the public Corporation of the City of Toronto (or simply the City of Toronto) acts as the government of Toronto, Ontario. Its actions, decisions and operations are governed by the Toronto City Council, which is a government body democratically elected by the population. It does so under the regulations established in the City of Toronto Act (City of Toronto, 2006). To avoid confusion when referring to the municipal government in this document, the municipality, the city, the city of Toronto and the Toronto city Council are considered equivalent names for the purposes of this research. As part of the municipality, Toronto Water (TW) is the entity responsible for: (i) drinking water treatment and supply; (ii) wastewater collection and treatment and (iii) stormwater management. It operates, manages, and maintains 85 stormwater management pond facilities across the City. TW is also in charge of the operation of the four drinking water plants as well as the four wastewater treatment plants (WWTP's).

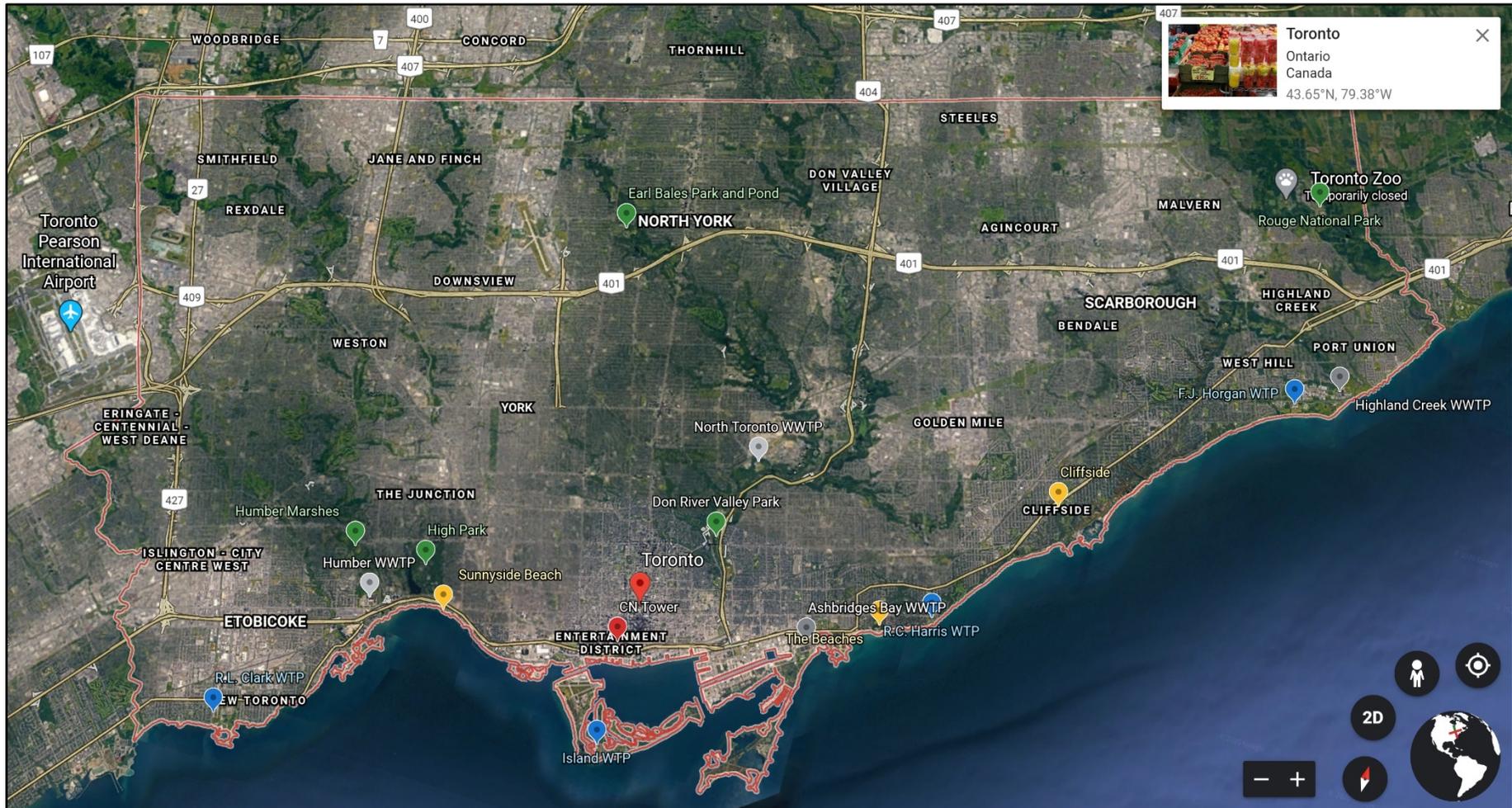


FIGURE 7: TORONTO CITY MAP AND PLACES OF INTEREST

Source: Google Earth

5.2. Results for the FUNqyWATER approach

This section presents the results for the FUNqyWATER assessment. To facilitate the citation, the corresponding interviews are referenced as explained in section 4.3.

5.2.1. Current water use by use function

Table 6 shows the results related to the different ways that water is currently being used in the city of Toronto, according to the classification of use functions proposed by FUNqyWATER. These results are based on the analysis of the interviews and the dataset provided by the project researcher.

TABLE 6: CURRENT WATER USE BY USE FUNCTION IN TORONTO

Section 1/4 provisioning use functions			Toronto
DIVISION	CODE	USE FUNCTION	
Nutrition	U1-1	Fishing for consumption purposes	
	U1-2	Catch of other surface water related animals for consumption	No info.
	U1-3	Harvest of aquatic plants or algae for consumption	No info.
	U1-4	Surface water extractions for drinking water production	
Materials; water extractions for non-drinking purposes	U1-5	For irrigation of crops, livestock watering	
	U1-6	For irrigation of other vegetation	
	U1-7	For industrial process water	
	U1-8	For fire fighting	
	U1-9	For filling ponds	
	U1-10	For other non-drinking purposes	
Other materials	U1-11	Extraction of biomass for non-food purposes	
	U1-12	Extraction of abiotic materials	
Energy	U1-13	Thermal energy extraction	
	U1-14	Energy production by using the salinity gradient in water	
	U1-15	Energy production by using kinetic energy of water	No info.
Section 2/4 regulation and maintenance use functions			
DIVISION	CODE	USE FUNCTION	
Mediation of waste, toxics and other nuisances	U2-1	Managing water quality	
Mediation of flows	U2-2	Managing water quantity	
Maintenance of physical, chemical, biological conditions	U2-3	Global climate regulation by reduction of GHG concentrations	No info.
	U2-4	Local climate regulation	No info.
Section 3/4 Cultural use functions			
DIVISION	CODE	USE FUNCTION	
Physical and intellectual interactions	U3-1	Primary contact recreation	
	U3-2	Secondary contact recreation	
	U3-3	Recreational boating without water-body contact	
	U3-4	Recreational fishing	
	U3-5	Hunting aquatic animals	
	U3-6	Enjoying a landscape characterized by surface water	
	U3-7	Ice-skating	
Spiritual, symbolic interactions (...)	U3-8	Designation of cultural heritage value	
	U3-8	Religious use	No info.
Section 4/4 Space			
	CODE	USE FUNCTION	
	U4-1	Building on water	No info.
	U4-2	Under water storage	
	U4-3	Transporting goods	
	U4-4	Transporting persons	
	U4-5	Using water as a barrier	No info.

	Current use
	No use
	No used directly

As already mentioned, the water system in the city of Toronto is highly influenced by the presence of Lake Ontario, which corresponds to the main source of consumptive uses of water resources. In some areas of the GTA outside of Toronto (TGF-1), drinking water is drawn from aquifers, however, in the city all the drinking water comes from Lake Ontario (FW-1) through four water treatment plants located across the shoreline (Figure 7).

Section 1: provisioning use functions

Regarding the nutrition category, in addition to the extraction from the lake for drinking water, the other activity observed is fishing, which is primarily recreational but there is some commercialization for local markets. Although it is a minor activity with little development due to the conditions of a highly urbanized city, it is increasingly taking place in the lake and the rivers and has institutional support (Ontario, 2020; TRCA, 2020). For instance, there are Atlantic salmon running up both the Humber and the Don river, which is not an endemic species of the region (FW2-FW4). Municipal efforts to protect and improve the natural environment of the rivers have led to better water quality that increases the opportunities to develop this activity. Regarding the harvesting of other surface water related animals for human consumption, no examples were found, also the case for the harvesting of aquatic plants or algae for consumption.

Related to the extraction of water for non-drinking purposes, there is less and less use for crops and livestock watering. As a result of intensive urban development, these activities are decreasing, and urban farming trends observed in some water wise cities are not yet as well developed in Toronto. On the other hand, the irrigation of other types of vegetation is quite intensive, such as golf courses. Golf is a popular activity in the city of Toronto, which demands a large amount of fresh water that comes from rivers and creeks, mainly in the Humber, Don and Rouge watersheds. In general, the companies that manage these courses have municipal permits to extract water directly from the rivers or groundwater rights. Extractions for industrial uses are also observed from rivers and from Lake Ontario. For firefighting, surface water is not used directly due to accessibility reasons, and drinking water is used instead.



FIGURE 8: WESTON GOLF CLUB AT ST. PHILLIPS RD. BRIDGE IN THE HUMBER RIVER
Source: <https://scoregolf.com/>

Regarding the other materials category, the extraction of biomass, such as plants or algae for non-food purposes, is not observed. For the extraction of abiotic materials, such as sand or gravel for construction purposes, most of the interviewees argued that this activity is strictly prohibited in the city and those materials are obtained from other regions.

Related to the energy category, in the case of thermal energy extraction, there is an interesting application in the city. The Enwave company uses deep lake water for cooling and heating buildings in the downtown area. Interviewees reported that it has been a quite sustainable source of energy so far (FW-1). In the case of energy production using the salinity gradient of water, this use function doesn't occur in the city because the water system in Toronto is made up of exclusively freshwater bodies, and therefore, there is not sufficient salinity. For the energy production using the kinetic potential of water, no examples were found.

Section 2: Regulation and maintenance use functions

In Toronto, there is an increasing trend for low impact development techniques for stormwater management, as many old areas in the city do not have storm water management treatment. Thus, there are increasing efforts to retrofit these areas to provide storm water controls for water quality. The solutions include infiltration, green roofs, permeable paving, bioswales, and storm water ponds. A good example of application of the latter is the Earl bales water pond, located to the north of the city, which is a multifunctional solution used to manage both stormwater quantity and quality (Figure 9).



FIGURE 9: EARLBALES STORMWATER POND, JANUARY 2020

No examples of uses related to global or local climate regulation were found.

Section 3: Cultural use functions

Related with the category of Physical and intellectual interactions many activities are taking place in the Toronto's water bodies. As the water quality has improved during the recent decades, both the lake and the river system has become a source of recreation and enjoyment. The beaches across the lake's shoreline are widely used for recreational uses. There are 14 of them and some are blue flag beaches. In those locations, there is swimming, diving and boating. Regarding to the river system there are examples of canoeing and kayaking, as in the Humber Marshes. As already mentioned, there is also recreational fishing but also hunting of aquatic animals in permitted areas of the ravines. These are all uses that have recently increased mainly due to the strong protection of the ravine and natural systems that has taken place during recent years. In this way, all the interviewees agree that enjoying a landscape characterized by surface water is a use in gradual increase.



FIGURE 10: SUNNYSIDE BEACH NEAR THE HUMBER RIVER MOUTH
 Source: <https://www.sunnysidepavilion.com/>

No specific example of religious use was found in the city's water bodies. However, there has been designation of cultural heritage value. Such is the case of the Humber river, which was designated a Canadian Heritage river for its recreational and cultural values.

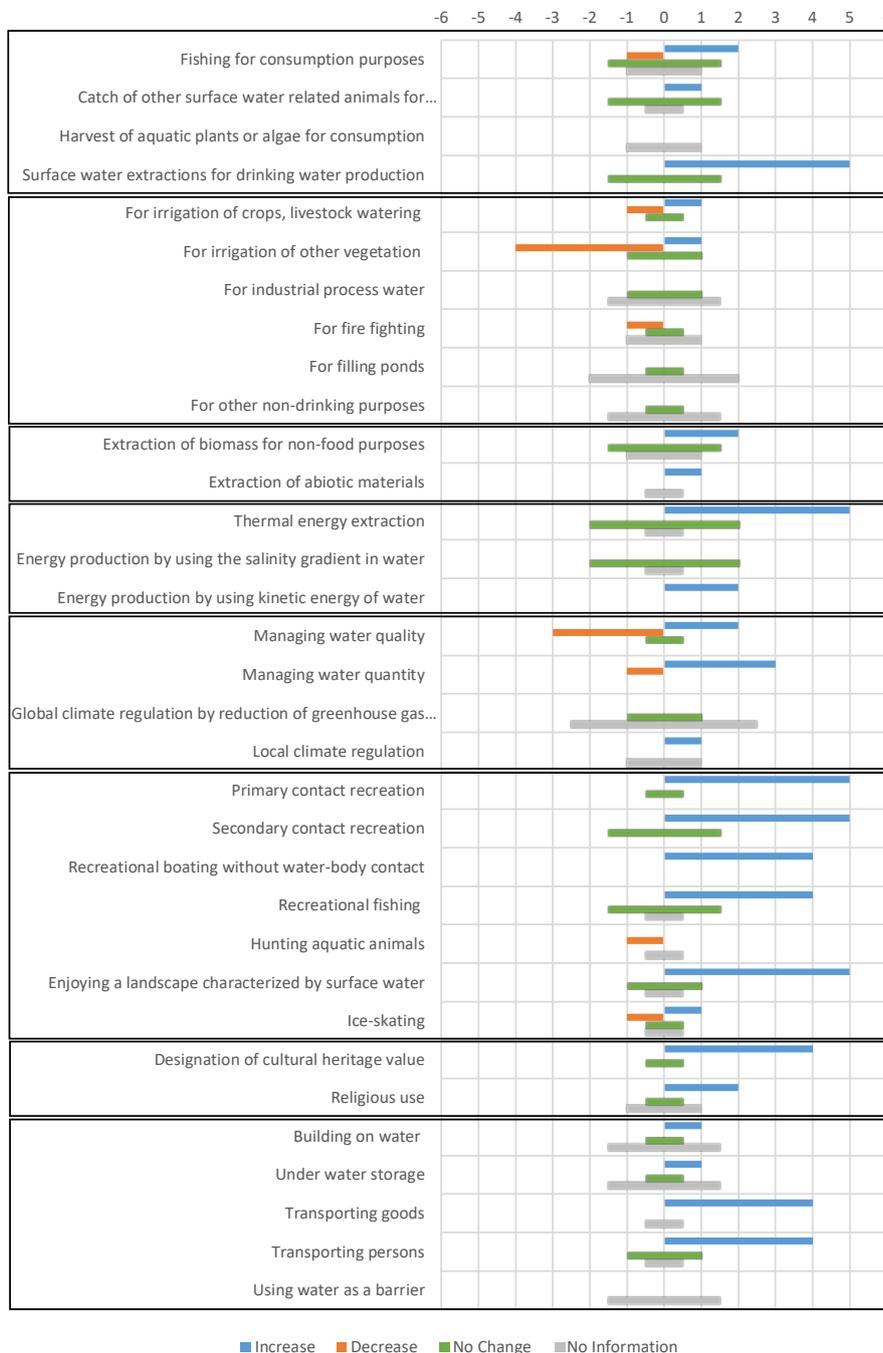
Section 4: Space

In this section, the most significant usage is transport. Transportation of people is common in Lake Ontario, although it is an activity that has decreased on the last century as people increasingly prefer land options. However, ferries are still needed to transport people from the city to Toronto Island or to the airport located there. Regarding transportation of goods through the lake there are considerable amounts of raw material that are moved, mainly exportation to the US, through the international port of Toronto. For the river system, transportation of people was a predominant activity hundreds of years ago, but it does not really occur nowadays beyond the recreational uses. There are no examples of building on water as the case of cities such as Amsterdam, basically because is not an activity that is allowed. In the case of under water storage, there is no direct application of this kind of use function. However, there is a lot of underwater infrastructure, such as the pipes and watermains of the drinking and wastewater plants.

5.2.2. Trends for future water demand by use function

Table 7 shows the information provided by the 5 interview participants regarding future demand for surface water by use function, considering 2040 as the horizon reference.

TABLE 7: FUTURE TRENDS FOR URBAN WATER USE TORONTO



For each of the use functions it is shown:

a) **Light blue:** The number of respondents who think that the demand for such use function will increase in the future. This value is displayed to the right side of the horizontal axis as a positive value, starting from zero. For example, for the use function "surface water extraction for drinking water" all 5 participants answered that this use function will increase.

b) **Orange:** The number of respondents who think that the demand for such use function will decrease in the future. This value is displayed to the left side of the horizontal axis as a negative value, starting from zero. For example, for the use function "irrigation of other vegetation" 4 participants answered that this use function will decrease.

c) **Green:** The number of respondents who think that the demand for such use function will not change in the future. This value is displayed as an absolute value from zero to both sides of the horizontal axis. For example, for the use function "fishing for consumption" 3 participants answered that this function will not change. Thus, in the chart this is shown as a green bar from -1.5 to 1.5 representing an absolute value of 3.

d) **Grey:** The number of respondents who state that they do not have enough information to answer whether demand will increase or decrease in the future. This value is displayed as an absolute value from zero to both sides of the horizontal axis. For example, for the use function "harvest of aquatic plants or algae for consumption" 2 participants stated that they do not know or do not have enough information to respond. Thus, in the chart this is shown as a grey bar from -1 to 1 representing an absolute value of 2.

Some clear trends are derived from the Table 7. Respondents agree that drinking water consumption will increase due to population growth, despite the decrease in per capita consumption and water use efficiency (WUE) efforts that the city pursues. All water demands for cultural uses will also increase as well as for other uses such as extraction for thermal energy and transportation on water. There are not clear examples for decreasing demands, except for irrigation of other vegetation related to golf courses, whose water withdrawals may be restricted due to policies or deterioration in water quality.

5.2.3. Drivers of change for future urban water demand

Review of drivers at a global scale

It is a complicated process to establish clear relations between drivers of change with each of the different uses of water categorized by FUNqyWATER. This is due to the specificity of the available studies in the literature and the lack of research that categorize the different urban water uses in a similar manner. However, some general conclusions can be derived from an exhaustive literature review conducted for the purpose of this research and included in **Appendix V**. At the city level, population growth is one of the most cited drivers of change and crosses most of the literature. In this regard, the associated concepts of urbanization, densification and urban expansion also appear prominent and can explain the increase in demand for many of the use functions. Climate change is another of the most cited drivers and is used to explain the change in behaviour patterns of different uses. Economic growth as well as infrastructure development are also widely cited to explain the increase in total urban water demand. In this sense, the increase in people's wealth and the general improvement of economic welfare, are also mentioned to explain the change in demand for several use functions, such as the increase in the use of water for cooling or the increase in recreational fishing. At a different level, changes in social behaviours, such as changes in lifestyle, beliefs and habits, the rise of environmental awareness or changes in diets, also drive changes for water use, either to increase or decrease the consumption. Regarding drivers that lead to decrease in demand for certain uses, water quality deterioration, pollution related to sewage and nuisance issues are cited on the literature.

Specific Drivers for Toronto

Table 8 shows an exhaustive analysis regarding drivers of change for future water demand in the city of Toronto, based on the responses of the 5 interviewees. It is worth mentioning that the interviewees openly answered the question "What do you think are the drivers of change for use function X?" Thus, the responses enabled to elaborate and complete a predefined list of drivers. Only drivers that were mentioned at least twice are presented in Table 8. The complete list of them can be found in **Appendix V** at the end of this report.

Some general conclusions can be derived from the results presented in Table 8 that are consistent with the results for drivers on a global scale, and might explain the trends presented in Table 7. For instance, population growth is one of the most cited drivers of change and is mentioned for many use functions as responsible of the increase in future demands. At the same time, drivers related to climate change are commonly mentioned to explain changes in behavioural patterns related to water use. Redevelopment close to water, urbanization and land use change are cited as well to justify the increase in water demands. Sustainability ambitions and insufficient water quality are some drivers that may explain decreasing demands for certain use functions.

TABLE 8: OCCURRENCE TABLE FOR DRIVERS OF CHANGE

DRIVER OF CHANGE\USE FUNCTION	U1-1	U1-2	U1-3	U1-4	U1-5	U1-6	U1-7	U1-8	U1-9	U1-10	U1-11	U1-12	U1-13	U1-14	U1-15	U2-1	U2-2	U2-3	U2-4	U3-1	U3-2	U3-3	U3-4	U3-5	U3-6	U3-7	U3-8	U4-1	U4-2	U4-3	U4-4	U4-5				
D0-Access to surface water is unpractical	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
D0-Alternatives are better	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
D0-Ecological protection ambitions	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0				
D0-Local water system not suitable	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	1	0	0	0			
D0-No reason for change/don't know	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1			
D0-Potential capacity already fully used	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0			
D0-Potential capacity is too small to be relevant	0	3	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0			
D0-This is not a habit/lack of knowledge	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1			
D-Ambition to increase the low impact development	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
D-Ambitions to promote the use/activity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0			
D-Awareness about First Nations heritage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0			
Db-High costs	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0			
Db-Other functions prevail/conflict between users	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0			
Db-Preference for other source of water	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Db-Regulations don't allow the use	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	1	0	1	0	0	1	0		
Db-Water quality deterioration/salinization	0	0	0	0	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Db-Water quality not sufficient	1	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0		
Db-Water quantity not sufficient	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0			
D-Circular economy/re-use of waste ambitions	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
D-Cost saving ambitions	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
D-Densification	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0		
D-Dry periods longer and/or more frequent	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
D-Lack of space on land	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
D-Land Value Increase	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
D-Popularity of the activity	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	1	1	0	0	0		
D-Population growth	1	1	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	1	5	0	0	5	3	3	1	4	0	3	3	0	0	0		
D-Rain storms more intense due to CC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
D-Redevelopment close to water	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	4	0	1	2	3	0	0	1	0	1	1	0	0	0		
D-Remediation Plans	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0		
D-Revitalisation of traditional habitats	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	
D-Revitalisation of traditional systems	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0		
D-Stormwater management	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
D-Sustainability ambitions	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	
D-Technological developments	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D-Temperature increase due to CC	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	
D-Urban agriculture increase	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D-Urbanization/land use change	0	0	0	0	0	1	0	1	0	0	0	0	2	2	0	0	0	1	1	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	
D-Water quality improvement	1	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	2	0	1	0	0	0	0	0	0	0	
D-Water use efficiency	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

In the horizontal direction the 33 use functions are shown with their respective code. In the vertical direction a thorough list of drivers is displayed. The numbers in the table body represent the times that each driver was mentioned as one of the underlying reasons for the change in future demand for the corresponding use function. Therefore, each number takes values between 0 and 5. The drivers are classified as follow. Drivers presented with “D0” code correspond to drivers that lead to no-change for the future demand. Those coded with “Db” are drivers that act as barriers leading to either a decrease or no change in demand. Those presented just with “D” are drivers that directly lead to an increase or decrease in demand. Only drivers that were mentioned at least twice are presented. The complete list of drivers can be found in **Appendix V**.

5.3. Results for the City Blueprint Approach

5.3.1. Trends and Pressures Indicators and Index

Table 9 shows the score for each of the indicators as a result of the TPF analysis for the city of Toronto.

TABLE 9: RESULTS FOR THE TPF TORONTO

Category	Indicators		N°	Score
I SOCIAL	Urbanization rate		1	3.6
	Burden of disease		2	2.0
	Education rate		3	4.3
II ENVIRONMENTAL	Flood risk	Urban drainage flood	4	4.3
		Sea level rise	5	0.0
		River peak discharges	6	7.5
		Land subsidence	7	0.0
	Water scarcity	Freshwater scarcity	8	0.0
		Groundwater scarcity	9	0.0
		Sea water intrusion	10	5.0
	Water quality	Surface water quality	11	0.7
		Biodiversity	12	0.9
	Heat risk	Heat island	13	2.8
Air Quality		14	0.8	
III FINANCIAL	Economic pressure		15	1.2
	Unemployment rate		16	4.1
	Poverty rate		17	2.8
	Inflation		18	4.0
IV GOVERNANCE	Voice and accountability		19	2.0
	Political Stability		20	3.0
	Government effectiveness		21	1.6
	Regulatory quality		22	1.7
	Rule of law		23	1.5
	Control of corruption		24	1.3

Figure 11 shows the corresponding TPF spider diagram.

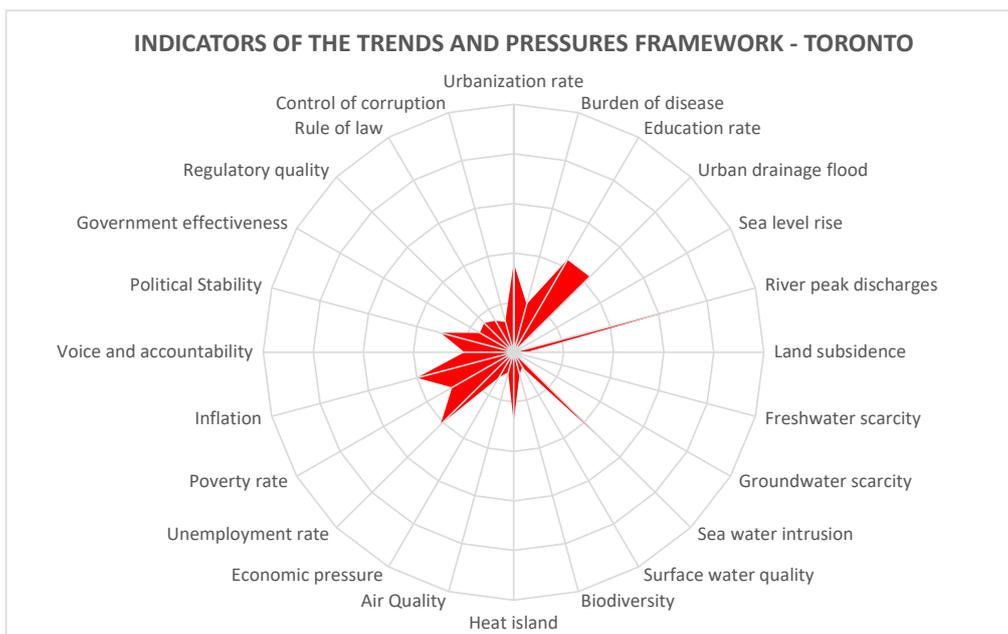


FIGURE 11: SPIDER DIAGRAM FOR TPF INDICATORS IN TORONTO

The average of the 24 indicators gives a final index of 2.3, which comprises an auspicious environment for the development of IWRM.

➤ **Trends and Pressures Index (TPI): 2.3**

Most of the indicators vary between no concern to little concern, according to the scale presented in Table 2. Some indicators are of (medium) concern, such is the case of urban drainage flood, river peak discharge, seawater intrusion (salinization) and heat island. It is worthwhile mentioning that some indicators were calculated using national data, due to the lack of information at the local level. Therefore, the resulting indicators and TPI should be judged accordingly. For example, the Canadian urbanization rate was used for indicator 1, where the rate for Toronto is surely higher. Although, it was not possible to find the precise data for the city. Information for each indicator is provided in **Appendix I** as well as definitions, calculation methods and sources.

5.3.2. City Blueprint Performance Indicators and Index

Table 10 presents the final score for each of the CBF indicators.

TABLE 10: RESULTS FOR THE CBF TORONTO

Category	N°	Indicator	Score
I Basic water services	1	Access to drinking water	10.0
	2	Access to sanitation	10.0
	3	Drinking water quality	9.8
II Water Quality	4	Secondary WWT	9.8
	5	Tertiary WWT	3.9
	6	Groundwater quality	7.6
III Wastewater treatment	7	Nutrient recovery	0.0
	8	Energy recovery	9.6
	9	Sewage sludge recycling	9.7
	10	WWT energy efficiency	4.0
IV Water infrastructure	11	Stormwater separation	8.6
	12	Average age sewer	2.4
	13	Water system leakages	5.0
	14	Operation cost recovery	10.0
V Solid waste	15	Solid waste collected	0.3
	16	Solid waste recycled	2.4
	17	Solid waste energy recovered	1.0
VI Climate adaptation	18	Green space	4.4
	19	Climate adaptation	8.0
	20	Climate-robust buildings	5.0
VII Plans and actions	21	Management and action plans	5.0
	22	Water efficiency measures	6.0
	23	Drinking water consumption	8.0
	24	Attractiveness	8.0

A detailed description of each indicator, calculation methods and sources are provided in **Appendix II** at the end of this thesis report.

Figure 12 shows the corresponding CBF spider diagram.

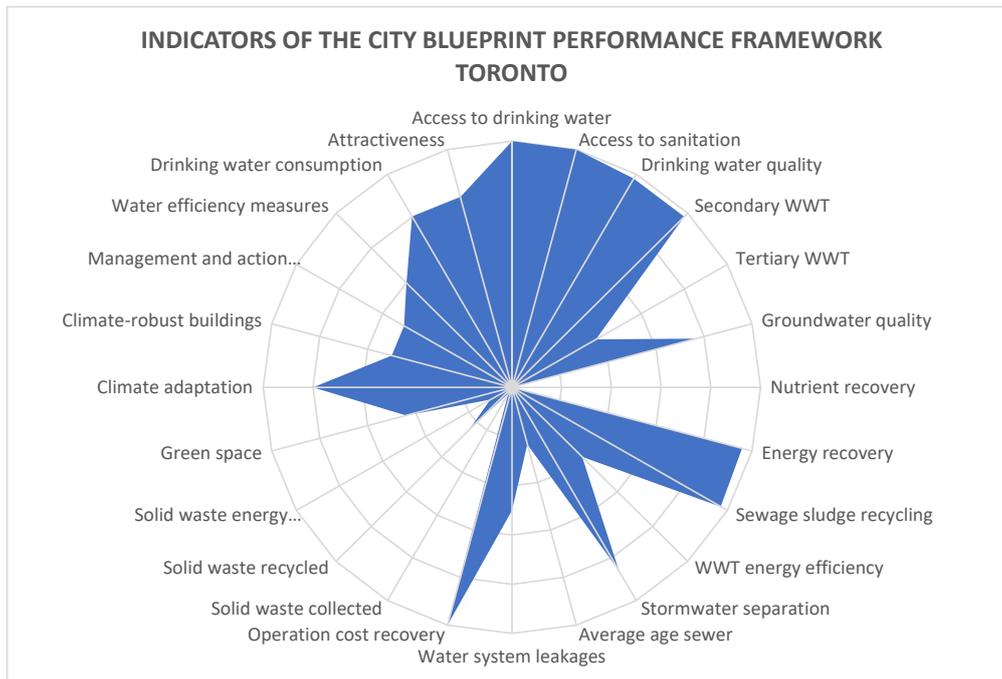


FIGURE 12: SPIDER DIAGRAM FOR CBF INDICATORS IN TORONTO

The calculation of the BCI results in a general score of 5.1.

➤ **Blue City Index (BCI): 5.1**

In the basic water services category (I), Toronto show an excellent performance, guaranteeing access to water and sanitation for the whole population and a good quality of drinking water. Regarding the water quality category (II), the performance is high, except for tertiary wastewater treatment, given that only 39% of the population is connected to this service. For the Wastewater treatment category (III), the performance is again high, except for nutrient recovery, as there is no information on direct nutrient recovery (e.g. struvite production) from wastewater. The scores on the Water Infrastructure category (IV) are varied. The city shows an excellent performance in stormwater separation, although many stakeholders argue that the 23% degree of separation is still very high. The performance of Operation Cost Recovery is also excellent. Indicator 13 is of medium performance as water leakages correspond to 25%. The biggest problem comes to the average age of sewer, since this is 48 years old on average. The solid waste category (V) shows the worst performance by far. Solid waste collected is extremely high in Toronto, as the production is 673 kg per capita per year. Recycling is far from being sufficient and shows low performance, the same for energy recovered from waste. The Climate adaptation (VI) shows a varied performance. While the level of action taken by the city to adapt to climate change can be considered of high performance, the percentage of green and blue areas represented by indicator 18 is quite low. Finally, for the Plans and Actions category (VII) a high performance is observed, highlighting the city's efforts to increase WUE and the relatively low drinking water consumption. However, indicator 21 is of medium performance, and this can be explained as there is limited information available in national and local documents regarding this matter.

5.3.3. Governance Capacity Analysis

As already mentioned, 10 interviews were conducted specifically to assess the water governance capacity of Toronto. The analysis of the interviews derived in the following analysis that is divided in three different sections. First, a general assessment of the city's governance capacity is provided in 5.3.3.1. Then, two water challenges are analysed: (i) flood risk and (ii) wastewater management. Each of the participants answered the predefined questionnaire considering one or some of these aspects, based on their own knowledge, vision, expertise, perception and experience. Therefore, the answers provided do not necessarily represent the thinking of the institution for which they work. Table 11 presents the scoring as a result of the GCF assessment. The equivalence between the GFC scoring and the numeric score can be found in Table 4 in the methodology section. The Interviews transcripts for are presented in **Appendix III**. To facilitate the citation in this section, the interviews for GCF were coded as explained in section 4.3.

TABLE 11: RESULTS FOR THE GCF TORONTO

Dimension	Condition	Indicator	General	Flood	WW
Knowing	1 Awareness	1.1 Community knowledge	1.5	2.1	1.7
		1.2 Local sense of urgency	1.8	2.8	2.1
		1.3 Behavioural internalization	1.9	1.9	1.5
	2 Useful knowledge	2.1 Information availability	2.0	3.1	2.4
		2.2 Information transparency	1.6	3.2	2.2
		2.3 Knowledge cohesion	1.7	2.2	1.6
	3 Continuous learning	3.1 Smart monitoring	1.4	1.9	1.9
		3.2 Evaluation	1.6	2.4	2.0
		3.3 Cross-stakeholder learning	2.7	2.7	2.4
Wanting	4 Stakeholder engagement process	4.1 Stakeholder inclusiveness	2.7	2.4	2.4
		4.2 Protection of core values	2.1	2.4	2.1
		4.3 Progress and variety of options	2.1	2.4	1.7
	5 Management ambition	5.1 Ambitious management	2.3	2.9	2.7
		5.2 Discourse embedding	1.7	2.7	2.3
		5.3 Management cohesion	1.8	2.3	1.6
	6 Agents of change	6.1 Entrepreneurial agents	1.4	2.4	2.3
		6.2 Collaborative agents	1.8	2.6	2.3
		6.3 Visionary agents	1.8	2.6	2.1
Enabling	7 Multi-level network potential	7.1 Room to manoeuvre	2.0	2.6	2.4
		7.2 Clear division of responsibilities	2.3	3.0	2.2
		7.3 Authority	1.8	2.8	2.7
	8 Financial viability	8.1 Affordability	2.6	2.7	2.9
		8.2 Consumer willingness-to-pay	2.3	2.2	2.5
		8.3 Financial continuation	2.6	2.5	3.1
	9 Implementing capacity	9.1 Policy instruments	1.8	2.9	2.8
		9.2 Statutory compliance	2.2	2.4	2.3
		9.3 Preparedness	2.3	3.0	2.4
Average			2.0	2.2	2.6

As mentioned in methods section, The GCF uses a sign scoring scale (-; -; 0; +; ++) which was converted to a numerical scale from 0 to 4 to average the participants' responses.

5.3.3.1 General Assessment of the Governance Capacity

Figure 13 shows the spider diagram as a result of the general assessment of the Governance Capacity analysis for the city of Toronto. This encompasses the five challenges consider by the GCF (water scarcity, flood risk, wastewater treatment, solid waste treatment and urban heat islands) but also watershed management for source water protection, managing of the riverine system and the control of water pollution. In this regard, this analysis aims to reveal different aspects of the IWRM at the city level, which was explicitly discussed with the respondents before each interview.

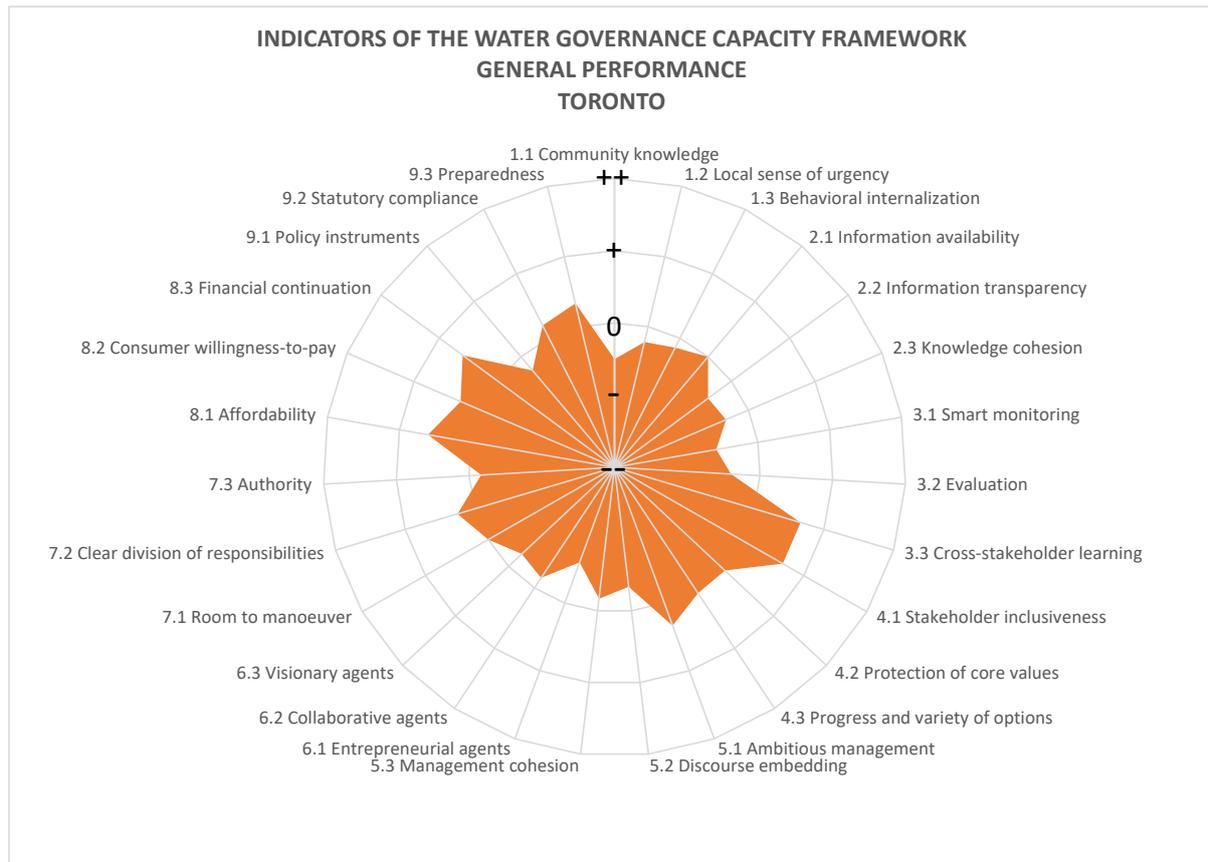


FIGURE 13: SPIDER DIAGRAM FOR GCF GENERAL ASSESSMENT

It is not surprising that the overall governance capacity assessment is on average lower than the obtained for the specific water challenges analysed (see 5.3.3.2 and 5.3.3.3). This is firstly rooted in the aforementioned high level of institutional fragmentation related to water management. Additionally, it was found that the level of knowledge and awareness among the community is relatively low and water issues become public only when there is a manifest societal risk (TGP-2; TA-1). The Walkerton tragedy is a good example of this, when in early 2000's 6 people died and more than 2000 got sick as a result of contamination of drinking water with E. coli. However, even an event as serious as this seems to have already been forgotten by the common citizen. "Just the key actors have a complete understanding of what's going on, while the general public doesn't" stated one of the interviewees (TGM-2). The same happens when it comes to useful knowledge. Information is not that available nor accessible at the community level and it is commonly described as fragmented and inconsistent (TGP-2; TGM-2). The situation is much better at the institutional level, where there are several sources of quality information for professionals, although with a lack of aggregation and cohesion (TGM-1). A good example of information availability is the Environmental Bill of Rights (EBR) which is a provincial law that gives Ontario residents the right to participate in environmental decision-making. The environmental impact

assessment processes of all provincial projects are published in the Environmental Registry of Ontario (ERO) where any citizen can consult and participate (TA-2). Finally, there is also some push for open data, and it is a formal initiative from the city of Toronto and many other municipalities, but the implementation is being rather slow (TA-1).

Regarding monitoring, this is usually described as limited. “The monitoring system is not covering all the assets related to the water challenges” (TA-1). When it comes to the mechanical and man-made systems (pumps, pipes, channels and so on) the monitoring is useful and even real-time in some places. For instance, the monitoring of the drinking water system is remarkable (TA-3). However, for ecosystems and the natural environment the monitoring system results insufficient and limited. Moreover, both the mechanical and the natural system, are not brought together into a single interrelated water observation network (TGM-2; TA-1).

One of the best evaluated conditions in Toronto is stakeholder’s engagement. At the provincial level, stakeholders are open to interact and learn from each other’s perspective and there is a clear desire to do so among people working in the water sector. However, there are some political barriers that make it difficult to materialize, as imposed budgetary constraints (TGP-2). Community inclusion is also highlighted, and a good example is again the ERO, which present opportunities for the public to participate and comment regarding different options of any major public work (TGF-1). Although this process is not without flaws. Whereas it is open and transparent, opinions are allowed to be expressed, and all the inputs are addressed, stakeholders sometimes complain that decisions end up being made among a small group of people. However, this is a common problem in environmental assessments processes; “just because a process is transparent it doesn't necessarily mean that everybody is happy at the end of the day” (TA-1). This process may also substantially slow down projects. For example, the new stormwater management criteria have been in consultation for the past three years (TA-2).

Regarding management ambition, respondents agree that goals are generally ambitious, however there is also a general culture of caution and risk aversion in Ontario society and government, which hinders the transition to more sustainable and long-term solutions (TP-2). Cohesion is also not a strong aspect due to the high degree of fragmentation among different institutions involved in water management (municipal-provincial-federal). Additionally, Conservation Authorities also play a role in terms of source water protection which are focused on watershed boundaries. Many times, decision making tends to focus on political and boundaries, which are inconsistent with watersheds (TA-1). On the top of the historical institutional fragmentation, there is also a recent political matter that is leading to insufficient water management and causing many other environmental issues. This relates to the polarization between the municipal and the provincial government, due to opposing political views. While the city is recognized as more progressive and liberal, tending towards more sustainable visions, the recently elected Ontario’s government is more conservative and neoliberal (TI-1). “The (provincial) government was pretty much elected by the whole province except for Toronto, it's like a rural government, elected by the rural Ontario,...., is more laissez faire, is more business-oriented” (TI-1) Thus, usually serves the needs of business at the expense of the environment (TGP-2) and is leading to a lot of lags in government policies for environmental regulations (TGP-1).

Related to agents of changes, one of the barriers that emerge for entrepreneurship is the tendency to maintain the status quo. To explain this, we must consider that Toronto is a highly populated and large city which was born by the junction of many small disconnected cities. Therefore, it usually takes a long time to get an overall agreement on the implementation of a new innovative system (TGM-1). A common example of this situation happens when entrepreneurs present a new innovative solution. The bureaucratic system in Toronto does not allow to adopt it until is proven locally, even if it has been



demonstrated to work elsewhere in a region with similar conditions (TA-2). Thus, Toronto has gained a reputation of not being adoptive with new technologies. “We are too cautious with adopting even simple things” (TA-2). However, when it comes to collaboration among agents, the picture is slightly better with some successful stories. Such is the case of the Partners and Project Green project, which is an eco-business around the Pearson Airport, that brings together all types of various stakeholders to create sustainable water practices (TA-1); or the Enwave cooling system, where there was a clear engagement between the private industry and the Municipality (TA-2).

Regarding multi-level network potential, the room to maneuver is described as limited both at the provincial and the municipal level (TGP-2). Actors have limited autonomy to deviate from traditional solutions and they therefore deal with water issues in a narrow and technical manner. In part, this relates to the added level of bureaucracy between the municipality and the province. The municipality must meet the province's requirements but on top of that they add their own, which are often more restrictive (TGP-2). On the other hand, whereas the division of responsibilities is clearly defined (TA-1) is paradoxically described as limiting at the same time, since professionals are sometimes concerned about just their own piece of responsibility and not caring about the whole picture. “There is a delineation of power and authority, but I don't find them being followed. There is political interference and bureaucratic process. This is one of those grey areas where you see an erosion or deterioration of those delineations” (TGP-2).

Financial matters are an aspect that moderately stands out. Water services are comparatively cheap and affordable in the city, and the entire city's population has access to them. However, when it comes to climate adaptation or sustainable long-term measures the situation is unsound. For example, there is a worrying matter happening between the provincial government and many municipalities, including Toronto. Ontario has declared the need to have climate change action plans, but has kept it at a very high and vague level without going any further in its responsibility, just to avoid creating expectations among municipalities about the resources to finance such measures (TGP-2). Another financial issue relates to the way that users are charged for water services. The water bill includes payment for all drinking, waste and storm water. This situation creates competing interests among those three water sectors under municipal control for the same pot of money (TGP-2; TGM-2; TA-1). It leads to inequity issues as well. For example, someone who lives in a high-rise rental apartment with very little footprint in terms of stormwater must pay the same as someone living in a house with garden and lawn; “that's intrinsically unfair” (TA-1).

Finally, implementing capacity is assessed as moderate. There is a wide variety of water management policy instruments at the provincial level that are not fully integrated into a single water policy strategy (TGP-2). Statutory compliance is described as strict but there is some room for new ambitious goals and innovation. Regarding preparedness, the results show a low awareness of preparation strategies, however the municipality is trying to rebuild its infrastructure to address climate change impacts through creating resilience capacity (TGP-2).

5.3.3.2 GCF Water Challenge: Flood Risk

Figure 14 shows the spider diagram as a result of the GCF for the water challenge of flood risk in Toronto.

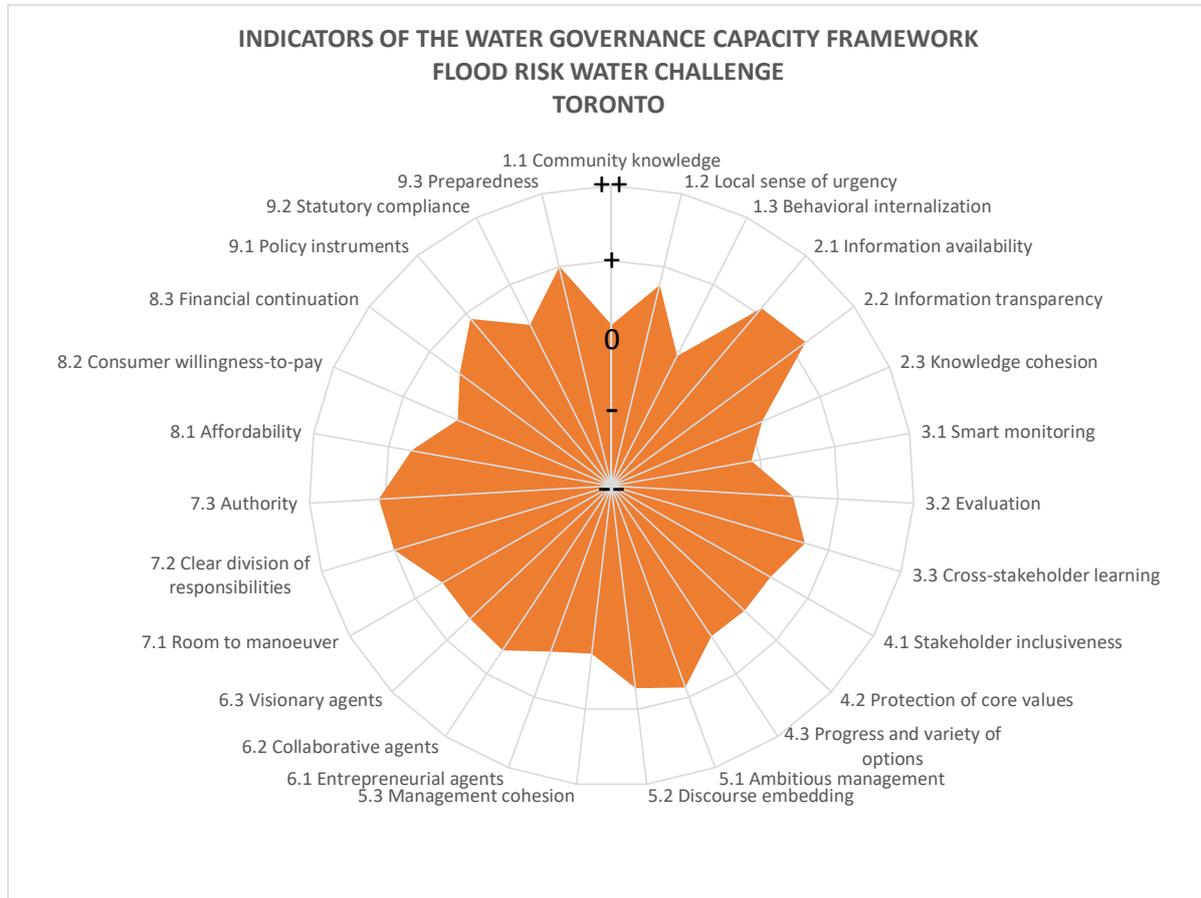


FIGURE 14: SPIDER DIAGRAM FOR GCF FLOOD RISK

Flood risk is the water challenge that is best assessed when it comes to governance capacity in Toronto. The reasons for that start with a higher awareness on this matter. The community has better knowledge on flooding mainly because the problems are very visible and are usually on the media (TGP-1). However, there is a common criticism among respondents about the individualistic behaviour that some citizens show. “People tend to be interested only in their neighbourhood flooding, and then they are willing to do something” (TGM-1). Basement flooding is one of the biggest issues in the city of Toronto. A huge budget from TW goes to projects that deal with this issue, which is about a billion dollar a year (TGM-1). These projects come to public consultation through the EBR and the community is notified about how these projects are being executed, how the products are selected across the city, and how they are prioritized; this is just one example of information availability and transparency. Flooding in the city is well-known because of historical events. Thus, there is mapping systems of where events happen, where the low-lying areas are, but also predictive models are available. The supply of information is described as fragmented, though, tending to be too specific and sometimes inconsistent among sectors (TGM-1). However, there is a movement at the staff level to address flooding and stormwater issues in a more cohesive manner. “City resources are working directly with the CA’s and the ministry to identify all of the resiliencies adaptation and mitigation opportunities for the city” (TGP-1).



Despite how well evaluated the availability of information is, smart monitoring is assessed as moderate to limiting. The monitoring system is also described as inadequate and insufficient, as it is lacking in the most critical needs for environmental health of communities (TGP-2). Additionally, it has significant gaps since the arrival of the new provincial government. This institutional shift led the MECP to stop taking responsibility in terms of water quality under the Ontario Water Resources Act (OWRA). Anyhow, Conservation Authorities -and TRCA among them- are filling those policy gaps by undertaking water quality activities and thus complementing their water quantity monitoring request when addressing flooding. Another example of the limited monitoring system is that the only data relatively accessible online are streamflow's from local gauges. For instance, precipitation is not real-time available, which may seem counter intuitive for a developed region as Ontario. "We're very backwards in some things" (TA-2).

Stakeholders engagement is quite well assessed. Water sector professionals are typically quite receptive and are willing to share knowledge and interact with each other's, even if this is detrimental of their own work (TGP-1). Inclusiveness is also better assessed in this water challenge, and the reason for that is the city's recognition about the need for active engagement and community involvement at different levels. However, criticism remains regarding the real contribution and influence of the public in the final decision-making process (TGP-2). Management ambitions are also quite well scored. This can also be explained by historical flood events that the region has suffered. Hurricane Hazel in the 50's led to the mapping of all flood areas, the prohibition on building in low-lying areas and other good practices regarding flood control (TA-2). There are also clear strategies and long-term goals, although the targets in the short term might not be realistic (TGP-3). A good example of ambitious goal is the Toronto wet weather flow master plan (WWFP) which is a long-term strategy first developed in 2003 for wet weather management (TA-2; City of Toronto, 2017). WWFP also addresses flood costs and combined sewer overflows issues (CSO). Other remarkable examples are the major and long-term vision projects to realign the Don river, a key watershed in the Toronto region, to prevent severe weather events over the next 100 years (TA-1). Regarding agents of change, the environment is described as open for innovation but challenging when it comes to implementation. There are several pilots' projects across the city for green infrastructure, low impact development (LID), and other innovation "but to move forward as a provincial approach, or a city wise approach, this is maybe even impossible; because of the regulations and the status quo" (TGP-3). And this is again rooted in the consequences of being a megacity, where it takes time to get an agreement about something new. For example, Toronto is considered a world leader in basement flooding control and wet weather flow management, but the city is still dealing with existing problems. Thus, when it comes to innovation or drastic changes, those processes happen at a slower pace (TGM-1).

The condition multi-level network potential stands out. The room to maneuver among water professionals is described as sufficient, favored by a direct relationship between the municipality and the TRCA (TGP-1). However, a sectoral and technical vision of the flooding issues remains. The division of responsibilities is clear and cooperative strategies have consequently emerged. The role of authorities has been encouraging and there is now a recognition of long-term and sustainable approaches that is implemented as declaration of intent in policies and regulations. When it comes to financial viability there are three matters of concern for water managers. (i) The first one relates to the fact that the stormwater rate is still charged through the water bill as a percentage of drinking water consumption. An independent stormwater fee was proposed by TW a few years ago which failed due to political reasons (TGM-1). (ii) The second has to do with the difficulties of setting up a funding program to rebuild aging infrastructure. "We don't know how to adjust our financial planning in order to account for something that has been built for 100 years" (TGP-1). On a financial basis, flood control is the

hardest matter in terms of justifying capital resources expenditures, yet the easiest to notice. “You are looking at massive multi billion dollars infrastructure needs... even the stormwater charge won’t pay for that” (TGP-1). (iii) The third issue relates to residential flood protection. What usually happens in the Toronto region nowadays is that flood protection is provided by insurance companies. Thus, house owners must pay additional premiums for something that in the past was already covered by the home insurance. This practice has been institutionalized in the region and is even regulated through the Insurance Bureau of Canada (IBC). It is described as an unsustainable practice that is holding back measures for building resilience and creating a vacuum message among the population. “The better insurances would only pay for the damages afterwards. It doesn’t actually protect you for even getting damages in the first place” (TGP-1). Finally, the implementing capacity condition is moderately well assessed. However, there is no regulatory or legislative push for resiliency or sustainable flood control nowadays (TGP-1), especially from the provincial government side, which has become very conservative and less focused on flood and stormwater issues. Regarding preparedness, respondents agree that is not perfect, but there is a pursue and push to be more prepared (TGP-1; TGM-1).

5.3.3.3 GCF Water Challenge: Wastewater

Figure 15 shows the spider diagram as a result of the GCF for the water challenge of wastewater management.

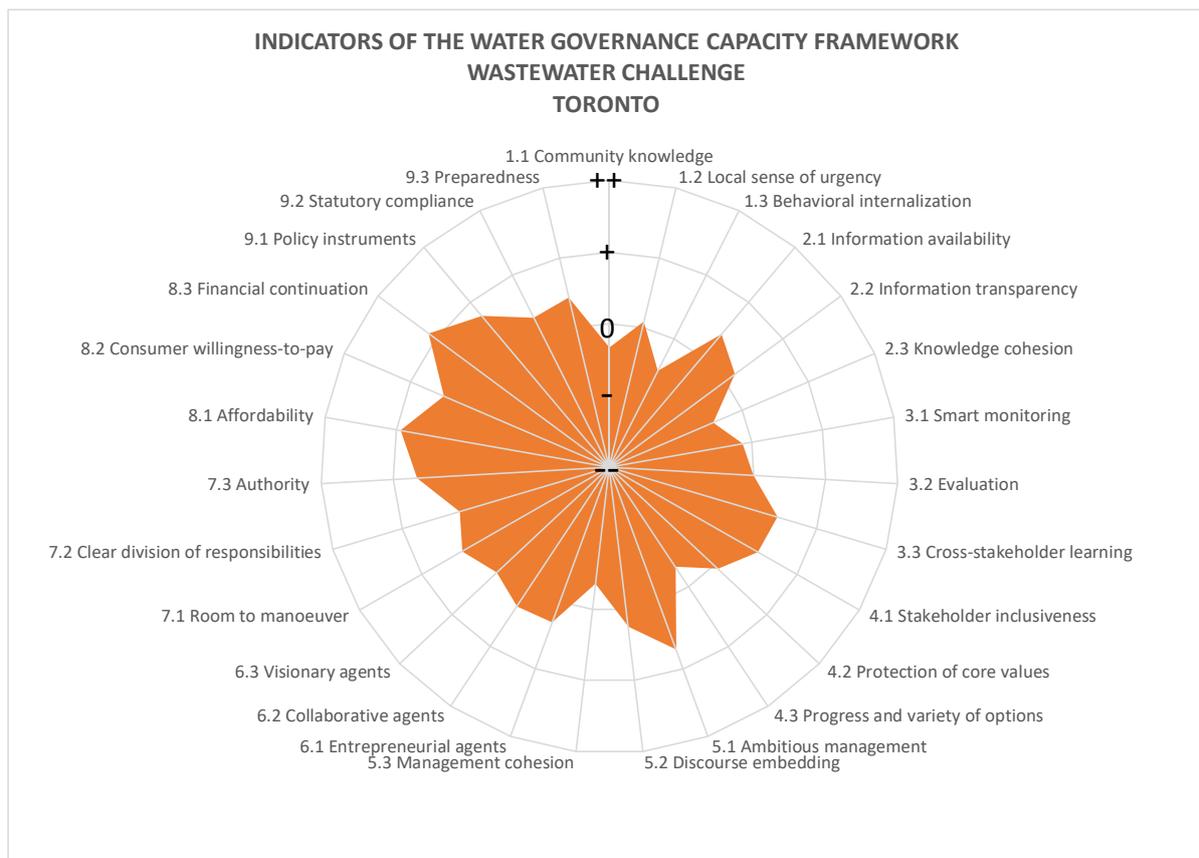


FIGURE 15: SPIDER DIAGRAM FOR GCF WASTEWATER

The overall assessment of wastewater management shows a moderate capacity, scoring slightly worse compared to flood risk. Community knowledge and awareness tend to be limited even though the sewage issues are not minor in the city. There is still a high percentage of outdated and aging water infrastructure and CSO issues are common. However, the public is simply not aware of this. “CSO happens more often



than the storm issues, which only happen in extreme weather. CSO issues actually happens every day” (TGP-1). The picture is better regarding information availability and transparency. TW provides a decent supply of information on potable and wastewater and the reports shows that systems are meeting the capacity. Information cohesion is enough, basically because TW -as part of the municipality- is the only institution in charge and “it is doing on its own” (TGP-1). The same criticism rises when it comes to monitoring. There is adequate monitoring capacity, but it is only covering the basic requirements for CSO alarm setting, non-compliance, and compliance issues. “There is anything of being proactive about it... we have all the data, but we are not actively pursuing anything” (TGP-1).

Stakeholder engagement is well assessed and the willingness to cooperate among water professionals is highlighted again. Nevertheless, insufficient stakeholder inclusiveness is again noticeable, especially among small groups. Communities, First Nations, and NGO’s participate and are being consulted, but they are not usually part of the decision-making process (TGM-1). Management ambitions is one of the best scored indicators and is due to the existing long-term management plans, such as the Downtown Water Strategy and the Waterfront Sanitary Servicing Master Plan (TGF-1). “TW poses a corporate strategy... and there is willingness to make bigger changes” (TGM-1). However, sustainability is not especially embedded into the discourse and the city has not recently announced anything strategic in this direction (TGP-1). About management cohesion, there is some overlapping regarding jurisdiction between TW and TRCA. The city oversees sewers and the Conservation Authority looks after the streams. The problems emerge when there are streams that have been converted to pipes or sewers, and then the same streams are daylighted again, so they continue as a stream. In consequence, practical management problems occur for different sections of the same stream. Regarding entrepreneurship, there is a growing environment of innovation regarding wastewater. “Because you don’t want to ever be at risk of having a not compliance in wastewater. So, they easily can justify (the budget for) those types of things” (TGP-1). The degree of collaboration is quite conventional, though, and the status quo play a huge role as described in previous sections.

The condition of multi-level network potential is generally described as of moderate capacity. There is limited room for innovation and collaboration among actors; the division of responsibilities is clear but somewhat inflexible; and there are well defined and legitimate -yet restricted- authorities. The financial viability condition stand-out and there is one visible reason for that. There are abundant resources for wastewater management, as 5 years ago the city approved a financial plan which consider a 9% increase in drinking and wastewater rates every year for a total period of 9 years (TGM-1; TGP-1). The purpose was to create a pool of capital dollars to upgrade aging infrastructure and improve the capacity of WWTP’s. This plan has been positively valued among water professionals, mainly because the city had not increased water rates in 30 years (TGP-1). However, consumer’s willingness to pay has been rather low and there is also some mistrust as to where this money is being spent (TA-1; TGP-3). Regarding the implementing capacity, policy instruments are described as strong and sound but challenging to implement at the same time, as targets are sometimes unrealistic and too ambitious (TGM-1). Additionally, the city has not recently increased the compliance and non-compliance discharge inspection rates. From the provincial government side, there has been no increase in compliance regulation either, being a period of strong status quo from a regulatory side. “It was moving towards more progressive policies and regulations over the last 5 years and they just kind of hit a wall now with the new government” (TGP-1). Statutory compliance is moderately well assessed as the regulations are very punitive with non-compliances. “Since the Walkerton crisis, we got almost the strictest regulatory environment in the world” (TA-1). The level of preparedness is described as sufficient because of the financial capacity, but the allocation of resources may be unclear (TGP-2).

6. DISCUSSION

First, the application and integration of the FUNqyWATER and the City Blueprint approaches is discussed, including the limitations found and opportunities for further research. Next, a comparison of Toronto with other urban areas is made, based on the results from chapter 5. Finally, some reflections on the concepts of IWRM and the implications of institutional integration/fragmentation is provided.

6.1. Reflections on the application of the two approaches

Given the novelty of the FUNqyWATER project, the integration with the City Blueprint approach is fairly new and there are no guidelines or any previous studies to exemplify how to properly do it. Both are intended to assess the sustainability of water resources at the urban level from a human-centred perspective, although the approaches are remarkably different. The FUNqyWATER focuses on the relationship between the water resources provided by the natural environment and society. The proposed categorization considers a wide spectrum of water services, the so-called use functions, for which current and future demands are assessed in a qualitative manner. Thus, it serves well as an introductory picture of how, where, and how much the resource is used in a city, as well as how and why it may change in the future. On the other hand, the City Blueprint Approach is an increasingly recognized method that assess the degree of IWRM in a pragmatic way. Each of its three complementary frameworks has a clear and specific objective, that enable differentiation of the water issues that are invariable parts of the system - such as climatic, economic or geographic conditions - from those on which water managers can act and are subject to improvement. This is further facilitated by the wide range of result indicators, which leads to a well-balanced assessment with a strong focus on sanitary aspects. Thus, both approaches complement each other and present opportunities to capture the full picture of water sustainability and IWRM performance in a city. The resulted holistic assessment could be used to optimize urban water resources while identifying the water management and governance issues that are unsound.

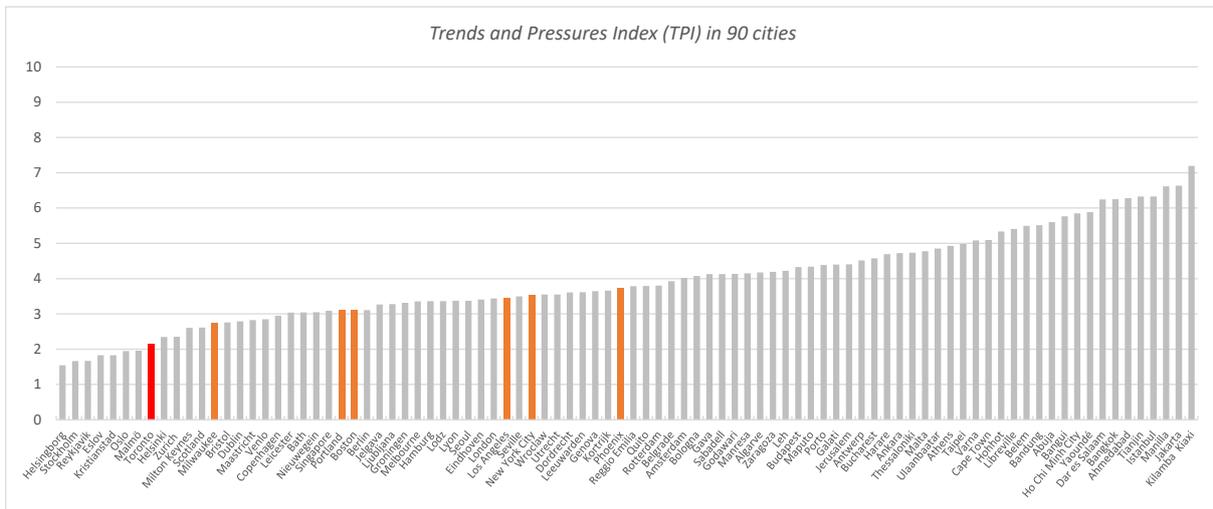
The limitations for the FUNqyWATER approach have already been briefly mentioned. This is a novel method and has therefore not yet been peer-reviewed by the academic community. For the same reason, there are no other tested cities that enable cross-city learning. Furthermore, the assessment of water demands is rather of a qualitative nature, although it might be complemented with a quantitative analysis. Thus, an opportunity for further research is the project's next phase which relates to indicators and criteria development aiming to optimize urban water for multifunctional uses.

Identified limitations for the City Blueprint approach relates to the GCF analysis. Given Toronto's water context, a selection of water challenges was needed when interviewing stakeholders. This makes the comparison with other regions difficult as the water challenges assessed are simply different across cities. Additionally, the interviewees frequently provided excessively negative visions or biased opinions of a particular subject, while the analysis as an external researcher does not emerge as so discouraging. This may be explained by the justified interest on improving what results obviously deficient for them, but a global perspective might be missing.

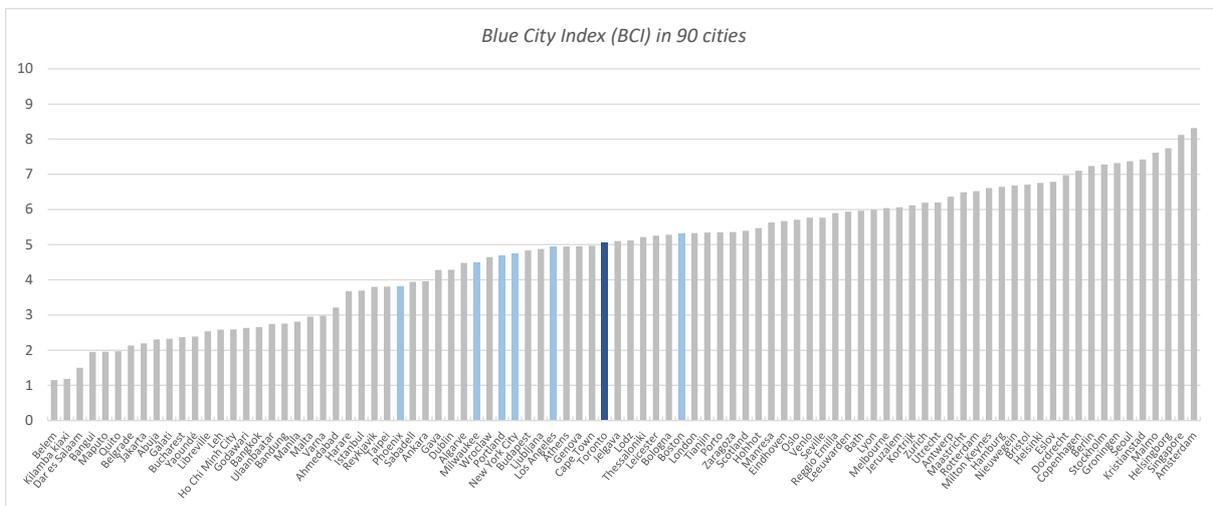
Finally, as the application of the two methods present the opportunity to show the whole picture of the water system, as already discussed, it might also complicate communication. Whilst the results for both approaches could be easily understood by experts and non-experts, the aggregation of the two increases complexity. Thus, it comprises both a strength and weakness, and may limit its use among stakeholders that do not pose scientific or academic knowledge.

6.2. Comparison with other cities

Cross-city learning is crucial to accelerate transition towards sustainability of water resources and sound water governance in urban areas (Koop and Van Leeuwen, 2016). While the results for FUNqyWATER cannot yet be compared given its newness, the application of the City Blueprint to different regions around the world provides a useful perspective of Toronto's performance. Figure 16 and Figure 17 show respectively the TPI and BCI of 90 municipalities that have been tested so far with these methods.



**FIGURE 16: THE TRENDS AND PRESSURES INDEX (TPI) OF 90 MUNICIPALITIES AND REGIONS
TORONTO VALUE IS HIGHLIGHTED IN RED WHILE U.S. CITIES VALUES IN ORANGE**



**FIGURE 17: THE BLUE CITY INDEX (BCI) OF 90 MUNICIPALITIES AND REGIONS
TORONTO VALUE IS HIGHLIGHTED IN DARK BLUE WHILE U.S. CITIES VALUES IN LIGHT BLUE**

Special attention is given to cities in the U.S. due to the cultural, political, and economic similarities with Toronto. TPI for the Canadian city is 2.3, which shows an auspicious environment for the development of IWRM that compares well with the other North American cities, but also stands out globally. However, when it comes to the BCI the results are not that encouraging. Toronto scores 5.1 for this index, which places the city right in the middle of the chart, although better than other North American cities, except for Boston. This score defines Toronto as a water efficient city as shown in Table 12. Based on the CBF analyses Toronto still needs long-term strategic planning to improve the water system, sharing similar challenges with the assessed U.S. cities by Feingold et al. (2017).

Like cities in the U.S. and many others in OECD countries, Toronto have not yet solved water management problems. (OECD, 2015; Vaux, 2015). While the entire city's population has access to basic water services and protection against water risks is relatively high, it still faces practical challenges, such as aging infrastructure, insufficient wastewater treatment and other water management issues that ratify "the water paradox in developed nations" (Vaux, 2015). As OECD points out (2015a) developed cities must change the old paradigm and move towards long-term solutions and adequate infrastructure in response to climatic and demographic pressures.

**TABLE 12: STANDARDIZED CATEGORIES OF IWRM IN CITIES USING THE BCI
(KOOP AND VAN LEEUWEN 2015B)**

BCI	Categories of IWRM in cities
0-2	<p>Cities lacking basic water services</p> <p>Access to potable drinking water of sufficient quality and access to sanitation facilities are insufficient. Typically, water pollution is high due to a lack of wastewater treatment (WWT). Solid waste production is relatively low but is only partially collected and, if collected, almost exclusively put in landfills. Water consumption is low, but water system leakages are high due to serious infrastructure investment deficits. Basic water services cannot be expanded or improved due to rapid urbanization. Improvements are hindered due to insufficient governance capacity and funding gap</p>
2-4	<p>Wasteful cities</p> <p>Basic water services are largely met but flood risk can be high and WWT is insufficiently covered. Often, only primary and a small portion of secondary WWT is applied, leading to large-scale pollution. Water consumption and infrastructure leakages are high due to a lack of environmental awareness and infrastructure maintenance. Solid waste production is high, and waste is almost completely dumped in landfills. In many cases, community involvement is relatively low</p>
4-6	<p>Water efficient cities</p> <p>Cities are implementing centralized, well-known, technological solutions to increase water efficiency and to control pollution. Secondary WWT coverage is high, and tertiary WWT is rising. Water-efficient technologies are partially applied, infrastructure leakages are substantially reduced but water consumption is still high. Energy recovery from WWT is relatively high, while nutrient recovery is limited. Both solid waste recycling and energy recovery are partially applied. These cities are often vulnerable to climate change, e.g., urban heat islands and drainage flooding, due to poor adaptation strategies, limited storm water separation and low green surface ratios. Governance community involvement has improved</p>
6-8	<p>Resource efficient and adaptive cities</p> <p>WWT techniques to recover energy and nutrients are often applied. Solid waste recycling and energy recovery are largely covered, whereas solid waste production has not yet been reduced. Water-efficient techniques are widely applied, and water consumption has been reduced. Climate adaptation in urban planning is applied, e.g., incorporation of green infrastructures and storm water separation. Integrative, (de)centralized and decentralized as well as long-term planning, community involvement, and sustainability initiatives are established to cope with limited resources and climate change</p>
8-10	<p>Water wise cities</p> <p>(Singapore and Amsterdam so far). These cities apply full resource and energy recovery in their WWT and solid waste treatment, fully integrate water into urban planning, have multi-functional and adaptive infrastructures, and local communities promote sustainable integrated decision-making and behaviour. Cities are largely water self-sufficient, attractive, innovative and circular by applying multiple centralized and decentralized solutions</p>

6.3. Reflections on IWRM and institutional fragmentation

Although this study advocates for integration through the IWRM paradigm, based on the recommendations of related institutions such as UNEP, OECD, GWP, etc., this concept should be considered a healthy pathway more than a rigid mantra. Theoretically, applying the IWRM framework in a region will lead to water sustainability and efficient water governance. However, as true as excessive jurisdictional fragmentation will be unsound, a full degree of governance centralization in water management does not grant water sustainability, as in the case of Israel (Fischhendler, 2008). "Integration is a necessary but not sufficient condition for sustainable water resources management" (Jønch-Clausen & Fugl, 2001). Additionally, it is also hard to determine in practice exactly how to integrate, especially in complex institutional scenarios as Canada, where the fragmentation degree is quite high (Cook, 2014). Furthermore, governance fragmentation is so deeply interwoven in Ontario and Toronto, due to geographical and historical reasons, that expectations of sudden change are naïve, especially given the current constitutional and political context. Long-term water management strategies that build capacity towards more cooperation and integration among different governmental levels would undoubtedly benefit this region. However, some degree of fragmentation may still promote governance efficiency by preventing the accumulation of power through overlapping responsibilities among actors (Cook, 2014). Thus, Toronto can also take advantage of these features on the way to more IWRM.

7. CONCLUSIONS

Toronto is a region that has historically faced water management issues. Given the projections for population growth and climate change, local water challenges are likely to intensify in the future. This study focuses on the sustainability of water resources management for this urban area. It aims to determine the water governance capacity to address future water challenges in the city by applying two assessment frameworks. First, (i) The FUNqyWATER approach which led to a qualitative evaluation of the current use and future demands for different use functions as well as the underlying drivers of change. Most of the use functions will face an increase in demand. This trend is clear for recreational uses, extraction for thermal energy and drinking water consumption, despite WUE efforts. Population growth, climate change, urbanization and infrastructure development are drivers commonly mentioned to explain the increase in future water demands. On the other hand, water quality deterioration and sustainability ambitions may lead to decrease in demands for certain uses. Second, (ii) The City Blueprint Approach resulted in (a) the identification of external pressures and conditions, through the TPF analysis; (b) a measure of the current IWRM performance, through the CBF analysis; and finally (c) an assessment of the city's governance capacity for different water challenges, through the GCF analysis. The calculation of the TPI resulted in a score of 2.3 which shows an auspicious environment and favourable conditions that stands out when comparing this region with other urban areas. The calculation of the CBI resulted in a final score of 5.1, which defines Toronto as a water efficient city. In this regard, the city is implementing centralized and well-known solutions to address urban water issues, such as the control of pollution and to increase WUE. However, it still faces many water management problems and is somewhat vulnerable to climate change. The application of the GCF led to an exhaustive assessment of the general water governance capacity and the specific challenges of flood risk and wastewater. When it comes to flood risk, the city shows a somewhat encouraging capacity, on a scale from very limiting to very encouraging. Assessment of the overall governance capacity and wastewater management is moderate, although with different nuances.

7.1. Strengths and weaknesses of Toronto's water management and governance

Like many other sustainability issues, water management performance in Toronto is neither black nor white. Rather, what exists is a wide range of grays from the lightest to the darkest. Regarding management strengths, the entire city's population has access to quality water and totally healthful sanitation services. Secondary WWT coverage is quite high with a sound performance for energy recovery and efficiency. Financial aspects also stand out, with a high degree of operation cost recovery and a solid capacity to invest in water services. Highlights of the city's water governance are the increasing level of stakeholder's engagement, information availability and transparency, ambitious management objectives and the sound institutional network, with clear divisions of responsibilities, legitimate power and sufficient authority.

On the other hand, both CBF and GCF revealed many practical water management deficiencies in different areas. The city faces problems related to aging infrastructure, which lead to CSO and flooding events. Tertiary WWT is rather insufficient and nutrient recovery is lacking. Infrastructure leakages are still substantial. The amount of the generated solid waste is particularly high, and the recycling capacity is insufficient. Finally, the ratio of green areas is quite low. Among governance weaknesses, the high degree of institutional fragmentation stands out. Particularly, the political differences between the provincial government and the city are undermining progress towards IWRM. The level of status quo at all institutional level is substantial, with little room for innovation. Additionally, community knowledge

and awareness are limited for some water issues. The inclusion of small communities in the decision-making process is also insufficient. The monitoring network system is rather outdated, and some data collection processes need to be modernized. Finally, the financial scheme for residential flood protection is especially unsustainable and more adaptive solutions need to be adopted.

7.2. Final recommendations to water managers

One of the aims of this study was to provide recommendations for sustainable water management in Toronto. Based on the results, this is a summary of practical issues that should be addressed.

- Capital investment should be increased to update aging infrastructure, improve tertiary wastewater treatment, nutrient recovery and solid waste collection and recycling.
- Move towards a more sustainable flood protection financing scheme for the long term. Clearly, the insurance approach is creating a vacuum message and is hampering more resilient solutions.
- Continue the separation of sewage and stormwater infrastructure to reduce CSO issues and foster LID stormwater solutions.
- Multi-functional water infrastructure should be also further promoted to face increasing water challenges. There are already good experiences in the city, but it is still not sufficient.
- Enhance city-resiliency by increasing green and blue space through smart urban planning. This will alleviate the more intense and frequent flooding events and improve the quality of life.
- Separate the drinking, waste, and storm water rates on the water utility bill, and insist on the idea of creating a separate stormwater fee. This will bring payment equity for different citizen profiles.
- Move towards more decentralized solutions to separately collect and treat domestic wastewater, especially in high-rise residential buildings, in order to alleviate the city's infrastructure.
- For the latter, it is important to facilitate action and improve opportunities for agents of change and advance towards creating a more open environment for innovative solutions.
- Modernize monitoring networks and information systems to improve data availability and transparency. Open-data solutions should be embraced.
- Increase the power in decision-making processes by citizens, first nations and non-governmental institutions. Certainly, the level of participation is sufficient but direct influence is lacking. Monitoring and evaluation of projects and improved. Promoting cross-stakeholder learning and inclusiveness leads to more effective water governance.
- Finally, increase cooperation between the city and the provincial government. Although there are political reasons behind it beyond the scope of this research, both parties should address social, environmental, and economic water issues with the same level of urgency.

Overall, an adaptive management approach should be adopted to cope with increasing water challenges as the city continues to grow and develop while facing the consequences of climate change. As many other developed cities, Toronto needs to change the old paradigm for future urban planning. Long-term adaptive solutions and urban resilience must be fostered and embraced. Therefore, it is urgent to address the limiting water governance issues identified by this research.



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APPENDIX I

The Trends and Pressures Framework (TPF) for the city of Toronto

12 June 2020

SEBASTIAN RIVADENEIRA
MASTER'S THESIS



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Key publications

This appendix is based on the latest version of the “Questionnaire for The Trends and Pressure Indicators” version 31-03-2020. To maintain consistency, this document used the same definitions, descriptions and calculations methods as the original. The raw version of the questionnaire is available upon request or can be found on the website of the European Innovation Partnership on Water: https://www.eip-water.eu/City_Blueprints

The following are key publications to understand the theoretical basis and framework of this appendix:

Van Leeuwen, C.J., Frijns, J., van Wezel, A., van de Ven, F.H.M. 2012. City Blueprints: 24 indicators to assess the sustainability of the urban water cycle. Water Resources Management 26: 2177–2197 ([open access](#))

Koop, S.H.A. and C.J. Van Leeuwen. (2015a). Assessment of the Sustainability of Water Resources Management: A Critical Review of the City Blueprint Approach. Water Resources Management. 29:5649–5670 ([open access](#))

Koop, S.H.A. and C.J. Van Leeuwen. (2015b). Application of the Improved City Blueprint Framework in 45 municipalities and regions. Water Resources Management, 29(13), 4629-4647 ([open access](#))

Koop, S.H.A. and Van Leeuwen, C.J.(2016). The challenges of water, waste and climate change in cities. Environment, Development and Sustainability, DOI :10.1007/s10668-016-9760-4. ([open access](#))

Koop SHA, Koetsier L, Doornhof A, Reinstra O, Van Leeuwen CJ, Brouwer S, Dieperink C, Driessen PPJ (2017) Assessing the Governance Capacity of Cities to Address Challenges of Water, Waste, and Climate Change. Water Resources Management. 31(11), 3427-3443. doi:10.1007/s11269-017-1677-7 ([open access](#))

1. INDICATORS

The Trends and Pressures Framework is made up of a total of 24 indicators divided as follow:

Table 1: Indicators of the Trends and Pressures Framework

Category	Indicators			N°	Score
I SOCIAL	Urbanization rate		Urbanization rate	1	3.6
	Burden of disease		Burden of disease	2	2.0
	Education rate		Education rate	3	4.3
II ENVIRONMENTAL	Flood risk	Urban drainage flood	Urban drainage flood	4	4.3
		Sea level rise	Sea level rise	5	0.0
		River peak discharges	River peak discharges	6	7.5
		Land subsidence	Land subsidence	7	0.0
	Water scarcity	Freshwater scarcity	Freshwater scarcity	8	0.0
		Groundwater scarcity	Groundwater scarcity	9	0.0
		Sea water intrusion	Sea water intrusion	10	5.0
	Water quality	Surface water quality	Surface water quality	11	0.7
		Biodiversity	Biodiversity	12	0.9
	Heat risk	Heat island	Heat island	13	2.8
Air Quality		Air Quality	14	0.8	
III FINANCIAL	Economic pressure		Economic pressure	15	1.2
	Unemployment rate		Unemployment rate	16	4.1
	Poverty rate		Poverty rate	17	2.8
	Inflation		Inflation	18	4.0
IV GOVERNANCE	Voice and accountability		Voice and accountability	19	2.0
	Political Stability		Political Stability	20	3.0
	Government effectiveness		Government effectiveness	21	1.6
	Regulatory quality		Regulatory quality	22	1.7
	Rule of law		Rule of law	23	1.5
	Control of corruption		Control of corruption	24	1.3

TPI 2.3

2. SCORES

The 24 indicators are divided in classes which represent a 'degree of concern', standardized in a scale from 0 to 10 as shown below.

Table 2: Scores v/s degree of concern

TPF indicator score	Degree of concern
0 – 2	no concern
2 – 4	little concern
4 – 6	medium concern
6 – 8	concern
8 – 10	great concern

3. RESULTS

Figure 1 shows the spider diagram as a result of TPF analysis for the city of Toronto. The average of the 24 indicators gives a final index of 2.3, which represents in general terms an auspicious environment for the development of IWRM.

➤ **Trends and Pressures Index: 2.3**

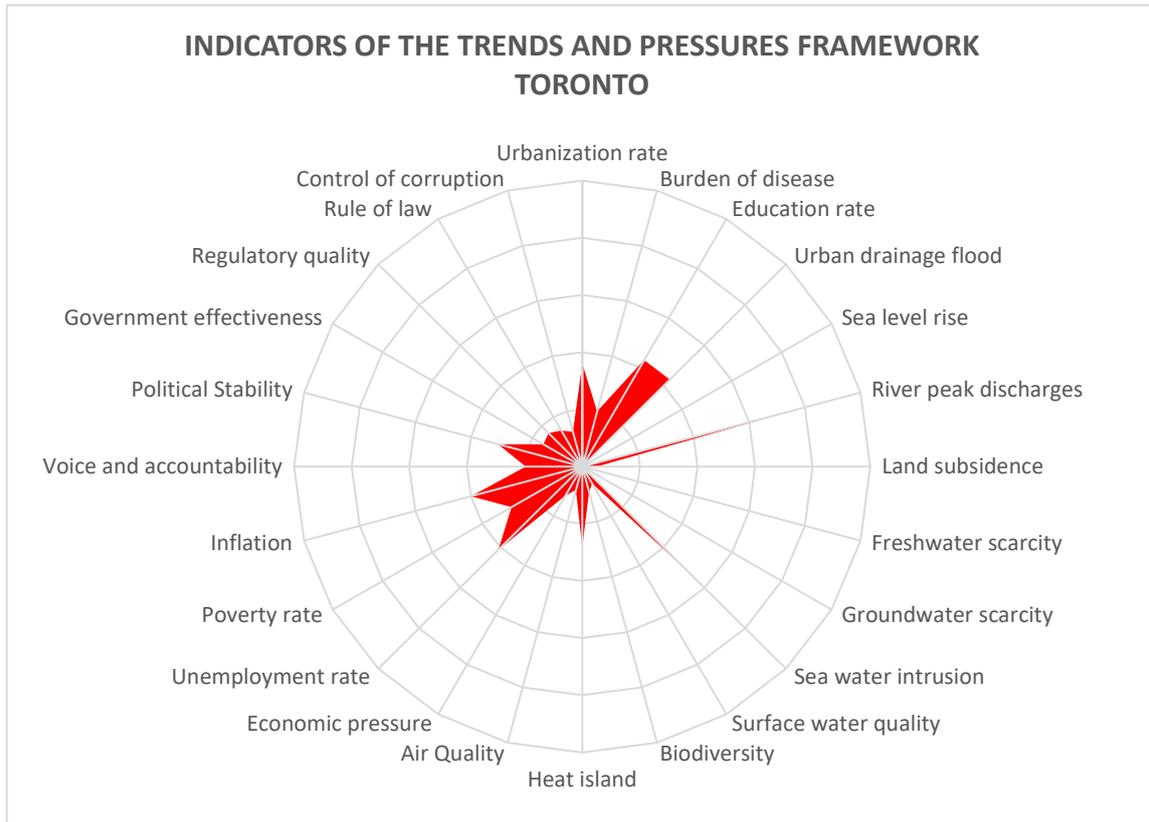


Figure 1: Spider Diagram for TPF Indicators in Toronto

4. ASSESSMENT METHOD

Category 1: Social Pressures

Indicator 1: Urbanization rate

Description: Percentage of population growth either by birth or migration. The percentages are annually averages per country. Urbanization increases the pressure on IWRM.

Calculation method

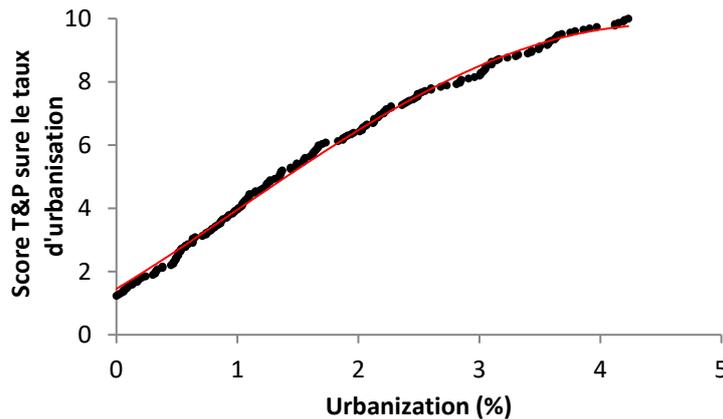


Figure 2: Score TPF for urbanization

Figure 2: Equation fit for urbanization rate (%). The score for trends and pressures is based on the country rankings. Correlation coefficient is $r=0.997$.

X = Urbanization rate (%)

$$\text{Score urbanization rate} = 0.00444X^4 - 0.1102X^3 + 2.3001X + 1.4535$$

For urbanization rates lower than 0% the score is also zero and the above formula is not applied.

Literature:

CIA (2014). Central Intelligence Agency: The World Factbook for Canada. Urbanization. <https://www.cia.gov/library/publications/the-world-factbook/> Accessed 10 December 2019

For Canada:

rate of urbanization: 0.97% annual rate of change (2015-20 est.)

Applying the formula → **Score urbanization rate = 3.6**

Scale: National scale. Toronto might have a higher urbanization rate



Indicator 2: Burden of disease

Principal: The gap between current health status and an ideal situation where everyone lives into old age, free of disease and disability (WHO, 2004). The average DALY per 100.000 people is a strong tool to indicate the burden of disease.

Calculation method

The indicator measures the age-standardized disability-adjusted life years (DALY) per 100.000 people. DALY is the quantification of premature death, burdens of disease and disability in life years. It is a time-based measure that combines years of life lost due to premature mortality and years of life lost due to time lived in states of less than full health, e.g. disease, injuries and risk factors (WHO, 2004). The WHO subdivided these DALY's per 100.000 people into 5 classes. These classes are used to standardize this indicator to a score of 0 to 4 in the TPF analysis as shown in the Table below.

DALY = Years of premature death + Years lost due to disability

Years of premature death: Sum of, the number of deaths at each age * [global standard life expectancy for each age - the actual age].

Years lost due to disability: Number of incident cases in that period * average duration of the disease * weight factor.

Table 3: Score TPF for Burden of disease

DALY per 100.000 people	Score	Degree of
0 - 8.000	0	No concern
8.000 - 16.000	1	
16.000 - 24.000	2	
24.000 - 32.000	3	Little concern
32.000 - 40.000	4	
40.000 - 48.000	5	Medium concern
48.000 - 56.000	6	
56.000 - 64.000	7	concern
64.000 - 72.000	8	
72.000 - 80.000	9	Great concern
81.000<	10	

Literature:

WHO (2004) World Health Organization: The Global Burden of Disease 2004 Update http://www.who.int/healthinfo/global_burden_disease/GBD_report_2004update_full.pdf Accessed 10 December 2019

For Canada:

18838 Disabled Adjusted Life Years (DALY's) per 100.000 people. This is between the 16.000 - 24.000 DALY's per 100.000 people and therefore receives a score of 2. This score implies no concern for disease burden in Toronto

Scale: National scale

Indicator 3: Education rate

Principal: Education rate expressed as percentage of children completing their primary education.

Calculation method:

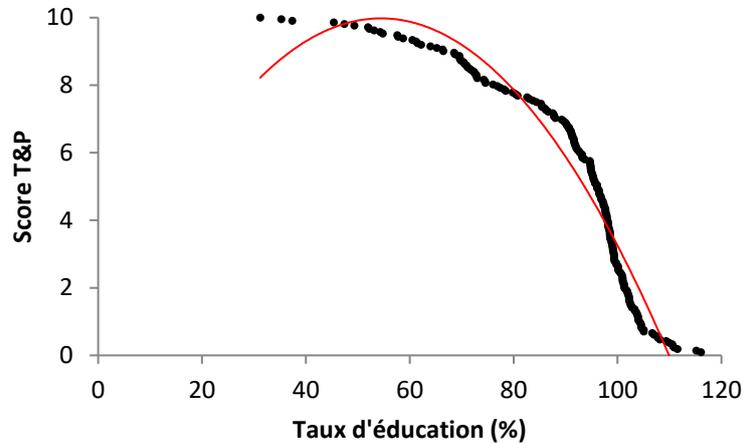


Figure 3: Score TPF for education

Figure 3: Equation fit for education rate (%). The score for trends and pressures is based on the country rankings. Correlation coefficient is $r=0.9706$.

X = Education rate (%)

Score education rate = $-0.0032X^2 + 0.3533X + 0.359$

Range formula application: $60 < X < 100$

Literature:

World Bank (2014C) Primary completion rate, total (% of relevant age group)
<http://data.worldbank.org/indicator/SE.PRM.CMPT.ZS/countries/IW-AO?display=default> Accessed 10 December 2019

For Canada:

Education rate: 97.81% (year 2000)

Applying the formula → Score education rate = 4.3

Scale: National scale

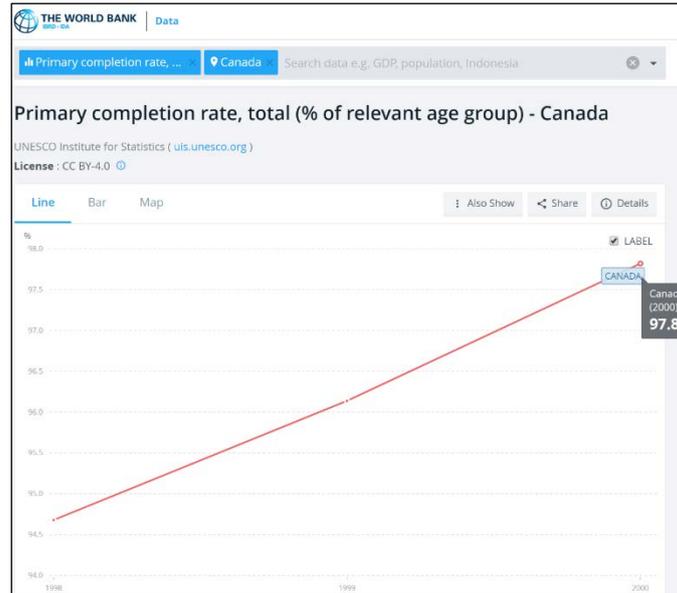


Figure 4: World Bank Education rate for Canada

Another source:

https://www.unicef.org/infobycountry/canada_statistics.html#0

Table 4: World Bank Education rate for Canada

Education	to the top
Youth (15-24 years) literacy rate (%) 2008-2012*, male	-
Youth (15-24 years) literacy rate (%) 2008-2012*, female	-
Number per 100 population 2012, mobile phones	75.7
Number per 100 population 2012, Internet users	86.8
Pre-primary school participation, Gross enrolment ratio (%) 2008 -2012*, male	72.6
Pre-primary school participation, Gross enrolment ratio (%) 2008 -2012*, female	72.5
Primary school participation, Gross enrolment ratio (%) 2008-2012*, male	100.1
Primary school participation, Gross enrolment ratio (%) 2008-2012*, female	99.9
Primary school participation, Net enrolment ratio (%) 2008-2012*, male	-
Primary school participation, Net enrolment ratio (%) 2008-2012*, female	-
Primary school participation, Net attendance ratio (%) 2008-2012*, male	-
Primary school participation, Net attendance ratio (%) 2008-2012*, female	-
Primary school participation, Survival rate to last primary grade (%) , 2008-2012*, admin. data	-
Primary school participation, Survival rate to last primary grade (%) , 2008-2012*, survey data	-
Secondary school participation, Net enrolment ratio (%) 2008-2012*, male	-
Secondary school participation, Net enrolment ratio (%) 2008-2012*, female	-
Secondary school participation, Net attendance ratio (%) 2008-2012*, male	-
Secondary school participation, Net attendance ratio (%) 2008-2012*, female	-

For Canada:

Education rate: 98% (year 2008-2012)

Applying the formula → Score education rate = 4.2 (little concern)

Category 2: Environmental pressures

Flood risk

Indicator 4 Urban drainage flood

Principal: Risk of flooding due to intensive rainfall expressed as the share of urban soil that is sealed.

Calculation method

Sealed soil cover in the city standardized according to the min-max method. The minimum and maximum value are determined by taking the bottom and the top 10% of the 572 European cities assessed (EEA 2015).

EEA (2012) *European environmental agency: Urban adaptation to climate change. Annex II. ISBN 978-92-9213-308-5* <http://www.eea.europa.eu/publications/urban-adaptation-to-climate-change> Accessed 7 September 2017. Open the excel file Annex II. City Data sensitivity.

An estimated score for non-EU countries is based on descriptions of soil sealing of the cities (mostly without exact coverage's) found in literature. Lower 10% of all European cities assessed is 31.7%, top 10% has a share impermeable area of 69.6%.

Literature for Toronto:

Nowak, D., Hoehn, R., Bodine, Al., Greenfield, E., Ellis, A., Endreny, T., Yang, Y., ... (2013). *Assessing urban forest effects and values: Toronto's urban forest. Resour. Bull. NRS-79. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 59 p. Available from: https://www.fs.usda.gov/treearch/pubs/43543* accessed 06 March, 2020.

Table 5: Impervious cover in Toronto

Land Use	Tree Cover (%)			Impervious Cover (%)		
	1999	2009	Sig. ^a	1999	2009	Sig. ^a
Commercial	8.5	8.9		77.2	80.9	**
Industrial	5.2	6.3	*	73.0	76.4	**
Institutional	19.0	20.5	*	49.7	50.1	
MF residential	23.4	23.1		58.4	61.3	**
Parks	53.8	56.9	**	9.9	10.1	
Open Space	31.1	31.8		16.2	16.9	
Other	20.0	21.4		24.1	31.7	**
SF residential	30.4	31.4	**	47.7	49.7	**
Utility & Transportation	11.6	14.9	**	38.2	39.4	
Unknown	12.0	14.1		26.6	29.7	*
Toronto	25.3	26.6	**	45.6	47.9	**

^a Sig. = statistically significant difference in cover between 1999 and 2009 where * = $\alpha < 0.05$ and ** = $\alpha < 0.01$

Toronto Impervious surface: 47.9 (2009)

The formula to calculate the score is: $\frac{47.9-31.7}{69.6-31.7} \cdot 10 = 4.3$

A score of 4.3 implies that urban drainage flooding is of medium concern for the city of Toronto.

**Indicator 5: Sea level rise**

Principal: Measure of the vulnerability of flooding due to sea level rise. Percentage of the city that would flood with 1-meter sea level rise. Only environmental circumstances are considered. Protection measures such as dikes, dams *etcetera* are not considered (that would be a performance).

Calculation method

In accordance with the European Environmental Agency (2012) the following classification is used to standardize the area being affected by a 1-meter sea level increase without flood protection on a scale from 1 to 5.

Table 6: Score TPF for sea level rise

Urban area affected	Score	Level of concern
0 - 5	0	No Concern
5 - 10	2.5	Little concern
10 - 20	5	Medium concern
20 - 40	7.5	Concern
40 - 100	10	Great concern

For non-European cities, the assessment is based on literature available. Classes are in principle the same as for European cities.

Literature:

EEA (2012) European Environment Agency: Urban adaptation to climate change in Europe. Challenges and opportunities for cities together with supportive national and European policies. ISBN 978-92-9213-308-5 <http://www.eea.europa.eu/publications/urban-adaptation-to-climate-change> (Accessed 04-05-2020)

For non-European cities, the assessment is based on literature available. Classes are in principle the same as for European cities.

For Toronto:

As Toronto is an inland city the urban area affected is 0%

Score: 0

Thus, this is a matter of no concern.

Indicator 6: River peak discharges

Principal: Measure for the vulnerability of flooding due to river level rise. Also flash floods from outside the city are included in this indicator. Percentage of the city that would flood with 1-meter river level rise. Only environmental circumstances are considered. Protection measures such as dikes, dams etcetera are not considered (that would be a performance).

Calculation method

In accordance with the European Environmental Agency (2012) the following classification is used to standardize the area being affected by a 1-meter river level increase without flood protection on a scale from 1 to 5.

Table 7: Score TPF for river peak discharge

Urban area	Score	Level of concern
0 – 5	0	No concern
6 – 10	2.5	Little concern
11 – 20	5	Medium concern
21 – 40	7.5	Concern
40 – 100	10	Great concern

Literature for European cities

EEA (2012) *European Environment Agency: Urban adaptation to climate change in Europe. Challenges and opportunities for cities together with supportive national and European policies.* ISBN 978-92-9213-308-5 <http://www.eea.europa.eu/publications/urban-adaptation-to-climate-change>

For non-European cities, the assessment is based on literature available. Classes are in principle the same as for European cities.

<https://portlandsto.ca/flood-risks-in-toronto/> (Accessed 04-05-2020)

http://www.hurricanehazel.ca/ssi/about_community.shtml (Accessed 04-05-2020)

For Toronto:

Flooding is a matter of concern in the city of Toronto, due to historical catastrophic events as the hurricane Hazel in 1954. The Humber River caused the most serious destruction for the infrastructure in Toronto. Many bridges and important highways were heavily damaged. Several roads and railways were washed out as well. At the peak of this flooding event, the Don River's flow rate was 1,680 m³/s, while normally the flow is 10 m³/s rising to 100 m³/s during the spring.

Then, score = 7.5

Indicator 7: Land subsidence

Principal: Land subsidence increases the risks of river and coastal floods and salt water intrusion. The cause of land subsidence is irrelevant for its impact on flooding.

Calculation method

This score is based on a qualitative assessment according to the following classification:

Table 8: Score TPF for land subsidence

Score	Description
0	No infrastructure damage, no flood risk
2.5	Low/medium infrastructure damage expected, no major increase in flood risk expected
5	Experienced infrastructure damage and medium infrastructure damage expected or <0.50m subsidence by 2100 in a substantial area of the city.
7.5	Serious experienced infrastructural damage or < 1m subsidence by 2100 in a substantial area of the city
10	Serious experienced infrastructure damage, Imminent flooding/ < 2m subsidence by 2100 in a substantial area of the city

Literature:

Local websites, government reports, strategic plans *etcetera*.

For Toronto:

Land subsidence is of no concern in the city of Toronto.

Then, score = 0.

Water scarcity

Indicator 8: Fresh water scarcity

Principal: The abstracted fresh water as percentage of total renewable resource. This includes surface water and groundwater sources.

Calculation method

The scoring method is in accordance with the European Environmental Agencies classification (OECD, 2004; WRI, 2013).

Table 9: Score for freshwater scarcity

% of renewable resource abstracted	Score	Level of concern
0 – 2	0	No concern
2 – 5	1	
5 -10	2	
10 – 15	3	Little concern
15 – 20	4	
20 – 25	5	Medium concern
25 – 30	6	
30 – 35	7	Concern
35 – 38	8	
38 – 40	9	Great concern
>40	10	

Literature:

a) Aquastat

Aquastat → Water use → Pressure on water resources → Fresh water withdrawal as % of total actual renewable water resources.

Aquastat (2015) Select variables

<http://www.fao.org/nr/water/aquastat/data/query/index.html;jsessionid=B022D1C2732DF571D2A384B57E0128D6> Accessed 06 March 2020.

According to this source, for Canada 1.227 of the total renewable water resource is used. It therefore receives a score of 0 meaning that freshwater scarcity is no concern there.

Another Sources:

b) World Bank

World Bank (2020). World Bank data. Accessed on 06 March 2020
<https://data.worldbank.org/country/canada>

Annual freshwater withdrawals total (% of internal resources) in Canada was reported at 1.36 % in 2012, according to the World Bank collection of development indicators, compiled from officially recognized sources.

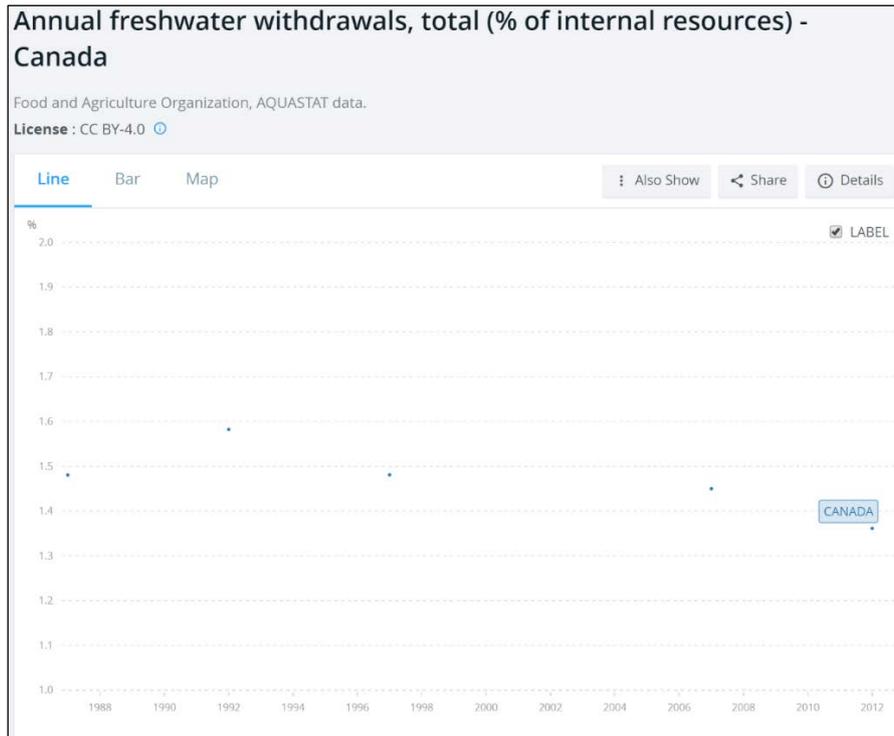


Figure 5: World Bank data freshwater withdrawal Canada

C) Aqueduct, WRI.

Gassert, F., P. Reig, T. Luo, and A. Maddocks. 2013. "Aqueduct country and river basin rankings: a weighted aggregation of spatially distinct hydrological indicators." Working paper. Washington, DC: World Resources Institute, November 2013. Available online at wri.org/publication/aqueduct-country-river-basin-rankings.

Table 10: Freshwater withdrawals in Canada according to WRI

RANK	NAME	ALL SECTORS	AGRICULTURAL	DOMESTIC	INDUSTRIAL
109	Canada	1.21 (1.31)†	2.35 (1.40)†	0.92 (1.03)†	1.16 (1.31)†

Nevertheless, according to this source "by focusing on the areas in which humans rely most on water, this aggregation methodology can reveal water stress that isn't otherwise immediately apparent. Brazil, Russia, and Canada, for example, are often considered immune to water risk because of their vast water resources. The reality is different, however: most of the water use in these countries is concentrated in a few regions with relatively limited supplies, while their water resources are largely remote and inaccessible"

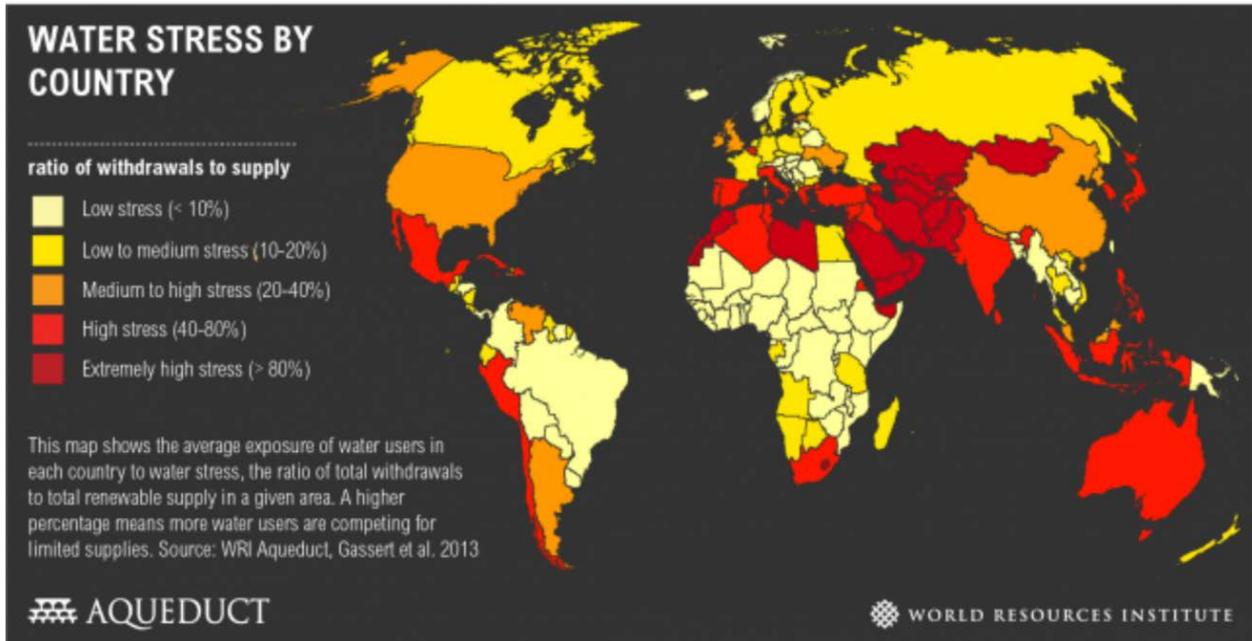


Figure 6: Water Stress by country according to WRI Aqueduct

APPENDIX: COUNTRY AND RIVER BASIN RANKINGS (BASELINE WATER STRESS)

Baseline water stress measures total annual water withdrawals expressed as a percentage of the total annual available blue water. Higher values indicate more competition among users.

- [4-5]: Extremely high stress (>80%)
- [3-4]: High stress (40-80%)
- [2-3]: Medium-high stress (20-40%)
- [1-2]: Low-medium stress (10-20%)
- [0-1]: Low stress (<10%)

Therefore, according to this source, Canadian cities would be in a condition of medium to high stress.

Indicator 9: Groundwater scarcity

Principal: The abstracted groundwater as a percentage of the annual groundwater recharge. This is a measure of the pressure on groundwater resources. Groundwater development stress (GDS) is defined as the current annual rate of groundwater abstraction (A) divided by the mean annual natural groundwater recharge (R), multiplied by 100%: $GDS = A/R * 100\%$

Calculation method

The indicator scoring is in accordance with the classification used by UNESCO.

% abstracted of annual recharge	Score	Level of
0 - 2	0	No concern
2 - 20	2.5	Little concern
20 - 50	5	Medium
50 - 100	7.5	Concern
>100	10	Great concern

Literature:

Igrac (2010) Groundwater Development stress:

http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/temp/wwap_pdf/Groundwater_developmnt_stress_GDS.pdf p. 15 Accessed 06 March 2020.

and <https://www.un-igrac.org/news/igrac-contribution-world-water-development-report> Accessed 06 March 2020.

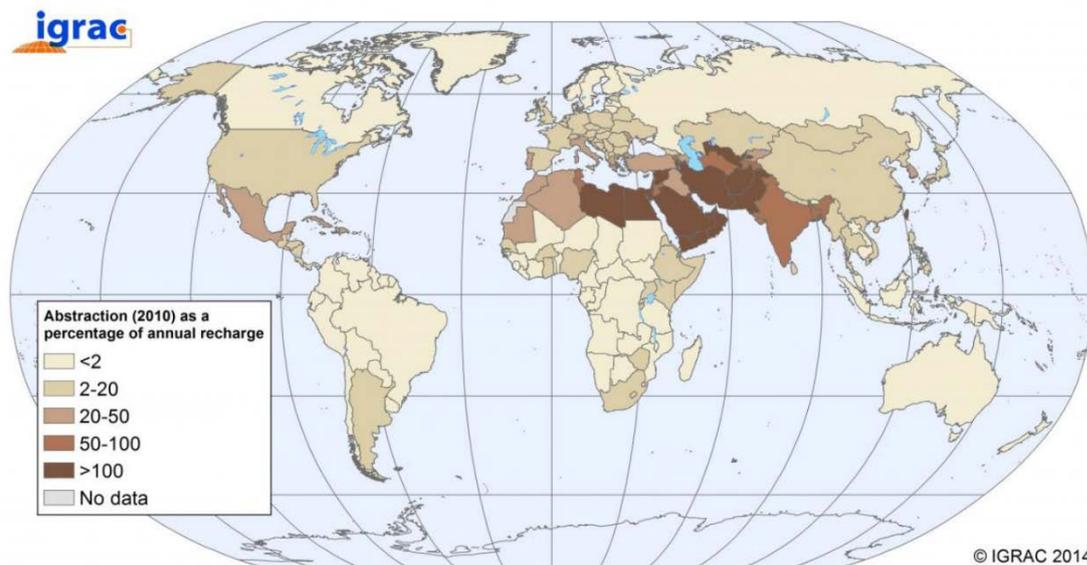


Figure 7: IGRAC Map for groundwater abstractions

For Canada:

Canada extracts less than 2% of the annual recharged groundwater and therefore receives a score of 0 implying that groundwater scarcity is of no concern for Toronto.

Indicator 10: Seawater intrusion (and/or salinization)

Principal: Measure of the vulnerability of seawater intrusion and salinization of the soil.

Calculation method

This indicator score is based on a quick literature check in which seawater and groundwater intrusion are scored as suggested below.

Seawater intrusion

Table 11: Score TPF for Seawater intrusion

Description	Score
No seawater intrusion reported and city not prone to (future) intrusion	0
No seawater intrusion reported, and city can experience intrusion in coming century	2.5
No seawater intrusion reported but city is prone to intrusion in the near future	5
Seawater intrusion reported	7.5
Seawater intrusion reported and city is particularly prone to intrusion	10

Groundwater salinization

Based on literature studies, here the following scheme is applied to determine a score:

Table 12: Score TPF for Groundwater salinization

Description	Score
No concern	0
Low concern	2.5
Medium concern	5
Concern	7.5
Great concern	10

The highest score of the two indicators is used as the final score for salinization and/or seawater intrusion.

For Toronto:

There is no seawater intrusion as Toronto is not a coastal city. However, there is lot of issues with salinization due to the application of salt for road maintenance in winter. As is shown in the next articles:

<https://www.cbc.ca/news/canada/toronto/road-salt-gta-water-1.4515132>

<https://www.tvo.org/article/oversalted-why-ontario-needs-a-new-approach-to-snow-removal>

<http://www.waterkeeper.ca/blog/2018/12/18/a-salty-lake-ontario-and-aquatic-life>

<https://www.tvo.org/article/oversalted-why-ontario-needs-a-new-approach-to-snow-removal>

Based on a concise literature research this score is set on 5, stating that salinization is of medium concern for the city.

Water quality

Indicator 11: Surface water quality

Principal: Measure of relative surface water quality. A lower Indicator score is given for better quality.

Calculation method

A national surface water quality index (WQI) is available as a measure out of 100. Then, the indicator is calculated as follows:

$$\frac{100-WQI}{10} = score$$

Literature:

The WQI data are obtained from the Country Profiles:

EPI (2010) Environmental performance index:

http://www.ciesin.columbia.edu/repository/epi/data/2010EPI_country_profiles.pdf Accessed 19 January 2015. This is a 327 page document, with 2 pages per country in alphabetical order. On the first page of the country, take the 'Country' value for 'Water (impact on ecosystems)', which is a factor out of 100.

For Canada:

The WQI for Canada is 93.1

Applying the formula $\rightarrow \frac{100-93.1}{10} = 0.69 \rightarrow$ score water quality = 0.69

Scale: National scale

Indicator 12: Biodiversity

Principal: Measure of the biodiversity of aquatic ecosystems in the city. A low indicator score is given where biodiversity is good.

Calculation method

The calculation is based on national or regional data when city-level data are not available. There are many ways of assessing biodiversity, so there is no globally uniform approach.

Table 13: Score TPF for Biodiversity

% of waters with less than good	Indicator 12 value	Level of concern
<10%	0	No concern
10 to 30%	2.5	Little concern
30 to 50%	5	Medium concern
50 to 70%	7.5	Concern
≥ 70%	10	Great concern

For non-EU countries, it is recommended to use data from a program called the Environmental Performance Index (EPI), led by Yale University (epi.yale.edu). The 2012 update does not include the relevant parameter called 'Water – impact on ecosystem'. This is available from the 2010 version (see also Indicator 4). The value is obtained from the Country Profiles:

Literature:

EPI (2010) Environmental performance index:

http://www.ciesin.columbia.edu/repository/epi/data/2010EPI_country_profiles.pdf Accessed 20 March 2020. This is a 327-page document, with 2 pages per country in alphabetical order. On the first page of the country, take the 'Country' value for 'Water (impact on ecosystems)', which is a factor out of 100.

$$\frac{100 - \text{Water (impact on ecosystems)}}{10} = \text{score factor out of 100.}$$

For Canada:

For Canada the Water (impact on ecosystem) = 90.7. This leads to the following score: $[100 - 90.7] / 10 = 0.93$. This score implies that (aquatic) biodiversity is an issue of little concern in Canada.

(However, Toronto has been declared as an area of concern).

Indicator 13: Heat risk

Principal: Prediction of heat island effects severity on human health.

Calculation method

1. Number of combined tropical nights (>20 °C) and hot days (>35 °C) in the future. More specifically, the estimated tropical nights and hot days that are expected between the years 2071 and 2100 must be selected, where the maximum is set on 50 days. The number is standardized using the following formula:

$$[\text{Number of combined tropical nights and hot days} / 50] \times 4 = \text{score}$$

2. Percentage of green and blue urban area. Share of green and blue areas is available for all European cities. The EEA city database presents data for of 367 European cities. From these data the average of the lowest 10% is taken as minimum (16%) and the average of the highest 10% is taken as maximum (48%). The percentages for the EU cities are standardized according to the min-max method. For non-European cities percentages for green and blue area are mostly not available. A best estimate is given by comparing this city to a similar European city. It is important for these cities to provide better information on the share of green area. Formula:

$$\text{score} = 10 - [(\% \text{ green and blue area} - 16) / (48 - 16) \times 10]$$

3. The overall score is the arithmetic average of both standardized scores.

Literature:

OECD (2015) *Organization for Economic Co-operation and Development: Environment at a glance 2015. OECD indicators.* OECD Publishing. <https://doi.org/10.1787/19964064>. https://www.oecd-ilibrary.org/environment/environment-at-a-glance-2015_9789264235199-en Accessed 07 March 2020

City of Toronto (2020). 2018 Pressure on Toronto's Green Spaces & Ecosystems. <https://www.toronto.ca/city-government/council/2018-council-issue-notes/pressure-on-torontos-green-spaces-and-ecosystems/>. Accessed on 08 March 2020.

Arcadis (2018). *Citizen centric cities. The Sustainable Cities Index 2018* https://www.arcadis.com/media/1/D/5/%7B1D5AE7E2-A348-4B6E-B1D7-6D94FA7D7567%7DSustainable_Cities_Index_2018_Arcadis.pdf. Accessed on 08 March 2020.

<https://www.currentresults.com/Weather/Canada/Ontario/Places/toronto-temperatures-by-month-average.php> (Accessed 04-05-2020)

<https://en.climate-data.org/north-america/canada/ontario/toronto-53/> (Accessed 04-05-2020)

For Toronto

1. The Number of combined tropical nights and hot days is 0.

2. Toronto's 8,000 hectares in over 1,600 parks cover **13** percent of the city. Also, the houses have gardens. The total green space is therefore estimated at about 30%. Although, Lake Ontario cannot be forgotten in this matter, as it represents a huge freshwater body that is essential for climate adaptation, it does not directly add as buffer for stormwater. Indicator score = $(30-16)/(48-16) * 10 \rightarrow$ Score = 5.6

3. Thus, the score is 2.8. Then, Heat risk is of little concern in Toronto.

Indicator 14: Air Quality

Principal: The measurement of air quality consists of the measurement of particular matter.

Calculation method:

$$X_1 = \text{PM}_{2.5}$$

$$X_2 = \text{PM}_{10}$$

If there is only a value for X_1 than use:

$$\left[\frac{X_1 - 5.1}{63.6 - 5.1} \right] 10$$

If there is only a value for X_2 than use:

$$\left[\frac{X_2 - 9.5}{118.9 - 9.5} \right] 10$$

If X_1 and X_2 are both available use:

$$\left[\frac{X_1 - 5.1}{63.6 - 5.1} \right] 5 + \left[\frac{X_2 - 9.5}{118.9 - 9.5} \right] 5$$

Literature:

Main database: *World Health Organisation (2018) WHO Global Ambient Air Quality Database (update 2018)* <https://www.who.int/airpollution/data/cities/en/>

World Bank (2017) PM_{2.5} air pollution, mean annual exposure (micrograms per cubic meter). <https://data.worldbank.org/indicator/EN.ATM.PM25.MC.M3>

For Toronto

$$\text{PM}_{2.5} \text{ available} = 12 \mu\text{g m}^{-3}$$

$$\text{PM}_{10} \text{ available} = 15 \mu\text{g m}^{-3}$$

Applying the formula \rightarrow score = 0.84

Then, Air quality is of little concern in Toronto.



Category 3: Financial pressures

Indicator 15: Economic pressure

Principal: Gross Domestic Product (GDP) per head of the population is a measure of the economic power of a country. A low GDP per capita implies a large economic pressure.

Calculation method:

$$X = \text{GDP per capita per year (US\$)}$$
$$10 - [(X - 514.7) / (59231.2 - 514.7) * 10]$$

Literature:

IMF (2013). *International Monetary Fund: World economic outlook database, 2013*
<http://www.imf.org/external/pubs/ft/weo/2013/01/weodata/index.aspx> Accessed 06 March 2020

For Canada:

GDP per capita: 52364 USD. Applying the formula results in:

$$10 - [(52364 - 514.7) / (58716.5) * 10] = 1.2 \rightarrow \text{score} = 1.2$$

Indicator 16: Unemployment rate

Principal: Percentage of population of the total labor force without a job.

Calculation method:

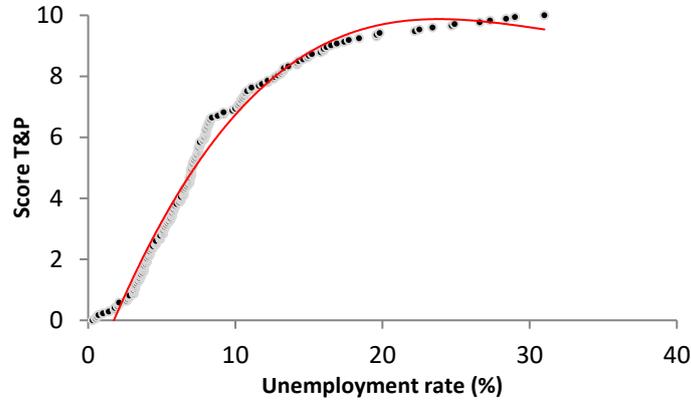


Figure 8: Score TPF for unemployment rate

Figure 8: Equation fit for unemployment rate (%). The score for trends and pressures is based on the country rankings. Correlation coefficient is $r=0.9886$.

$$X = \text{Unemployment rate (\%)}$$

$$\text{Score unemployment rate} = 0.0005X^3 - 0.0433X^2 + 1.2693X - 2.0889$$

Literature:

World Bank (2015) Unemployment total (% of total labour force) (modelled ILO estimate) <http://data.worldbank.org/indicator/SL.UEM.TOTL.ZS> (Accessed 10 December 2019).

For Canada:

Canada has an Unemployment rate of 6.057% of its labour force. Applying the formula results in: $0.0005 \cdot [6.057]^3 - 0.0433 \cdot [6.057]^2 + 1.2693 \cdot [6.057] - 2.0889 = 4.1$. Unemployment is a medium concern for the city.

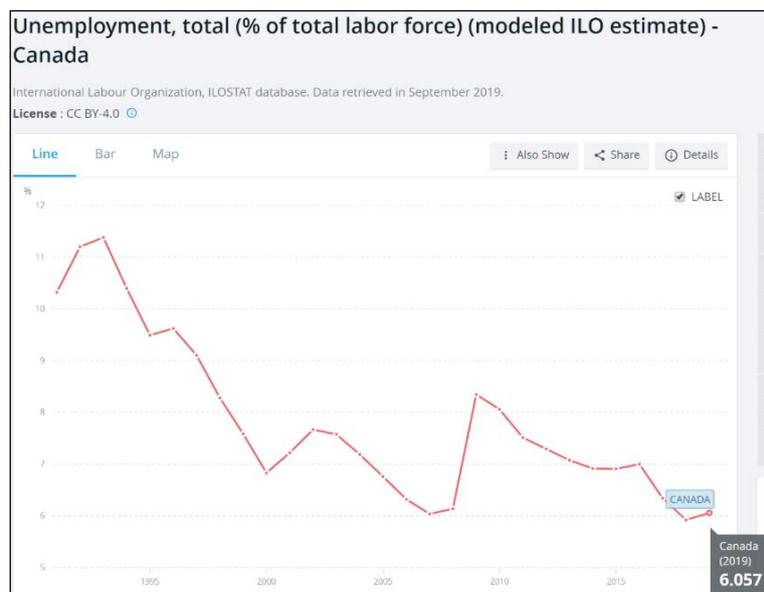


Figure 9: Unemployment rate Canada according to World Bank

Indicator 17: Poverty rate

Principal: Percentage of people that is below the poverty line of 2 US\$ a day.

Calculation method

Percentages of the population living from less than 2 US\$ a day.

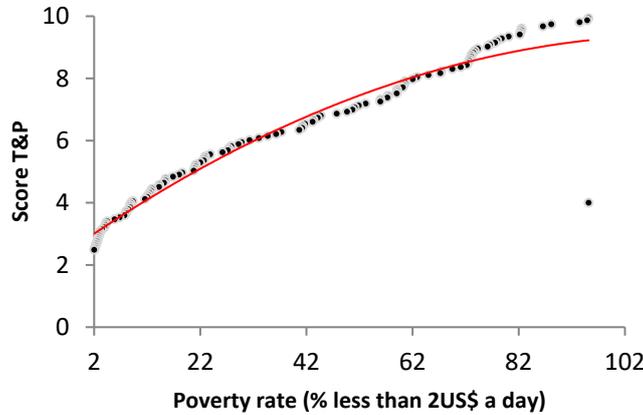


Figure 10: Score TPF for unemployment rate

Figure 10 Equation fit for poverty rate (% less than 2US\$ a day). The score for trends and pressures is based on the country rankings. Correlation coefficient is $r=0.9654$.

$$X = \text{Poverty rate (\% less than 2US\$ a day)}$$

$$\text{Score poverty rate} = -0.0005X^2 + 0.1167X + 2.7746$$

Literature:

World Bank (2013) Poverty gap at \$2 a day (PPP) (%)

<https://data.worldbank.org/indicator/SI.POV.DDAY?locations=CA> Accessed 20 March 2020, and now at \$ 1.9 available here: <http://wdi.worldbank.org/table/2.8>

For Canada:

0.5% of the people live below the poverty line of 1.9 US\$ a day. Using this information, it results in a score of 2.8. This is a problem of little concern in Toronto.

Table 14: TPF Poverty statistics for Canada (World Bank)

Country	< \$1.90 ^[4]	< \$3.20 ^[5]	< \$5.50 ^[6]	Year	Continent
Canada	0.5%	0.5%	1.0%	2013	North America

Indicator 18: Inflation

Principal: Percentage inflation per year. High inflation rates may hamper investments.

Calculation method

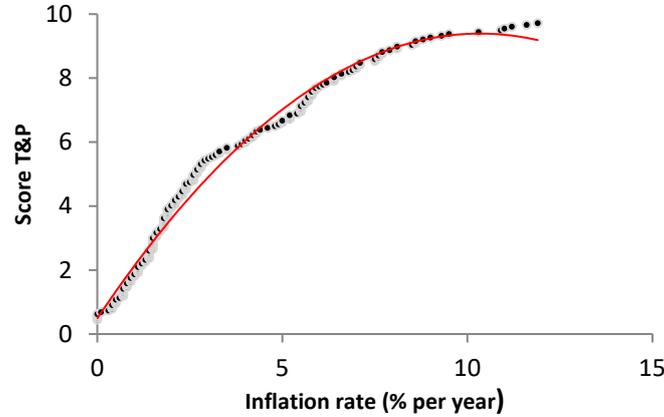


Figure 11: Score TPF for Inflation rate

Figure 11 Equation fit for inflation rate (%). The score for trends and pressures is based on the country rankings. Correlation coefficient is $r=0,9937$.

$$X = \text{Inflation rate (\%)}$$

$$\text{Score inflation rate} = -0.0832X^2 + 1.7212X + 0.4932$$

Literature:

World Bank (2015) Inflation, costumers price (annual %) <http://data.worldbank.org/indicator/FP.CPI.TOTL.ZG>

For Canada:

Canada has an inflation rate of 2.268% per year. Applying the formula results in: $-0.0832*[2.27]^2 + 1.7212*[2.27] + 0.4932 = 4$ Inflation is a medium concern for the city of Toronto.



Figure 12: Inflation rate Canada according to World Bank

Category 4: Governance

The Worldwide Governance Indicators report on six broad dimensions of governance for over 200 countries and territories over the period 1996-2018:

- Voice and Accountability
- Political Stability and Absence of Violence
- Government Effectiveness
- Regulatory Quality
- Rule of Law
- Control of Corruption

Indicator 19: Voice and Accountability

Principal: Reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.

Calculation method:

$$\frac{\text{value} - \text{minimum value}}{\text{maximum value} - \text{minimum value}} \times 10 = \text{World Bank Score on a scale of 0-10}$$

$$\text{So, } \{(x - (-2.5)) / \{2.5 - (-2.5)\} \} \times 10$$

This gives: $\{(x + 2.5) / 5\} \times 10 = \text{World Bank Score on a scale of 0 (low) to 10 (high)}$

A maximum score (very good) will be obtained with a WB Governance score of +2.5. This will lead to a score of 10. A minimum WB score will be 0.

In the TPF, however, we present scores as concern scores. So, a TPF score 0 is no concern and a TPF score of 10 is a maximum concern. Then, this requires a second transformation. We transform the WB score into a TPF concern score as follows:

$$\text{TPF concern score} = 10 - \text{WB score}$$

Literature:

World Bank (2020) Worldwide governance indicators [Accessed 03-05-2020]

- Click on the link: <http://info.worldbank.org/governance/wgi/#home>
- Click on data interactive data access
- Select Table View
- Select all indicators
- Select Canada
- Use the most recent time series (2018)

For Canada:

Canada's score for voice and accountability is 1.52. Applying the formula results in:

$$\{(1.52 - (-2.5)) / \{2.5 - (-2.5)\} \} \times 10 = 8 = \text{WB score on a scale of 0-10}$$

$$\text{TPF concern score} = 10 - 8 = 2.0;$$

Voice and accountability is of little concern for the city of Toronto.

Indicator 20: Political instability (and absence of violence)

Principal: The estimated likelihood that the government will be destabilized or overthrown by violent means such as terrorism and politically motivated violence.

Calculation method

Political stability (and absence of violence) is part of the set of governance indicators developed by the World Bank. The estimates of the indicator are aggregates of sub-indicators normalized by a standard normal distribution ranging from -2.5 to 2.5. The sub-indicators used by the World Bank to develop this indicator are:

Orderly transfer; Armed conflict; Violent demonstrations; Social Unrest; International tensions/terrorist threat; Cost of Terrorism; Frequency of political killings; Frequency of disappearances; Frequency of tortures; Political terror scale; Security Risk Rating; Intensity of internal conflicts: ethnic, religious or regional; Intensity of violent activities of underground political organizations; Intensity of social conflicts (excluding conflicts relating to land); Government stability; Internal conflict; External conflict; Ethnic tensions; Civil unrest: How widespread political unrest is, and how great a threat it poses to investors. Demonstrations in themselves may not be cause for concern, but they will cause major disruption if they escalate into severe violence. At the extreme, this factor would amount to civil war; Terrorism: Whether the country suffers from a sustained terrorist threat, and from who many sources. The degree of localization of the threat is assessed, and whether the active groups are likely to target or affect businesses (World Bank, 2014).

Literature:

Same process as indicator 19

For Canada:

Canada's score for political instability is 0.99. Applying the formula results in:

$$\{(0.99 - (-2.5)) / (2.5 - (-2.5))\} \times 10 = 7.0 = \text{WB score on a scale of 0-10}$$

$$\text{TPF concern score} = 10 - 7 = 3.0;$$

Political instability is of little concern for the city of Toronto

Indicator 21: Government effectiveness

Principal: Reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.

Calculation method:

The calculation is similar to the methodology to calculate indicator 19

Literature:

Same as indicator 19.

For Canada:

Canada's score for government effectiveness is 1.72. Applying the formula results in:

$$\{(1.72 - (-2.5)) / (2.5 - (-2.5))\} \times 10 = 8.4 = \text{WB score on a scale of 0-10}$$

$$\text{TPF concern score} = 10 - 8.4 = 1.6;$$

Government effectiveness is of no concern for the city of Toronto

Indicator 22: Regulatory Quality

Principal: Reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.

Calculation method:

The calculation is similar to the methodology to calculate indicator 19

Literature:

Same as indicator 19.

For Canada:

Canada's score for regulatory quality is 1.67. Applying the formula results in:

$$\{(1.67 - (-2.5)) / (2.5 - (-2.5))\} \times 10 = 8.3 = \text{WB score on a scale of 0-10}$$

$$\text{TPF concern score} = 10 - 8.3 = 1.7;$$

Regulatory quality is of no concern for the city of Toronto

Indicator 23: Rule of law

Principal: Reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.

Calculation method:

The calculation is similar to the methodology to calculate indicator 19

Literature:

Same as indicator 19.

For Canada:

Canada's score for rule of law is 1.77. Applying the formula results in:

$$\{(1.77 - (-2.5)) / \{2.5 - (-2.5)\} \times 10 = 8.5 = \text{WB score on a scale of 0-10}$$

$$\text{TPF concern score} = 10 - 8.5 = 1.5;$$

Rule of law is of no concern for the city of Toronto

Indicator 24: Control of corruption

Principal: Reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.

Calculation method

$$10 - [\text{Control of corruption} / 10] = \text{score}$$

Literature:

Same as indicator 19.

For Canada:

Canada's score for control of corruption is 1.87. Applying the formula results in:

$$\{(1.87 - (-2.5)) / \{2.5 - (-2.5)\} \times 10 = 8.7 = \text{WB score on a scale of 0-10}$$

$$\text{TPF concern score} = 10 - 8.7 = 1.3;$$

Control of corruption is of no concern for the city of Toronto



APPENDIX II

THE CITY BLUEPRINT PERFORMANCE FRAMEWORK (CBF) FOR THE
CITY OF TORONTO

12 June 2020

SEBASTIAN RIVADENEIRA
MASTER'S THESIS



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Key publications

This appendix is based on the latest version of the “Questionnaire: Indicators of the City Blueprint Indicators” version 31-03-2020. To maintain consistency, this document used the same definitions, descriptions and calculations methods as the original. The raw version of the questionnaire is available upon request or can be found on the website of the European Innovation Partnership on Water: https://www.eip-water.eu/City_Blueprints

The following are key publications to understand the theoretical basis and framework of this appendix:

Van Leeuwen, C.J., Frijns, J., van Wezel, A., van de Ven, F.H.M. 2012. City Blueprints: 24 indicators to assess the sustainability of the urban water cycle. Water Resources Management 26: 2177–2197 ([open access](#))

Koop, S.H.A. and C.J. Van Leeuwen. (2015a). Assessment of the Sustainability of Water Resources Management: A Critical Review of the City Blueprint Approach. Water Resources Management. 29:5649–5670 ([open access](#))

Koop, S.H.A. and C.J. Van Leeuwen. (2015b). Application of the Improved City Blueprint Framework in 45 municipalities and regions. Water Resources Management, 29(13), 4629-4647 ([open access](#))

Koop, S.H.A. and Van Leeuwen, C.J.(2016). The challenges of water, waste and climate change in cities. Environment, Development and Sustainability, DOI :10.1007/s10668-016-9760-4. ([open access](#))

Koop SHA, Koetsier L, Doornhof A, Reinstra O, Van Leeuwen CJ, Brouwer S, Dieperink C, Driessen PPJ (2017) Assessing the Governance Capacity of Cities to Address Challenges of Water, Waste, and Climate Change. Water Resources Management. 31(11), 3427-3443. doi:10.1007/s11269-017-1677-7 ([open access](#))

1. INDICATORS

The CBF framework consists of 24 indicators divided over 7 main categories, as shown below:

Table 1: Indicators of the City Blueprint Performance Framework

Category	N°	Indicator	Score
I Basic water services	1	Access to drinking water	10.0
	2	Access to sanitation	10.0
	3	Drinking water quality	9.8
II Water Quality	4	Secondary WWT	9.8
	5	Tertiary WWT	3.9
	6	Groundwater quality	7.6
III Wastewater treatment	7	Nutrient recovery	0.0
	8	Energy recovery	9.6
	9	Sewage sludge recycling	9.7
	10	WWT energy efficiency	4.0
IV Water infrastructure	11	Stormwater separation	8.6
	12	Average age sewer	2.4
	13	Water system leakages	5.0
	14	Operation cost recovery	10.0
V Solid waste	15	Solid waste collected	0.3
	16	Solid waste recycled	2.4
	17	Solid waste energy recovered	1.0
VI Climate adaptation	18	Green space	4.4
	19	Climate adaptation	8.0
	20	Climate-robust buildings	5.0
VII Plans and actions	21	Management and action plans	5.0
	22	Water efficiency measures	6.0
	23	Drinking water consumption	8.0
	24	Attractiveness	8.0

2. SCORES

The 24 City Blueprint indicators are standardized to a scale of 0-10 in which 10 points implies an excellent score and 0 points is a poor score. This is done by comparing the values from an international range, using natural boundaries of 0 and 100% or by using ordinal classes. Often the min-max method is applied:

$$\frac{\text{value} - \text{minimum value}}{\text{maximum value} - \text{minimum value}} \cdot 10 = \text{Indicator score}$$

The scoring scale for the CBF is presented in *Table 2*

Table 2: CBF Scoring Scale

CBF indicator score	Performance
0 – 2	Poor
2 – 4	Low
4 – 6	Medium
6 – 8	High
8 – 10	Excellent

3. RESULTS

Figure 1 shows the spider diagram as a result of CBF analysis for the city of Toronto. The average of the 24 indicators gives a BCI of 5.1.

➤ **Blue City Index (BCI): 5.1**

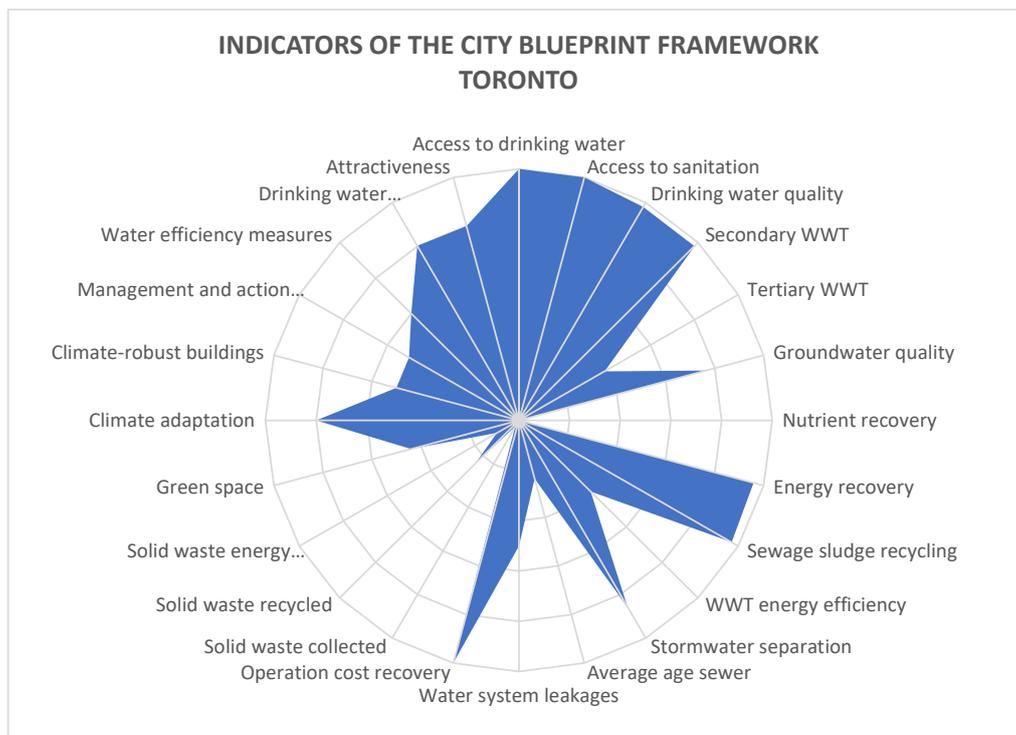


Figure 1: Spider Diagram for CBF Indicators in Toronto

4. ASSESSMENT METHOD

Category I: Basic water services

Indicator 1: Access to drinking water

Principal: The proportion of the population with access to affordable safe drinking water. A lower Indicator score is given where the percentage is lower.

Calculation Method:

X = Percentage (%) of total urban population with access to potable drinking water.

$$\frac{X}{10} = \text{score}$$

Literature:

WHO/UNICEF: *Progress on Sanitation and Drinking Water 2013 update*:
http://www.who.int/water_sanitation_health/publications/2013/jmp_report/en/

For Canada:

Access to drinking water in Canada is shown in next table:

Table 3: Access to drinking water in Canada (WHO/Unicef)

Country, area or territory	Year	USE OF DRINKING-WATER SOURCES [percentage of population]															Proportion of the 2011 population that gained access since 1985 (%)
		URBAN					RURAL					NATIONAL					
		Improved			Unimproved		Improved			Unimproved		Improved			Unimproved		
		Total improved	Piped on premises	Other improved	Unimproved	Surface water	Total improved	Piped on premises	Other improved	Unimproved	Surface water	Total improved	Piped on premises	Other improved	Unimproved	Surface water	
Canada	1990	100	100	0	0	0	99	-	-	1	-	100	-	-	0	0	15
	2000	100	100	0	0	0	99	38	61	1	-	100	87	13	0	0	
	2011	100	100	0	0	0	99	-	-	1	-	100	-	-	0	0	

For urban areas, such as Toronto, this value is 100%.

Applying the formula → **Score: 100/10 = 10**

Indicator 2: Access to sanitation

Principal: A measure of the percentage of the population covered by wastewater collection and treatment. A lower Indicator score is given where the percentage is lower.

Calculation method

X = Percentage (%) of total urban population with access to proper sanitation facilities.

$$\frac{X}{10} = \text{score}$$

Literature:

WHO/UNICEF: *Progress on Sanitation and Drinking Water 2013 update*:
http://www.who.int/water_sanitation_health/publications/2013/jmp_report/en/

For Canada:

Access to sanitation in Canada is shown in next table:

Country, area or territory	Year	Population (x 1000)	Percentage urban population	USE OF SANITATION FACILITIES (percentage of population)												Proportion of the 2011 population that gained access since 1995 [%]
				URBAN				RURAL				NATIONAL				
				Unimproved		Unimproved		Unimproved		Unimproved		Unimproved		Unimproved		
				Improved	Shared	Unimproved	Open defecation	Improved	Shared	Unimproved	Open defecation	Improved	Shared	Unimproved	Open defecation	
Canada	1990	27 701	77	100	0	0	0	99	-	1	-	100	-	0	0	15
	2000	30 667	79	100	0	0	0	99	-	1	-	100	-	0	0	
	2011	34 350	81	100	0	0	0	99	-	1	-	100	-	0	0	

For urban areas, such as Toronto, this value is 100%.

Applying the formula → **Score: 100/10 = 10**

**Indicator 3: Drinking water quality**

Principal: A measure of the level of compliance with local drinking water regulations. A lower Indicator score is given where compliance is lower.

Calculation method

The result is expressed as a percentage of the samples meeting the applicable standards.

X = Total number of samples meeting standards

Y = Total number of samples

$$\frac{X}{Y} \cdot 10 = score$$

Literature:

City of Toronto (2020). *Lead Drinking Water*. <https://www.toronto.ca/services-payments/water-environment/tap-water-in-toronto/lead-drinking-water/>

City of Toronto (2018). *Drinking Water Analysis Summary 2018* <https://www.toronto.ca/wp-content/uploads/2019/05/8fd4-Drinking-Water-Analysis-2018-AODA.pdf>

City of Toronto (2019). *Drinking Water System Annual Report 2019* https://www.toronto.ca/wp-content/uploads/2020/02/8e2f-2019-Drinking-Water-System-Annual-Report-Final_AODA.pdf

City of Toronto (2018). *Annual Lead Mitigation Report*. <https://www.toronto.ca/wp-content/uploads/2019/06/96ce-TW-Annual-Lead-Mitigation-Report-2018-Final-a.pdf>

Global news (2019). *Is Canada's tap water safe? Thousands of test results show high lead levels across the country* <https://globalnews.ca/news/6114854/canada-tapwater-high-lead-levels-investigation/>

Drinking water is safe at the plants and the distribution system and there were no incidents of non-compliances in any of the Drinking Water Plants. However, it contains lead in old buildings.

“The 2018 regulated tap water test results show significantly lower lead levels compared with the lead levels measured prior to initiating corrosion control treatment. Of the 55 homes and businesses tested, 1.7 percent of samples exceeded 10 parts per billion (ppb) and none of the samples in the water distribution system exceeded 10 ppb. This contrasts with 2008 when 100 homes and businesses were tested and 52 percent of the samples exceeded 10 ppb”. “In Ontario, a drinking water system is in compliance with the lead regulations when no more than 10 percent of the samples exceed the limit of 10 ppb”.

“The 2018-2019 Distribution System Drinking Water Inspection was performed on February 8, 2019 and the Inspection Report issued on March 28, 2019. From the report, there were no incidences of non-compliance and the Toronto Distribution and Supply System received a Final Inspection Rating of 100%”

$$\frac{54}{55} \cdot 10 = score$$

→ **Score: 9.8**

Category II: Water quality

Indicator 4: Secondary WWT

Principal: Measure of the urban population connected to secondary wastewater treatment plants. The focus on secondary treatment is chosen because primary treatment is considered rather insufficient for BOD and nutrient removal.

Calculation method

X = Percentage of population connected to secondary sewage treatment. We assume that there is only tertiary treatment after secondary treatment has been done.

Definition secondary WWT: Secondary treatment: process generally involving biological treatment with a secondary settlement or other process, with a BOD removal of at least 70% and a COD removal of at least 75% (OECD, 2013).

$$\frac{X}{10} = score$$

Literature:

OECD (2015) Organization for Economic Co-operation and Development: *Environment at a glance 2015. OECD indicators.* OECD Publishing. <https://doi.org/10.1787/19964064>. https://www.oecd-ilibrary.org/environment/environment-at-a-glance-2015_9789264235199-en Accessed 07 March 2020

Statistics Canada (2019). *Municipal wastewater systems in Canada, 2013 to 2017* <https://www150.statcan.gc.ca/n1/en/daily-quotidien/190625/dq190625c-eng.pdf?st=4TuHKpX9>

For Canada:

Canada has 53% of secondary treatment and 15% of tertiary treatment. The score for the coverage of secondary WWT becomes: $[53\% + 15\%] / 10 = 6.8$

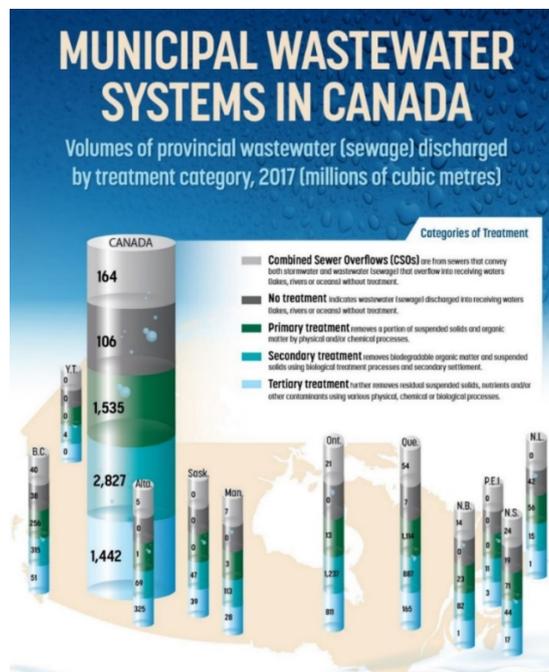


Figure 2: Municipal Wastewater systems in Canada (Statistics Can.)

For Toronto:

Total population served with 4 WWTP: 2,876,700

The Humber Treatment Plant (HTP) 685,000

The Ashbridges Bay Treatment Plant (ABTP) 1,603,700

The Highland Creek Treatment Plant (HCTP) 533,000.

The North Toronto Treatment Plant (NTTP) 55,000

Total Population of the city: 2,9300,000

→% served =98%

Score: 9,8

For Ontario:

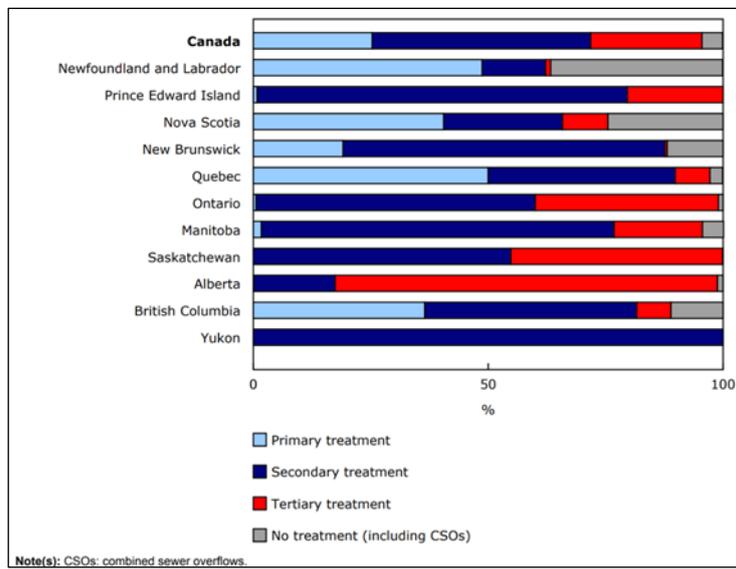


Figure 3: Municipal Wastewater discharges by treatment Canada 2017 (Statistics Can.)

From Figure 2:

$$X = (1237+811) / (21+0+13+1237+811) = 98\%$$

Same result than the city.

Indicator 5: Tertiary WWT

Principal: Measure for the urban population connected to tertiary wastewater treatment plants. This treatment step is important for water quality because much nutrients and chemical compounds are removed from the water before it enters the surface water.

Calculation method

X = Percentage of population connected to tertiary sewage treatment.

$$\frac{X}{10} = \text{score}$$

Definitions

Tertiary treatment: Tertiary treatment: treatment of nitrogen or phosphorous or any other pollutants affecting the quality or a specific use of water (microbiological pollution, color, etc.) (OECD, 2013).

Literature:

OECD (2015) *Organization for Economic Co-operation and Development: Environment at a glance 2015. OECD indicators.* OECD Publishing. <https://doi.org/10.1787/19964064>. https://www.oecd-ilibrary.org/environment/environment-at-a-glance-2015_9789264235199-en Accessed 07 March 2020

Statistics Canada (2019). Municipal wastewater systems in Canada, 2013 to 2017 <https://www150.statcan.gc.ca/n1/en/daily-quotidien/190625/dq190625c-eng.pdf?st=4TuHKpX9>

For Ontario:

From *Figure 2*:

$$X = 811 / (21+0+13+1237+811) = 39\%$$

→ **Score = 3.9**

Indicator 6: Groundwater quality

Principal: Measure of relative groundwater quality. A lower Indicator score is given for poorer quality.

Calculation method

Base the calculation on national or regional data where city-level data are not available. A limitation is that in any country, city water quality is typically worse than the national average.

$X = \text{Number of samples of 'good chemical status'}$

$Y = \text{Number of samples of 'poor chemical status'}$

$$\frac{X}{(X+Y)} \cdot 10 = \text{score}$$

Literature:

TRCA (2018). Report Card 2018. <https://reportcard.trca.ca/watershed-report-cards/>. Acc.07 March 2020

For Toronto:

Fertilizers (nitrogen) and road salt (chloride) are common sources of contamination in groundwater in Toronto. Concentrations of nitrate and chloride are measured at 17 monitoring wells across the TRCA jurisdiction. “Generally, concentrations of nitrate were better than the drinking water guidelines in most wells across the TRCA jurisdiction. About 60% of the GW monitoring wells in the region received an A grade for Cl. Most people in the region don’t get their drinking water from private wells.

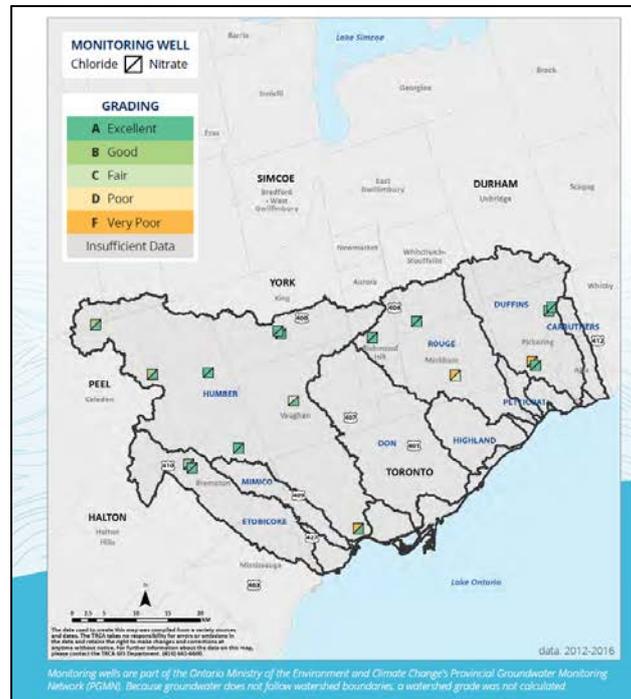


Figure 4: Water quality in Toronto (TRCA)

For Chloride:

$X = \text{Number of samples of 'good chemical status'} = 13$

$Y = \text{Number of samples of 'poor chemical status'} = 4$

Indicator 6 = $X / (X+Y) \times 10 = 13 / 17 \times 10 = 7.64$

Category III: Wastewater treatment

Indicator 7: Nutrient recovery

Principal: Measure of the level of nutrient recovery from the wastewater system.

Calculation method

A: Wastewater treated with nutrient recovering techniques at the WWTP (Mm³ year⁻¹)

B: Total volume of wastewater passing the WWTP (Mm³ year⁻¹)

$$\text{Indicator 7} = \frac{A}{B} \cdot \frac{\% \text{secondary WWT coverage}}{100} \cdot 10$$

Literature:

OECD (2015) Organization for Economic Co-operation and Development: Environment at a glance 2015. OECD indicators. OECD Publishing. <https://doi.org/10.1787/19964064>. https://www.oecd-ilibrary.org/environment/environment-at-a-glance-2015_9789264235199-en Accessed 07 March 2020

City of Toronto (2009). Biosolids Master Plan Update. <https://www.toronto.ca/legdocs/mmis/2009/pw/bgrd/backgroundfile-24358.pdf>

City of Toronto (2020). Wastewater Treatment Plants & Reports. Retrieved from: <https://www.toronto.ca/services-payments/water-environment/managing-sewage-in-toronto/wastewater-treatment-plants-and-reports/>

Improvement in calculation method: Previously, in the city blueprint only water that entered the WWT facilities was considered as total volume of water. Hereby disregarding the city's wastewater that is not treated at all. Therefore, the City Blueprint scores are now multiplied by the share of WWT coverage. In this way the concept of urban metabolism is better represented. To measure the full potential of nutrient abstraction from all wastewater the above equation is applied.

For Toronto:

There is no information on direct nutrient recovery (e.g. struvite production) from wastewater.

Score = 0

Indicator 8: Energy recovery

Principal: Measure of energy recovery from the wastewater system.

Calculation method

A: Total volume of wastewater treated with techniques to recover energy (Mm³/year).

B: Total volume of water produced by the city (Mm³/year).

$$\frac{A}{B} \cdot 10 = \text{score}$$

Often only the total volume of wastewater that enters the treatment facilities is known together with wastewater treatment coverage's (% of water going to the treatment facilities). In this case:

C: Total volume of wastewater treated with techniques to recover energy (Mm³/year).

D: Total volume of wastewater treated in wastewater treatment plants (Mm³/year).

$$\text{Indicator 8} = \frac{C}{D} \cdot \frac{\% \text{secondary WWT coverage}}{100} \cdot 10$$

Literature:

OECD (2015) *Organization for Economic Co-operation and Development: Environment at a glance 2015. OECD indicators.* OECD Publishing. <https://doi.org/10.1787/19964064>. https://www.oecd-ilibrary.org/environment/environment-at-a-glance-2015_9789264235199-en Accessed 07 March 2020

City of Toronto (2020). *Wastewater Treatment Plants & Reports.* Retrieved from: <https://www.toronto.ca/services-payments/water-environment/managing-sewage-in-toronto/wastewater-treatment-plants-and-reports/>

Postery Group (2018). *Market Characterization & Conservation Potential for Ontario's Drinking Water & Wastewater Treatment Plants.* Accessed 07 March 2020 <http://www.ieso.ca/-/media/Files/IESO/Document-Library/conservation-reports/Water-Wastewater-Treatment-and-Pumping-Report.pdf>

Improvement in calculation method: Previously, in the city blueprint only water that entered the WWT facilities was considered as total volume of water. Hereby disregarding the city's wastewater that is not treated at all. Therefore, the City Blueprint scores are now multiplied by the share of WWT coverage. In this way the concept of urban metabolism is better represented.

Table 4: WWTP's in Toronto

Name	Space consumption(ha)	Population served	Capacity (m3/day)	Operating since
Ashbridges Bay Treatment Plant	94	1,500,000	818,000	1917
Highland Creek Treatment Plant	54	450,000	219,000	1956
Humber Treatment Plant	41	680,000	473,000	1960
North Toronto Treatment Plant	22	55,000	34,000	1929

The four plants use conventional activated sludge (CAS) processes that generate biosolids through anaerobic digestion. Ashbridge's Bay TP and Highland Creek TP both mechanically dewater their biosolids to generate a biosolids cake with 26-28% solids content, while Humber TP and North Toronto TP generate liquid biosolids with 2-4% solids content.

Table 5: Ontario Treatment Plants with Combined Heat and Power (Postery Group)

Exhibit 5 – Ontario Wastewater Treatment Plants with CHP		
Municipality	Electrical Co-generation Capacity (kW)	Annual Flow of Wastewater Treated (ML)
Barrie	500	17,700
Chatham-Kent	250	Unknown
Collingwood	65	4,999
Guelph	500	18,537
Hamilton	1,600	105,464
Kingston (Ravensview)	370	19,373
Mississauga – Clarkson (in development)	1,400	69,026
Ottawa	2,400	143,080
Peterborough	380	14,383
Thunder Bay	600	29,396
Toronto – Humber	4,700	98,174
Waterloo Region (to be completed in 2020)	1,200 (3 plants combined)	291,333

C: 473000 + 219000 + 818000 m3/day

D: 1544000 m3/day

For Humber, Ashbridges Bay and Highland Creek:

“The process produces digester gas, made up predominantly of methane. This gas is used as a supplementary fuel for plant needs, including process and space heating and the generation of electricity via two cogeneration engines, thereby reducing the plant's operating costs and carbon footprint”.

$$\text{Indicator } 8 = \frac{818000 + 473000 + 219000}{1544000} \cdot \frac{98}{100} \cdot 10$$

→ Score = 9.6

**Indicator 9: Sewage sludge recycling**

Principal: A measure of the proportion of sewage sludge recycled or re-used. For example, it may be thermally processed and/or applied in agriculture.

The decision whether or not to apply sewage sludge in agriculture depends on the levels of organic and inorganic micro-contaminants. Often, sewage sludge is contaminated and in many countries it is not allowed to apply sewage sludge in agriculture. Instead, the sludge is burned in waste destruction installations or as biomass in power plants for the generation of electricity.

Calculation method

A: Dry weight of sludge produced in wastewater treatment plants serving the city

B: Dry weight of sludge going to landfill

C: Dry weight of sludge thermally processed

D: Dry weight of sludge disposed in agriculture

E: Dry weight of sludge disposed by other means (As a check, A should = B + C + D +E)

$$\text{Indicator 9} = \frac{C+D}{A} \cdot \frac{\% \text{ secondary WWT coverage}}{100} \cdot 10$$

To measure the full potential of nutrient and energy recovery, it is specifically chosen to multiply the first term in the equation above with the percentage of secondary WWT coverage as secondary WWT produces much more sewage sludge than primary WWT.

Literature:

Data needs to be provided locally. For WWT coverage's:

OECD (2015) Organization for Economic Co-operation and Development: Environment at a glance 2015. OECD indicators. OECD Publishing. <https://doi.org/10.1787/19964064>. https://www.oecd-ilibrary.org/environment/environment-at-a-glance-2015_9789264235199-en Accessed 07 March 2020

City of Toronto (2009). Biosolids Master Plan Update. <https://www.toronto.ca/legdocs/mmis/2009/pw/bgrd/backgroundfile-24358.pdf>

City of Toronto (2020). Wastewater Treatment Plants & Reports. Retrieved from: <https://www.toronto.ca/services-payments/water-environment/managing-sewage-in-toronto/wastewater-treatment-plants-and-reports/>

City of Toronto (2020). Biosolids Management <https://www.toronto.ca/services-payments/water-environment/managing-sewage-in-toronto/biosolids-management/>

Improvement in calculation method: Previously, in the city blueprint only water that entered the WWT facilities was considered as total volume of water. Hereby disregarding the city's wastewater that is not treated at all. To measure the full potential of nutrient and energy recovery from wastewater by using wastewater abstracted sewage sludge, secondary WWT is incorporated in the calculation and not primary WWT. In this way the concept of urban metabolism is better represented.

For Toronto:

The main characteristics of the 4 WWTP's are listed below:

Table 6: WWTP's in Toronto

Name	Space consumption(ha)	Population served	Capacity (m3/day)	Operating since
Ashbridges Bay Treatment Plant	94	1,500,000	818,000	1917
Highland Creek Treatment Plant	54	450,000	219,000	1956
Humber Treatment Plant	41	680,000	473,000	1960
North Toronto Treatment Plant	22	55,000	34,000	1929

The four plants use conventional activated sludge (CAS) processes that generate biosolids through anaerobic digestion. Ashbridge's Bay TP and Highland Creek TP both mechanically dewater their biosolids to generate a biosolids cake with 26-28% solids content, while Humber TP and North Toronto TP generate liquid biosolids with 2-4% solids content.

From the Biosolid Master Plan 2009:

Biosolids Management at Ashbridge's Bay TP

This is how Ashbridge's Bay TP manage the biosolids:

Table 7: Biosolids Management in Ashbridge's Bay:

Biosolids Management Method	Wet Tonnes		
	2018	2017	2016
Agricultural Land Application	27,835	32,653	35,414
Third Party Process Stabilization (Soil Amendment)	37,666	35,745	37,968
Pelletization	82,702	82,938	72,886
Landfill	0	0	0
Mine Land Reclamation	7,553	7,952	3,465
Total	155,756	159,288	149,733

Biosolids Management at Humber TP

"Liquid biosolids and some waste activated sludge is discharged to the Mid-Toronto Interceptor (MTI), where it is blended with wastewater from other parts of the City before entering the Ashbridges Bay TP for management". So it goes to Ashbridge's Bay.

"All sludge from HTP received further treatment at Ashbridges Bay Treatment Plant".

Biosolids Management at Highland Creek TP

"Biosolids generated at the Highland Creek TP are incinerated onsite by multiple hearth incinerators. There are two incinerators available for this purpose, each with reported capacity for about 35 dry tonnes of biosolids per day. One incinerator is intended to operate as duty, with the second in stand-by and contingency mode. Incinerator ash is stored in on-site ash storage lagoons. Ash is removed from the lagoons once a year and hauled off site to be disposed of at Green Lane landfill" (2009).

All primary sludge, thickened WAS (TWAS), and scum from the Primary and Secondary Clarification Tanks, collectively called sludge, is treated, handled and disposed of in a similar manner, consisting of anaerobic digestion, intermediate blending and storage, dewatering and then incineration and ash handling (2020). No recovery from this plant

**Biosolids Management at North Toronto TP**

“Liquid biosolids from the North Toronto TP are discharged to the Coxwell Trunk Sewer and combined with raw wastewater collected in this sewer, for treatment with incoming raw wastewater at Ashbridges Bay TP” (2009). “All primary sludge, WAS, and scum from the Primary and Secondary Clarification Tanks, collectively called sludge, is transferred to the Ashbridges Bay Treatment Plant for further treatment” (2020).

$$\text{Indicator 9} = \frac{C+D}{A} \cdot \frac{\% \text{ secondary WWT coverage}}{100} \cdot 10$$

$$(C+D)/A = (27835+37666+827021)/(27835+37666+82702+7553) = 892522/900075 = 0.9916$$

$$\text{Indicator 9} = 0.9916 \times 0.98 \times 10 = 9.7$$



Indicator 10: Energy efficiency WWT

Principal: A measure of the energy efficiency of the wastewater treatment. A lower Indicator score is given where efficiency measures are more limited.

Calculation method

The score is given by applying a self- assessment based on the plans, measures and their implementation to improve the efficiency of wastewater treatment. Self-assessment based on information from public sources (national/regional/local policy document, reports and websites of actors (e.g. water companies, cities, provincial or national authorities).

Table 8: Indicator 10 scores

Indicator score	Assessment
0	no information is available on this subject
1	limited information is available in a national document
2	limited information is available in national and local documents
3	the topic is addressed in a chapter in a national document
4	the topic is addressed in a chapter at the national and local level
5	a local policy plan is provided in a publicly available document
6	as 5 and the topic is also addressed at the local website
7	plans are implemented and clearly communicated to the public
8	as 7 plus subsidies are made available to implement the plans
9	as 8 plus annual reports are provided on the progress of the implementation and/or any other activity indicating that this is a very high priority implemented at the level of the local
10	as 9 and the activity is in place for = 3 years

Literature:

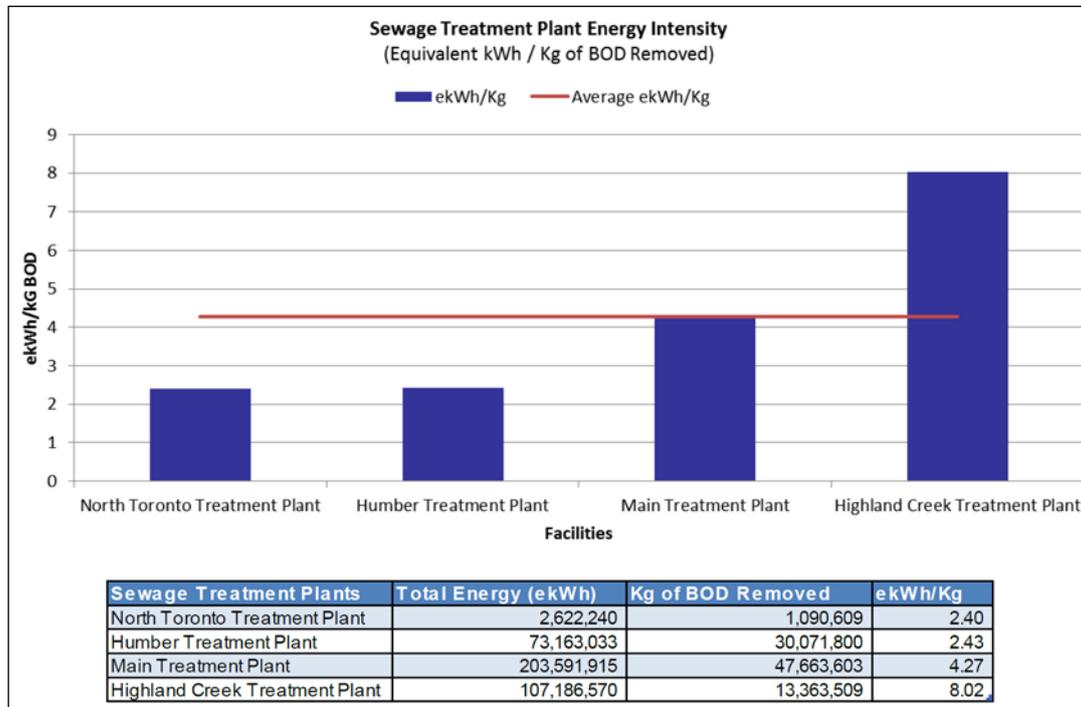
City of Toronto (2020). *Wastewater Treatment Plants & Reports*. Retrieved from: <https://www.toronto.ca/services-payments/water-environment/managing-sewage-in-toronto/wastewater-treatment-plants-and-reports/> Accessed 07 March 2020

City of Toronto (2017). *Annual Energy Consumption & Greenhouse Gas Emissions Report*. Retrieved from: <https://www.toronto.ca/wp-content/uploads/2019/01/958c-2017-Annual-energy-consumption-and-GHG-emissions-report-compressed.pdf> Accessed 07 March 2020

MECP (2009) *Green energy Act*. <https://www.ontario.ca/laws/statute/09g12>. Accessed 07 March 2020

For Toronto:

Figure 5: Sewage Treatment Plant Energy Intensity in Toronto



There is no information of this issue in the WWTP's annual reports nor in the Energy consumption annual report. This latter is already 3 years old. The Green energy act is the only plan that address this issue.

Then, → Score = 4



Category IV: Infrastructure

Indicator 11: Stormwater separation

Principal: A measure of the proportion of the wastewater system for which sanitary sewage and storm water flows are separated. In principal, a separate system is better than a combined system as extreme weather events may lead to sewer overflows into surface water. These sewer overflows are a major source of pollution. Also flooding vulnerability is larger if stormwater separation ratio is low. A lower Indicator score is given where the proportion of combined sewers is greater.

Calculation method

A: Total length of combined sewers managed by the utility (km)

B: Total length of stormwater sewers managed by the utility (km)

C: Total length of sanitary sewers managed by the utility (km)

$$\text{Indicator 11} = \frac{B+C}{A+B+C} \cdot 10$$

Literature:

City of Toronto (2020) The sewers on the streets. <https://www.toronto.ca/services-payments/water-environment/managing-rain-melted-snow/what-is-stormwater-where-does-it-go/the-sewers-on-the-street/>. Accessed 07 March 2020

City of Toronto (2020) Combined sewer overflows <https://www.toronto.ca/services-payments/water-environment/managing-rain-melted-snow/what-is-stormwater-where-does-it-go/combined-sewer-overflows/> Accessed 07 March 2020

City of Toronto (2016). 2016 Performance Measurement & Benchmarking Report <https://www.toronto.ca/wp-content/uploads/2018/04/977f-WastewaterServices2016-final-AODA.pdf> Accessed 07 March 2020

For Toronto

23% of sewer in Toronto is combined sewer.

“In Toronto, wastewater is collected and treated from 4,086 kilometres of separate sanitary sewers, and 1,525 kilometres of combined storm/sanitary sewers for a total 5,611 km of wastewater pipe. Also, 4,909 kilometres of completely separate storm sewers do not flow to Toronto's wastewater plants.”

A: Total length of combined sewers = 1525 km

B: Total length of stormwater sewers = 5611 km

C: Total length of sanitary sewers = 4086 km

$(5611+4086)/(1525+5611+4086) \cdot 10 \rightarrow \text{Score} = 8.6$

Indicator 12: Average age sewer

Principal: The age of the infrastructure for wastewater collection and distribution system is an important measure for the financial state of the UWCS.

Calculation method

The average age of the infrastructure is an indication of the commitment to regular system maintenance and replacement. The method compares the average age of the system to an arbitrarily maximum age of 60 years. Moreover, it is assumed that an age of <10 years receives a maximum score since younger systems generally well maintained.

$X = \text{Average age sewer}$

$$\text{Indicator 12} = \frac{60-X}{60-10} \cdot 10$$

NB. All values of $x > 60$ will lead to an indicator score of 0.

Improvement in calculation method: Previously, in the City Blueprint the average age was set on 100 years. Infrastructure refurbishment requirements obviously depend on age but this depends highly on subsoil, material used, *etcetera*. The differences in scores for this indicator appeared to be minimal because most sewers are much younger than the maximum age. Together with literature based estimates the average maximum age has now been set at 60 years. Moreover, it is assumed that a sewer with an age of <10 years is generally well maintained and should therefore receive a maximum score.

Literature:

City of Toronto (2020) *The sewers on the streets*. <https://www.toronto.ca/services-payments/building-construction/infrastructure-city-construction/understanding-city-construction/water-sewer-mains/> Accessed 07 March 2020

City of Toronto (2008). *Toronto Water's Infrastructure Renewal Backlog* <https://www.toronto.ca/legdocs/mmis/2008/ex/bgrd/backgroundfile-16566.pdf> Accessed 07 March 2020

The average age of Toronto's watermains is 59 years

The City's sewer system consists of 10,561 km of pipe. The average age of the sewer pipes is approximately 48 years, with 370 km (4%) of pipes over 100 years of age. An additional 705 km (7%) of pipes are between 80 and 100 years of age. The most common material type is concrete (75%), followed by vitrified clay (15%).

$$\text{Indicator 12} = \frac{60-48}{60-10} \cdot 10$$

→ Score = 2.4



Indicator 13: Water system leakages

Principal: A measure of the percentage of water lost in the distribution system due to leaks (typically arising from poor maintenance and/or system age).

Calculation method

Leakage rates of 50% or more are taken as maximum value and thus scored zero. A best score of 10 is given when the water system leakage is zero.

$X = \text{Water system leakages (\%)}$

$$\text{Indicator 13} = \frac{50-X}{50-0} \cdot 10$$

Literature:

RCCAO (2009) *Leaking Pipes News Release* <https://www.rccao.com/news/files/LeakingPipes-NewsRelease.pdf> Accessed 07 March 2020

The Star (2009). *Ontario drinking water leaking out pipes* https://www.thestar.com/news/gta/2009/06/11/ontario_drinking_water_leaking_out_of_pipes.html Accessed 07 March 2020

CBC (2011). <https://www.cbc.ca/news/canada/city-water-leaks-wasting-millions-of-tax-dollars-1.1048035> Accessed 07 March 2020

For Toronto:

“In the Greater Toronto Area alone, a 25-per-cent leakage rate represents a loss of more than 120 million cubic metres of water a year”.

Score= (50-25)/(50-0) * 10 → **Score = 5**

Indicator 14: Operating costs recovery (ratio)

Principal: Measure of revenue and cost balance of operating costs of water services. A higher ratio means that there is more money available to invest in water services, e.g. infrastructure maintenance or infrastructure separation.

Calculation method

Only the operational cost and revenues for Domestic water supply and sanitation services are included.

$$\text{Operating cost recovery (ratio)} = \frac{\text{Total annual operational revenues}}{\text{Total annual operating costs}}$$

Total annual operational revenues: Total annual income from tariffs and charges for drinking water and sanitation services (US\$ or any other currency/year).

Total annual operating costs: Total annual operational expenditures for drinking water and sanitation services (US\$ or any other currency/year).

If the ratio is >1 than there is no 100% coverage of operating costs. However, ratios <1 are often applied at utilities. This means that there is more than a 100% coverage in many cases (Figure 6).

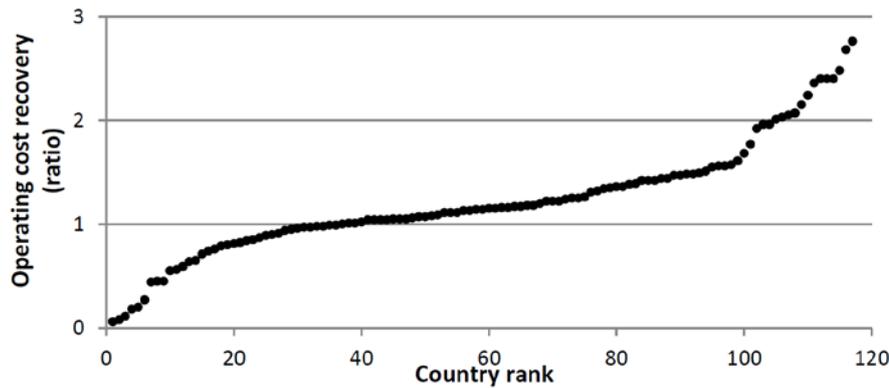


Figure 6: Operating cost recovery ratio for country

Figure 6: Operating cost recovery ratio for all 117 countries available (ib-net.org). Note that the majority of the countries have more than 100% operating cost recovery (which is a ratio of 1).

Of the operating cost recovery ratio's for all countries available (shown in Figure 6) the highest and lowest 10% are averages and used as minimum and maximum value to rescale the operating cost recovery ratio's to a score between 0 and 10 points. The minimum and maximum are respectively 0.33 and 2.34. The operating cost recovery is X.

X = Operating cost recovery (ratio)

$$\text{Indicator 14} = \frac{X - 0.33}{2.34 - 0.33} \cdot 10$$

All values of x < 0.33 will lead to an indicator score of 0.

Literature:

From the city's water utility financial reports.

IBNET: The international benchmarking network for water and sanitation utilities

<http://www.ib-net.org/>;

City Level: Explore detailed country maps with indicators information for each utility; Where city data is not available: The IB-net Water Supply and Sanitation Blue Book 2014 provides means for each country.

City of Toronto (2020) Water and Wastewater Consumption Rates and Service Fees.
<https://www.toronto.ca/legdocs/mmis/2019/bu/bgrd/backgroundfile-139975.pdf> Accessed 10 March 2020

For Toronto:

Table 9: Summary 2020 Operating and Capital budget 2020.2029.

Appendix A – Summary of 2020 Operating and Capital budget and 2020-2029 Capital Plan and Operating Forecast, Corresponding Rate Increases, and Capital Financing, \$ Million

TORONTO WATER	2019 Budget	2019 Projected Actual	2020-2029 Plan									
			2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Gross Operating Budget	463.87	436.69	469.22	480.95	492.97	505.30	510.94	523.71	536.81	550.23	563.98	578.08
Capital from Current	867.52	904.87	921.21	945.34	968.44	992.15	1,024.65	1,049.71	1,075.37	1,101.37	1,137.39	1,165.23
Net Expenditures to be Financed by Water rate	1,227.99	1,234.38	1,277.21	1,308.64	1,340.83	1,373.85	1,415.89	1,450.74	1,486.42	1,522.70	1,569.25	1,607.88
WATER RATE INCREASE	3.98%	3.98%	3%	3%	3%	4%	3%	3%	3%	4%	3%	3%
Other Revenues	103.40	107.18	113.22	117.64	120.58	123.60	119.70	122.69	125.76	128.90	132.13	135.43
Total Revenues	1,331.39	1,341.56	1,390.43	1,426.28	1,461.41	1,497.44	1,535.59	1,573.43	1,612.18	1,651.60	1,701.37	1,743.31
CAPITAL FINANCING												
Gross Capital Budget	951.53	951.53	1,217.84	1,688.71	1,683.09	1,569.60	1,463.93	1,366.36	1,409.21	1,437.58	1,396.75	1,254.49
Net Capital Budget	856.61	866.16	1,106.37	1,582.19	1,554.79	1,438.60	1,328.85	1,247.76	1,297.36	1,336.12	1,295.70	1,173.24
Capital Reserve Funding Level	85%	93%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
Net Capital Spending	728.12	801.65	940.42	1,344.86	1,321.57	1,222.81	1,129.52	1,060.59	1,102.76	1,135.70	1,101.34	997.25
CAPITAL RESERVE CLOSING BALANCE	1,259.06	1,262.61	1,241.96	837.35	475.03	235.36	127.69	113.31	81.26	42.11	74.57	239.28

2020 Recommended Operating Budget

	\$ Millions
Gross Operating Cost	\$469.217
Capital from Current	\$921.210
	\$1,390.427
Other Revenues	(\$113.215)
Net Expenditure to be Financed from Water Rates	\$1,277.211

Gross Operating Cost \$469.217 (2020)

Operation Revenues: \$1390.430 (2020)

X=2.96

$$(2.96-0.33)/(2.34-0.33) = 2.63/2.01 = 1.3$$

$$1.3*10 = 13 \rightarrow \text{Score} = 10$$

Category V: Solid waste treatment

Indicator 15: Solid waste collected

Principal: Represents waste collected from/ produced by households, small commercial activities, office buildings, institutions such as schools and government buildings, and small businesses that treat or dispose of waste at the same used for municipally collected waste (OECD, 2013).

Calculation method

X = kg/cap/year of collected solid waste. The min-max method is applied. Here the lowest and highest 10% produced solid waste of all countries that are available is taken. These are respectively 136.4 kg/cap/year and 689.2 kg/cap/year.

$$Indicator\ 15 = \left[1 - \frac{X - 136.4}{689.2 - 136.4} \right] \cdot 10$$

All values of $x \leq 136.4$ lead to an indicator score of 10

Literature:

OECD (2015) Organization for Economic Co-operation and Development: Environment at a glance 2015. OECD indicators. OECD Publishing. <https://doi.org/10.1787/19964064>. https://www.oecd-ilibrary.org/environment/environment-at-a-glance-2015_9789264235199-en Accessed 07 March 2020

The Conference Board of Canada (2012). How Canada performs <https://www.conferenceboard.ca/hcp/provincial/environment/waste.aspx> Accessed 07 March 2020

For Ontario

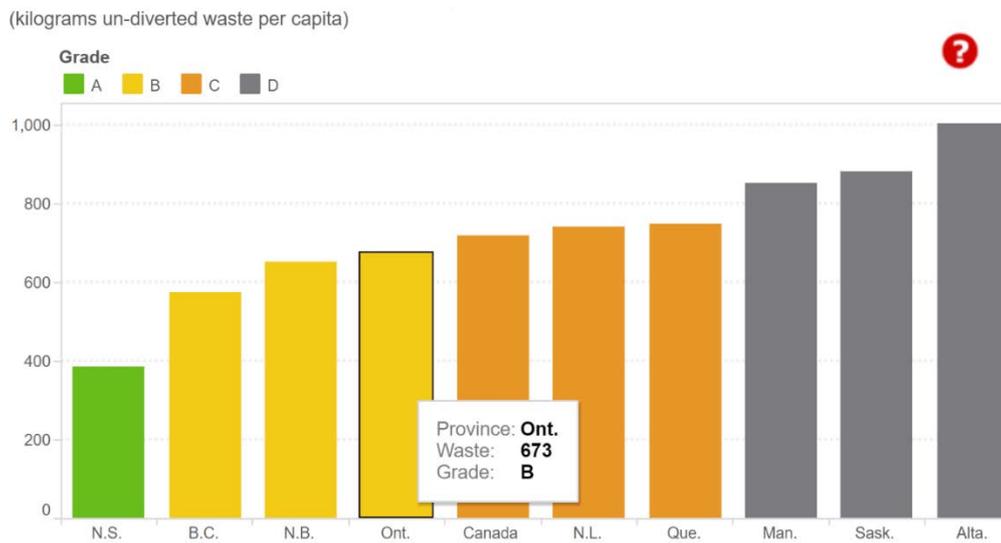


Figure 7: Waste Generation in Canada and Provinces

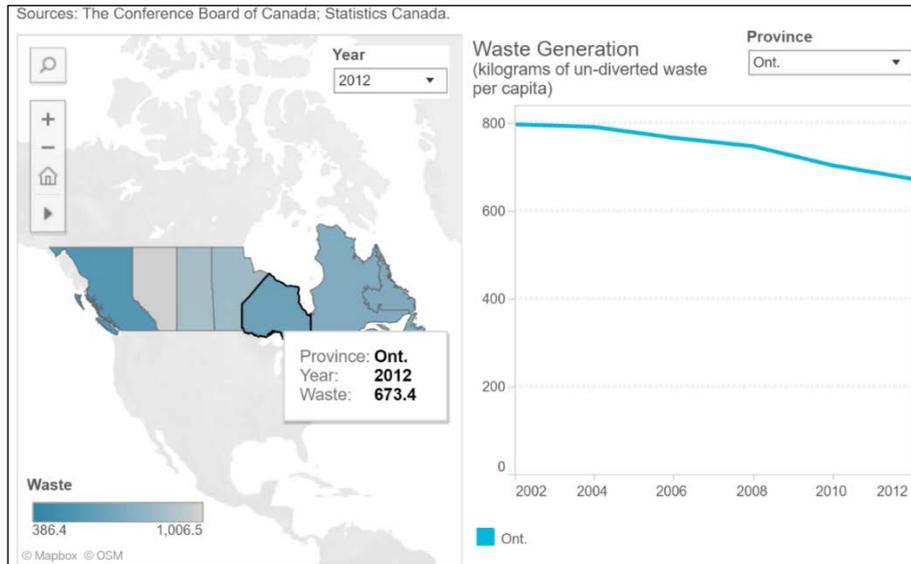


Figure 8: Waste Generation in Ontario

In Ontario:

Waste = 673 kg/per capita

$(1 - (673 - 136.4) / (689.2 - 136.4))$

→ Score = 0.29

Indicator 16: Solid waste recycled

Principal: Percentage of solid waste that is recycled or composted.

Calculation method

This indicator represents the percentage of the total collected municipal waste that is recycled or composted. However, when solid waste is used for incineration with energy recovery, it is not possible to also use it for recycling while both practices are sustainable. Therefore the % solid waste that is incinerated is subtracted from the total (100%) of collected municipal waste to obtain the potential percentage of solid waste that can be recycled (in numerator). Thus, this indicator is calculated as shown below.

$$\text{Indicator 16} = \frac{\% \text{ recycled or composted}}{100 - \% \text{ used for incineration with energy recovery}} \cdot 10$$

Literature

OECD (2015) *Organization for Economic Co-operation and Development: Environment at a glance 2015. OECD indicators. OECD Publishing.* <https://doi.org/10.1787/19964064>. https://www.oecd-ilibrary.org/environment/environment-at-a-glance-2015_9789264235199-en Accessed 07 March 2020

In non-EU cities local data of solid waste treatment are mostly available on local sites, municipal or company reports *etcetera*.

For Canada:

Table 10: Municipal waste disposal and recovery shares in Canada

	% of amounts treated				% change since 2000	
	Recycling and composting	Incineration with energy recovery	Incineration without energy recovery	Landfill	Recycling and composting	Landfill
Australia	41	1	..	58
Austria	58	35	0	4	5	-87
Belgium	55	43	1	1	16	-95
Canada	24	..	4	72	21	3

Indicator = $24/(100-0)*10 \rightarrow \text{Score} = 2.4$



Indicator 17: Solid waste energy recovery

Principal: Percentage of solid waste that is incinerated with energy recovery.

Calculation method

This indicator represents the percentage of the total collected municipal waste that incinerated with energy recovery (techniques). However, when solid waste is recycled or composted, it is not possible to also use it for incineration with energy recovery, while both practices are sustainable. Therefore the % solid waste that is recycled or composted is subtracted from the total (100%) of collected municipal waste to obtain the potential percentage of solid waste that can be incinerated with energy recovery (in numerator). Thus this indicator is calculated as shown below.

$$Indicator\ 17 = \frac{\% \text{ incinerated with energy recovery}}{100 - \% \text{ recycled or composted}} \cdot 10$$

Literature

OECD (2015) *Organization for Economic Co-operation and Development: Environment at a glance 2015. OECD indicators. OECD Publishing.* <https://doi.org/10.1787/19964064>. https://www.oecd-ilibrary.org/environment/environment-at-a-glance-2015_9789264235199-en Accessed 07 March 2020

In non-EU cities local data of solid waste treatment are mostly available on local sites, municipal or company reports *etcetera*.

<https://www.thestar.com/news/gta/2015/02/15/gtas-newest-incinerator-fires-up-in-clarington.html>

<https://www.covanta.com/Our-Facilities/Covanta-Durham-York>

For Canada:

Table 11: Municipal waste disposal and recovery shares in Canada

	% of amounts treated				% change since 2000	
	Recycling and composting	Incineration with energy recovery	Incineration without energy recovery	Landfill	Recycling and composting	Landfill
Australia	41	1	..	58
Austria	58	35	0	4	5	-87
Belgium	55	43	1	1	16	-95
Canada	24	..	4	72	21	3

Indicator 17: Solid waste energy recovery for Canada: 0



Category VI: Climate adaptation

Indicator 18: Green space

Principal: Represents the share of green and blue area which is essential to combat the heat island effect in urban areas (area defined as built-up area lying less than 200 meters apart).

Calculation method

City specific: Numbers are provided in %

Country average: Share of green and blue areas is available for all European cities. The EEA city database presents data for of 367 European cities. From these data the average of the lowest 10% is taken as minimum (16%) and the average of the highest 10% is taken as maximum (48%). The percentages for the EU cities are standardized according to the min-max method. For non-European cities percentages for green and blue area are mostly not available. A best estimate is given by comparing this city to a similar European city. It is important for these cities to provide better information on the share of green area.

$$X = \text{Share of blue and green area (\%)}$$

$$\text{Indicator 18} = \frac{X-16}{48-16} \cdot 10$$

All values of $x < 16$ will lead to an indicator score of 0 and all values > 48 will lead to an indicator score of 10.

Definition of green area (EEA, 2012A): These are green urban areas, sports and leisure facilities, agricultural areas, semi-natural areas and wetlands, forests, discontinuous low density urban fabric as a proxy for private gardens and water bodies.

Literature:

OECD (2015) *Organization for Economic Co-operation and Development: Environment at a glance 2015. OECD indicators.* OECD Publishing. <https://doi.org/10.1787/19964064>. https://www.oecd-ilibrary.org/environment/environment-at-a-glance-2015_9789264235199-en Accessed 07 March 2020

City of Toronto (2020). 2018 Pressure on Toronto's Green Spaces & Ecosystems. <https://www.toronto.ca/city-government/council/2018-council-issue-notes/pressure-on-torontos-green-spaces-and-ecosystems/>. Accessed on 08 March 2020.

Arcadis (2018). *Citizen centric cities. The Sustainable Cities Index 2018* [https://www.arcadis.com/media/1/D/5/%7B1D5AE7E2-A348-4B6E-B1D76D94FA7D7567%7DSustainable Cities Index 2018 Arcadis.pdf](https://www.arcadis.com/media/1/D/5/%7B1D5AE7E2-A348-4B6E-B1D76D94FA7D7567%7DSustainable%20Cities%20Index%202018%20Arcadis.pdf). Accessed on 08 March 2020.

Non-EU cities: A reliable estimate can be obtained via satellite maps google. As follows: google City Name Satellite Map; e.g. Kampala Satellite Map. Zoom in and estimate the green space surface (%). According to the EEA these are green urban areas, sports and leisure facilities, agricultural areas, semi-natural areas and wetlands, forests, discontinuous low-density urban fabric as a proxy for private gardens and water bodies. On the satellite image this is clearly visible by the trees and greens (parks). The green space is the total surface (100%) minus the sealed surface, i.e. normally all space occupied by buildings, streets, parking places, railway stations, etc., where water cannot penetrate the soil and subsoil.

For Toronto

Toronto's 8,000 hectares in over 1,600 parks cover **13** percent of the city. Also, the houses have gardens. The total green space is therefore estimated at about 30%. Although, Lake Ontario cannot be forgotten in this matter, as it represents a huge freshwater body that is essential for climate adaptation, it does not directly add as buffer for stormwater. Indicator score = $(30-16)/(48-16) * 10 \rightarrow \text{Score} = 4.4$

Indicator 19: Climate adaptation

Principal: A measure of the level of action taken to adapt to climate change threats. A lower Indicator score is given where actions or commitments are more limited.

Calculation method

The score is given by applying a self- assessment of the measures and their implementation to protect citizens against flooding and water scarcity related to climate change (e.g. green roofs, rainwater harvesting, safety plans etc.). The assessment is based on information gathered by interviewing relevant stakeholders and also from public sources (national / regional / local policy document, reports and websites of actors (e.g. water companies, cities, provincial or national authorities).

Table 12: Indicator 19 scores

Indicator	Assessment
0	no information is available on this subject
1	limited information is available in a national document
2	limited information is available in national and local documents
3	the topic is addressed in a chapter in a national document
4	the topic is addressed in a chapter at the national and local level
5	a local policy plan is provided in a publicly available document
6	as 5 and the topic is also addressed at the local website
7	plans are implemented and clearly communicated to the public
8	as 7 plus subsidies are made available to implement the plans
9	as 8 plus annual reports are provided on the progress of the implementation and/or any other activity indicating that this is a <u>very high priority implemented at the level of the local community.</u>
10	as 9 and the activity is in place for = 3 years

Literature:

City of Toronto (2020). *2018 Climate Change: Creating a Low Carbon and Climate Resilient Toronto*. <https://www.toronto.ca/city-government/council/2018-council-issue-notes/torontos-sustainability/climate-change/>. Accessed on 08 March 2020.

TRCA (2020). *Meeting the Climate Change*. <https://trca.ca/conservation/climate-change/>. Accessed on 08 March 2020.

<https://www.cbc.ca/news/canada/toronto/transformto-plan-climate-change-1.4091425>

For Toronto:

In 2007, the municipality committed to reduce local GHG emissions by 80 percent from 1990 levels by 2050 and unanimously reconfirmed that commitment in July 2017. This commitment aligns with internationally agreed upon targets to avoid the worst impacts of climate change.

According to the information gathered:

→ **Score = 10**

**Indicator 20: Climate robust buildings**

Principal: A measure of whether there is a clear policy for buildings to be robust regarding their contribution to climate change concerns (principally energy use). A lower Indicator score is given where policies are weaker.

Calculation method

The score is given by applying a self- assessment of the policies in place to promote energy efficiency for heating and cooling of houses and buildings, including the use of geothermal energy.

The assessment is based on information gathered by interviewing relevant stakeholders and also from public sources (national / regional / local policy documents, reports and websites of actors, e.g. water companies, cities, provincial or national authorities).

Table 13: Indicator 20 scores

Indicator	Assessment
0	no information is available on this subject
1	limited information is available in a national document
2	limited information is available in national and local documents
3	the topic is addressed in a chapter in a national document
4	the topic is addressed in a chapter at the national and local level
5	a local policy plan is provided in a publicly available document
6	as 5 and the topic is also addressed at the local website
7	plans are implemented and clearly communicated to the public
8	as 7 plus subsidies are made available to implement the plans
9	as 8 plus annual reports are provided on the progress of the implementation and/or any other activity indicating that this is a <u>very high priority implemented</u> at the level of the local community.
10	as 9 and the activity is in place for = 3 years

Literature:

City of Toronto (2017). Zero Emissions Buildings Framework. <https://www.toronto.ca/wp-content/uploads/2017/11/9875-Zero-Emissions-Buildings-Framework-Report.pdf>. Accessed on 08 March 2020.

“The Framework comprises a full set of targets for the five most common building archetypes that require increasing levels of performance over time. Four tiers of performance were developed to take the building industry from today’s building practices to a near-zero emissions level of performance by the year 2030. The establishment of this pathway to near-zero emissions building construction not only helps the City to meet its 2050 GHG reduction goals but provides the building industry with a clear and transparent picture of future requirements. The emphasis on total energy use, thermal demand reduction and GHGI encourages a passive design-first approach coupled with high efficiency active systems, such as heat recovery, and improved air tightness. Tier 4 targets represent a near-zero level of emissions performance, at which point fuel switching is promoted to foster a shift away from natural gas towards electricity and renewable energy sources”.

Nevertheless, there is no specific website for this issue. No annual reports. Partially being implemented.

→ Score = 5

Category VII: Plans and actions

Indicator 21: Management and action plans

Principal: A measure of the application of the concept of Integrated Water Resources Management (IWRM) in the city. A lower Indicator score is given where plans and actions are limited.

Calculation method

The score is given by applying a self- assessment of local and regional commitments to adaptive, multifunctional, infrastructure and design for IWRM as demonstrated by the ambition of the action plans and the actual commitments by local authorities or utilities. The assessment is based on information gathered by interviewing relevant stakeholders and also from public sources (national/regional/local policy document, reports and websites of actors (e.g. water companies, cities, provincial or national authorities)).

Table 14: Indicator 21 scores

Indicator	Assessment
0	no information is available on this subject
1	limited information is available in a national document
2	limited information is available in national and local documents
3	the topic is addressed in a chapter in a national document
4	the topic is addressed in a chapter at the national and local level
5	a local policy plan is provided in a publicly available document
6	as 5 and the topic is also addressed at the local website
7	plans are implemented and clearly communicated to the public
8	as 7 plus subsidies are made available to implement the plans
9	as 8 plus annual reports are provided on the progress of the implementation and/or any other activity indicating that this is a very high priority implemented at the level of the local community.
10	as 9 and the activity is in place for = 3 years

Literature:

Watson, N.; Shrubsole, D.; Mitchell, B. *Governance Arrangements for Integrated Water Resources Management in Ontario, Canada, and Oregon, USA: Evolution and Lessons*. Water 2019, 11, 663.

Worte, C. (2016): *Integrated watershed management and Ontario's conservation authorities*, *International Journal of Water Resources Development*, DOI:10.1080/07900627.2016.1217403

Bakker, K., & Cook, C. (2011). *Water governance in Canada: Innovation and fragmentation*. *Water Resources Development*, 27(02), 275-289.

Conservation Ontario (<https://conservationontario.ca/policy-priorities/integrated-watershed-management/>)

For Canada and Ontario:

Integrated Water management in Canada is a complicated issue, because of the vast territory and the decentralized approaches to environmental and water governance, with a high degree of fragmentation within the federal state (Bakker & Cook 2011). For example, in the last UNEP report related to progress on (IWRM) for SDG 6.5, the country faced serious difficulties for data collection and finally failed to submit its self-assessment (UNEP, 2018). When it comes to Ontario, IWRM has become a fragmented multi-agency environment that has hindered effective management (Worte, 2016). Thus, implementing water plans for Ontario is described as challenging, as the governance structure is fragmented and it lacks a thorough water management strategy at the provincial level (Worte, 2016). Further details of plans are provided in Watson et al., → **Score = 5**



Indicator 22: Water efficiency measures

Principal: Measure of the application of water efficiency measures by the range of water users across the city. A lower Indicator score is given where efficiency measures are more limited.

Calculation method

The score is given by applying a self- assessment based on the information gathered by interviewing relevant stakeholders and also from public sources (national/regional/local policy document, reports and websites of actors (e.g. water companies, cities, provincial or national authorities). It considers plans, measures and their implementation to improve the efficiency of water usage by e.g. water saving measures in taps, toilets, showers and baths, water efficient design, or behavioral changes.

Table 15: Indicator 22 scores

Indicator	Assessment
0	no information is available on this subject
1	limited information is available in a national document
2	limited information is available in national and local documents
3	the topic is addressed in a chapter in a national document
4	the topic is addressed in a chapter at the national and local level
5	a local policy plan is provided in a publicly available document
6	as 5 and the topic is also addressed at the local website
7	plans are implemented and clearly communicated to the public
8	as 7 plus subsidies are made available to implement the plans
9	as 8 plus annual reports are provided on the progress of the implementation and/or any other activity indicating that this is a <u>very high priority implemented</u>
10	as 9 and the activity is in place for = 3 years

Literature:

MECP (2020). Water and energy conservation guidance manual <https://www.ontario.ca/document/water-and-energy-conservation-guidance-manual-sewage-works/water-conservation-measures>. Accessed on 08 March 2020.

City of Toronto (2020). How to use less water. <https://www.toronto.ca/services-payments/water-environment/how-to-use-less-water/>. Accessed on 08 March 2020.

For Toronto

As water scarcity is not an issue in Toronto because of the high availability granted by Lake Ontario, awareness about water use efficiency is not high enough. Many interviewees agree with that affirmation and this was also a common topic during the Symposium on urban water at Ryerson University. Nevertheless, there is a local policy plan publicly available and the topic is also addressed on the municipality's website.

→ Score = 6

Indicator 23: Drinking water consumption

Principal: Measure of the average annual consumption of water per capita. A lower Indicator score is given where the volume per person is greater.

Definition: In this questionnaire we use authorized consumption as defined by the International Water Association (IWA). This is the total volume of metered and/or non-metered water that, during the assessment period (here: 1 year), is taken by registered customers, by the water supplier itself, or by others who are implicitly or explicitly authorized to do so by the water supplier, for residential, commercial, industrial or public purposes. It includes water exported. It is IWA code A14. This is then divided by the city population.

Calculation method:

$X = m^3/\text{person}/\text{year}$ drinking water consumption

The volume is then normalized against maximum and minimum volumes for European cities. The minimum is for Rotterdam at 45.2 m³/person/yr. The maximum is for Kiev at 266 m³/person/year (European Green City Index)

$$\text{Indicator 23} = \left[1 - \frac{X - 45.2}{266 - 45.2} \right] \cdot 10$$

All values of $x < 45.2$ will lead to an indicator score of 10 and all values of $x > 266$ will lead to an indicator score of 0.

Literature:

City of Toronto (2020). City of Toronto average water consumption. <https://www.toronto.ca/311/knowledgebase/kb/docs/articles/revenue-services/customer-service/call-centre/call-centre/city-of-toronto-average-water-consumption.html>. Accessed on 08 March 2020.

McGill University (2020). How Much water are we using? <https://www.mcgill.ca/waterislife/waterathome/how-much-are-we-using> Accessed on 08 March 2020.

Statistics Canada (2020). Census Profile, 2016 Census. <https://www12.statcan.gc.ca/census-recensement/2016/dppd/prof/details/page.cfm?Lang=E&Geo1=CMACA&Code1=535&Geo2=PR&Code2=01&SearchText=toronto&SearchType=Begins&SearchPR=01&B1=All&TABID=1&type=0>. Accessed on 08 March 2020

For Canada and Toronto.

In Canada the average water consumption per person is about 120 m³/day. However, in Toronto the picture is slightly different with a higher water use efficiency. According to the data from the Municipality of the Greater Toronto, the average household uses 240 m³ per year. If we consider that the average household size 2,7 persons/household, it results in a consumption of 89 m³/year

Indicator = $(1 - (89 - 45.2) / (266 - 45.2)) * 10 \rightarrow \text{score} = 8.0$

Indicator 24: Attractiveness

Principal: A measure of how surface water features are contributing to the attractiveness of the city and wellbeing of its inhabitants. A lower Indicator score is given where 'attractiveness' is less.

Definition: Examples of cities, that attract lot of tourists are Venice, Hamburg and Amsterdam. Water is a dominant feature of those cities. Often the property prices in the vicinity of canals and harbors are much higher than in other parts of the city where the presence of water is not so dominant. Private companies, the owners of the houses, and the local authorities are often working together to increase the attractiveness of those cities.

Calculation method:

The score is given by applying a self-assessment of how surface water is supporting the quality of the urban landscape as measured by the community sentiment/well-being within the city. The assessment is based on information (policy documents, reports, research articles, or documents related to water-related tourism that deal with the sentiment of the citizens). The score goes from 0 (no role) to 10 (water plays a dominating role in the well-being of citizens).

Table 16: Indicator 24 scores

Indicator	Assessment
0	no information is available on this subject
1	limited information is available in a national document
2	limited information is available in national and local documents
3	the topic is addressed in a chapter in a national document
4	the topic is addressed in a chapter at the national and local level
5	a local policy plan is provided in a publicly available document
6	as 5 and the topic is also addressed at the local website
7	plans are implemented and clearly communicated to the public
8	as 7 plus subsidies are made available to implement the plans
9	as 8 plus annual reports are provided on the progress of the implementation and/or any other activity indicating that this is a <u>very high priority implemented</u> at the level of the local community.
10	as 9 and the activity is in place for = 3 years

Literature:

Interviews, local websites.

For Toronto:

Toronto is a highly touristic city, and the presence of Lake Ontario plays a big role on that. Although the waterfront of Lake Ontario is not particularly an attractive place due to the industrial and harbour activities, there are many restoration efforts nowadays. In this context, Waterfront Toronto was created by the governments of Canada, Ontario and the municipality to transform the shoreline by redevelopment and revitalization (<https://www.waterfronttoronto.ca/nbe/portal/waterfront/Home>).

Additionally, there are many other water bodies that attract people for recreation, as in High Park, Humber Marshes or the ravine's parks.

Score: 8. There are plans implemented and communicated to the public and subsidies available.

APPENDIX III

Interviews for the Governance Capacity Framework

12 June 2020

SEBASTIAN RIVADENEIRA
MASTER'S THESIS



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Questions

The following questions are extracted from the latest version of the “Questionnaire for the Governance Capacity Framework”. This document can be found on the the website of the European Innovation Partnership on Water: http://www.eip-water.eu/City_Blueprints Visited: 04-06-2020

Indicator 1.1: Community knowledge

Predefined question: To what extent is knowledge regarding the current and future risks, impacts, and uncertainties of the water challenge dispersed throughout the community and local stakeholders which may results in their involvement in decision-making and implementation?

Indicator 1.2: Local sense of urgency

Predefined question: To what extent do actors have a sense of urgency, resulting in widely supported awareness, actions, and policies that address the water challenge?

Indicator 1.3: Behavioral internalization

Predefined question: To what extent do local communities and stakeholders try to understand, react, anticipate and change their behavior in order to contribute to solutions regarding the water challenge?

Indicator 2.1: Information availability

Predefined question: To what extent is information on the water challenge available, reliable, and based on multiple sources and methods, in order to meet current and future demands so as to reveal information gaps and enhance well-informed decision-making?

Indicator 2.2: Information transparency

Predefined question: To what extent is information on the water challenge accessible and understandable for experts and non-experts, including decision-makers?

Indicator 2.3: Knowledge cohesion

Predefined question: To what extent is information cohesive in terms of using, producing and sharing different kinds of information, usage of different methods and integration of short-term targets and long-term goals amongst different policy fields and stakeholders in order to deal with the water challenge?

Indicator 3.1: Smart monitoring

Predefined question: To what extent is the monitoring of process, progress, and policies able to improve the level of learning (i.e., to enable rapid recognition of alarming situations, identification or clarification of underlying trends)? Or can it even have predictive value?

Indicator 3.2: Evaluation

Predefined question: To what extent are current policy and implementation continuously assessed and improved, based on the quality of evaluation methods, the frequency of their application, and the level of learning?

Indicator 3.3: Cross-stakeholder learning

Predefined question: To what extent are stakeholders open to and have the opportunity to interact with other stakeholders and deliberately choose to learn from each other?

Indicator 4.1: Stakeholder inclusiveness

Predefined question: To what extent are stakeholders interact in the decision-making process interaction (i.e., are merely informed, are consulted or are actively involved)? Are their engagement processes clear and transparent? Are stakeholders able to speak on behalf of a group and decide on that group's behalf?

Indicator 4.2: Protection of core values

Predefined question: To what extent 1) is commitment focused on the process instead of on early end-results? 2) do stakeholders have the opportunity to be actively involved? 3) are the exit procedures clear and transparent? (All three ensure that stakeholders feel confident that their core values will not be harmed.)

Indicator 4.3: Progress and variety of options

Predefined question: To what extent are procedures clear and realistic, are a variety of alternatives co-created and thereafter selected from, and are decisions made at the end of the process in order to secure continued prospect of gain and thereby cooperative behavior and progress in the engagement process?

Indicator 5.1: Ambitious and realistic management

Predefined question: To what extent are goals ambitious (i.e., identification of challenges, period of action considered, and comprehensiveness of strategy) and yet realistic (i.e., cohesion of long-term goals and supporting flexible intermittent targets, and the inclusion of uncertainty in policy)?

Indicator 5.2: Discourse embedding

Predefined question: To what extent is sustainable policy interwoven in historical, cultural, normative and political context?

Indicator 5.3: Management cohesion

Predefined question: To what extent is policy relevant for the water challenge, and coherent regarding 1) geographic and administrative boundaries, and 2) alignment across sectors, government levels, and technical and financial possibilities?

Indicator 6.1: Entrepreneurial

Predefined question: To what extent are the entrepreneurial agents of change enabled to gain access to resources, seek and seize opportunities, and have influence on decision-making?

Indicator 6.2: Collaborative

Predefined question: To what extent are actors enabled to engage, build trust-collaboration, and connect business, government, and sectors, in order to address the water challenge in an unconventional and comprehensive way?

Indicator 6.3: Visionary

Predefined question: To what extent are actors in the network able to manage and effectively push forward long-term and integrated strategies which are adequately supported by interim targets?

Indicator 7.1: Room to manoeuvre

Predefined question: To what extent do actors have the freedom and opportunity to develop a variety of alternatives and approaches (this includes the possibility of forming ad hoc, fit-for-purpose partnerships that can adequately address existing or emerging issues regarding the water challenge)?



Indicator 7.2: Clear division of responsibilities

Predefined question: To what extent are responsibilities clearly formulated and allocated, in order to effectively address the water challenge?

Indicator 7.3: Authority

Predefined question: To what extent are legitimate forms of power and authority present that enable long-term, integrated and sustainable solutions for the water challenge?

Indicator 8.1: Affordability

Predefined question: To what extent are water services and climate adaptation measures available and affordable for all citizens, including the poorest?

Indicator 8.2: Consumer willingness to pay

Predefined question: How is expenditure regarding the water challenge perceived by all relevant stakeholders (i.e., is there trust that the money is well-spent)?

Indicator 8.3: Financial continuation

Predefined question: To what extent do financial arrangements secure long-term, robust policy implementation, continuation, and risk reduction?

Indicator 9.1: Policy instruments

Predefined question: To what extent are policy instruments effectively used (and evaluated), in order to stimulate desired behavior and discourage undesired activities and choices?

Indicator 9.2: Statutory compliance

Pre-defined question: To what extent is legislation and compliance, well-coordinated, clear and transparent and do stakeholders respect agreements, objectives, and legislation?

Indicator 9.3: Preparedness

Predefined question: To what extent is the city prepared (i.e. there is clear allocation of responsibilities, and clear policies and action plans) for both gradual and sudden uncertain changes and events?

*Transcript of interview**respondent TGP-1**interview date 19 February 2020**interviewer Sebastian Rivadeneira**transcript by Sebastian Rivadeneira*

The questions related to each indicator are those that appear in the GCF questionnaire. Some information has been removed to prevent identification of the respondent. Information indicated with quotation marks (“”) and italics represents the standardized answer given by the GCF (This is included when the respondent provided just the score by agreeing with the standardized answer). Particularly, this interviewee provided answers for both wastewater and flood risk water challenges.

Scores:++ : *plus plus*+ : *plus*0 : *zero*- : *minus*-- : *minus minus***Background:**

Conservation efforts and restoration efforts and protection of flood plain zones and the land on the watershed within our jurisdiction. What I do specifically is with Partners of Project Green (a department of the Conservation Authority) which focus on sustainability within the industrial, commercial and institutional sector with private companies of the Toronto Area. The group that I manage within Partners of Project Green focuses on water stewardship and as a part of the water stewardship its aim is to do all types of water, so process water, footprint reduction, wastewater balance, balance discharge reduction and impact and on-site of stormwater management for the private sector. So, I'm able to give you like commentaries for both n° 2 and n°3. It's likely is going to be for number 2 a perspective from TRCA side, which is more as a general perspective... and for n°3 wastewater side is both form a utility management side and the regulatory issues related to the private sector. That would be my background. I also worked in the clean “” per water wastewater prior to come TRCA 6 years ago. I've been in the water sector now for 13 years. I used to work in the US before. The 7 years prior, when I was in the US, it was for water wastewater treatment technologies for strategic analyst company, that was based in Antonio, but I was working in Toronto, so I was actually full-time remote here in my home office, for 7 years prior and for the last 6 years now I've been in the TRCA.

Indicator 1.1: Community knowledge

For flood risk it is a +. Mainly because in Toronto especially, whenever there is a major storm or calamity it's visible. The subway flood, the streets flood, the lakeshore area gets really heavy, the Toronto island, 2 years ago with that risk, a long-term damage because of rising lake level. So, everybody can see it. It's a very visible problem.

For wastewater is a 0. With the WW issue is a 0, is because of all of the people, from the regulatory side know that this is a big issue, because of outdated infrastructure, in Toronto we have quite a bit of combined sewer overflow issues, but none really notice about it. So, it's no newsworthy. It's only newsworthy when people get angry about it. It actually happens more often than the storm issues, the SWM issues only really happens in extreme weather. CSO issues actually happens every day. The challenge with that, is because of a lack of awareness, there isn't really a lot of governance of kind of reactivity being done for wastewater. My self-comment, from a wastewater industry background, I

actually think this is a bigger problem overall, so I'm a little bit biased, but the community doesn't know that much as they think they do. And we actually had the Walkerton crisis, which is drinking water related, we had that in the early 90's. And people have forgotten about that, in comparison to the big major storms over the last 5 years, including the big ones in Toronto within the last 5 years. So, there is a lot more awareness based on issues and relevancy.

Indicator 1.2: Local sense of urgency

For n° 2 is a +.

For n° 3 is a 0.

The same reason that I mentioned previously.

Indicator 1.3: Behavioural internalization

For n° 2 I'd say is actually a 0. I think in this case, for behavioural internalization, for flood risk, there isn't awareness right now... there isn't a lot of initiatives within TO at this point to really mobilize any changes. The lack of governance, we don't have a stormwater program necessarily, financially. The city of TO is very reactive. So, you get major insurance issues, but the city is pretty much static at the status quo, of what they are doing with regards to SW. There was a SW credit program and development for residences and the ICI (Industrial commercial and institutional) sector and that was shelved by the council. So there is an awareness that this is needed, but is definitely not at the urgency, to create any behavioural changes, even at the council, governmental level

For n° 3 I think is more a - right now. The reason why is a – for WW, is that is even further beyond where the SW issues are coming from is that, there is aging infrastructure at the treatment plants, there are CEC now being discharge by the ICI sector and regulatory issues happening within the region. There isn't that much of a response out of the side of the ministry, from the provincial side, and with the change to the conservative government over the last 2 years, there is being a lot of lags government policies for environmental regulations, which is directly impacting WW issues.

Indicator 2.1: Information availability

For flood risk, I think is a + right now. I think right now there is a movement at the staff level to address the SW issues both at the conservation authorities and the city staff. Really just trying to get basic alignment to allow for to effectively confirm what is actually happening. So, the generation of information, the collaboration between organisations, studying particularly floodplains, updating floodplains mapping, that is all being done. So, there is a long term aspect to this model, need to be addressed.

For WW treatment is a 0. There is nothing wrong with the systems. The systems are meeting capacity... They haven't really been planning for large scale capital change, outside of taxations. In the city of TO there is an increase in wastewater rate, over the last 5 years, and is scheduled to continue to go up for the next 4 years. So, 5 years ago they announced a 9% increase in water and WW rates every year for 9 years. So, 9% for 9 years is 9 times 9. So, by the end of it, the intend of that is to bring up the recovery rate for water treatment and the WW treatment in the city of TO, to what it should've been 30 years ago. The intent of that is to create a pool of capital dollars to upgrade aging in pipeline infrastructure and make a retrofit in new installation expenses on the existing WWTP's. So that is being acknowledged and identified, that actually is being imposed by council from a taxation basis. But there hasn't been a dissemination of what that money is being used for, where is going to go, where the master plan is going to put in place. That is why it got a 0.

There are a few years behind in where to use that money, they have the money which is great now, and they are collecting it and increasing the rate to recover the cost as they should now, so essentially almost making it for years of poor master plans, in terms of really being identifying what are the capacity issues of the wastewater and drinking water system... so they are addressing the financial aspects but they



haven't really identifying where that money is going to be spent. That's kind of relates to the next question.

Indicator 2.2: Information transparency

For flood risk is a +

For WW is a –

Indicator 2.3 Knowledge cohesion

For flood risk is a +. For the SW side, flood risk side, has had some cohesion between organizations that have impact, so the city staff, city resources are working directly with the CA's and the ministry to identify all of the resiliencies adaptation and mitigation opportunities for the city, so that is actually being done in a cohesion fashion.

For WW is a 0 (change later). The issue is that they are still trying to understand what is needed. So further behind on this level of issue resolution, so this is something that they got to really catch up. So if you asked me 3 years ago from now, probably it would be closer to a "0" rather than a "-". I think is a "-" right now mainly because it's doing it on its own. There hasn't been a lot of, what I perceive, interactivity between the city and the province on this issue. The city has just really moved forward with this taxation initiative without any knowledge behind it, it was more catching up on the cost of actually doing the business of the work.

Indicator 3.1: Smart monitoring

For flood risk a +. Because of the awareness over the last 5 years and the overlap with the resilience planning, there are a multibillion-dollar insurance claims, that have been done by residences and businesses and city properties over the last 5 years, because of all these floods. This has been the driving force behind that, making sure that monitoring is in place. And is only about data collection. In the TRCA side we have an entire division on what is monitoring, there is a whole team doing it on a daily basis.

For WW a 0. Is not something negative, they do have adequate monitoring capacity, but it is the basic requirement for alarm setting, noncompliance and compliance issues, for CSO outflow, there is anything of being proactive about it. They have the monitoring in place but is not in a way about how WW is treated or retention capacity, expansion... they are just doing basically what they are supposed to do.

Indicator 3.2: Evaluation

For FR is a + right now. Relates back to similar comments that I've made. Progressing towards using the data from flood risk side to start creating resilience opportunities, adaptation and mitigation opportunities are being identified, I don't think they've been implemented yet, but they've been identified

For WW is a "0". It's pretty status quo. It's like we are ok right now. There is no urgency, no issues. So, we have all the data, but we are not actively pursuing anything.

Indicator 3.3: Cross-stakeholder learning

Maybe this is the only point in which they both are pretty aligned. So, both, FR and WW are a "+". I have interacted with both staffs, city and the province, and I see them wanting to pursue these initiatives moving forward. Within the water industry and I'm hoping you have experienced it from even just your interactions so far within the Canadian water industry, within the Ontario regional Canadian water industry, everybody is pretty close with each other, we are all dealing with the same problems, a lot of the problems are universal whether they are public or private. Water sector professionals are typically more receptive to wanting to share and wanting to interact with each other's and help each other, even if this is detrimental of their own work. This is the reason why I wanted to answer your survey for the same reason. The CSL is almost embedded in to industry professional from this sector. We are always

trying to find better ways to do things, because is a very challenging industry to get “”, to get resources and to get support. That is a positive for both flood risk governance and WW governance. I think everybody wants to do this and speaking it out I don't know if is entirely supported but from the staff this is definitely a “”.

Indicator 4.1: Stakeholder inclusiveness.

FR a 0.

Mainly based on my response on the recent inactivity at the council level for buying the staff recommendation to put in SW charges. The fact is the SW charges that TO created which is model that Mississauga created, was developed for 3 years in preparation for a council “”, and the council was the one to put it on the shelf, they put it on hold, and now it's being on hold for 3 years. We look at that now and ok this is important but is not as important as everything else. That level of stakeholder inclusiveness where they've actually done all the groundwork to development program, done all the external stakeholder engagement to get by in, and then stop it. I think right now that is biased on my side, so that's why this is a 0, because all that work was kind of put to waste to some extent, because it was not actually being implemented

WW also a 0.

Is because of the status quo perspective. They got many years of support to raise the rate but there hasn't been any implementation that is comes from more expensive services.

Indicator 4.2: Protection of core values

For the FR it would be a +. There has been a lot of regional engagement within the city of Toronto to effective regional master planning with the business sector to include their input on maintaining an environmental resilience community for residents, also impact positively the business community, and that actually trickle into having stakeholders provide input on flood risk mitigation initiatives that the CA in the city would like to put in, into certain communities, but almost position for green infrastructure (GI), health and wellness, that things rather than SW management best practices. This has been positively received, so the example I would like to share with you is the Mount Dennis, which is the north eastern part of Toronto (regional part of TO). They just completed their economic development strategy which includes a bunch of GI with implementation opportunities that are encouraging the city to put in to improve health and wellness and best practices. As health and wellness attracts business development from the private sector community, but it also will be as a co-benefit by counterattack flood resilience ... “”. So that's a strategy developed with city staff and the economic development side and the community, with the council support, but is a micro-version of what essentially could have started to happen in Toronto as a whole. Because they are doing this, this is one of six, that they are going to do over the next 10 years. And this is a positive example of where grasp engagement of the core value perspectives, as this actually resulted in identifying flood risk as one of the big issues that needs to be addressed.

Look at Mount Dennis economic development strategy: they have a whole website about it.

For WW is a 0. Based on previous comment prior.

Indicator 4.3: Progress and variety of options.

I would say based on previous comment.

For FR is a + The fact that the city is acknowledging the need for active engagement and involving the community at different levels, so stakeholders' interactions. I think that is the reason why the FR is a +

For WW is a -. There hasn't been this type of engagement pursued.

Indicator 5.1: Ambitious and realistic management

Skip this one.

We as our group, and my access point to the city staff and program staff. We are not kind of situated with goal setting, we are more reactive in responses to this... so we don't have any new long-term goal related to the programming. We have been really being executing in the last 5 years with the initiatives that we received. So, I can't comment in what is the short-term vs long term goals, because we don't have any new one. That's the reason why I would prefer 5.1.

Indicator 5.2: Discourse embedding

For FR is a +

It's mainly because as I mentioned before, these initiatives with economic developments are a micro example of then really wanting to build in a bunch of different perspectives, including the political side. So, the fact they are working at the organic level with the community both business and residential representation. This is actually a very positive initiative. I was part of for the city of Toronto support to represent our team, but mainly because it was to engage the community to identify the short term and long-term opportunities which include water stewardship opportunities for a group.

For WW is a 0.

In this case is limited. They are very transparent in what is available, in terms of industry issues, what happens in terms of CSO, but they are not going out of their way to make it known. So, people have to find that out, you have to do freedom of information request, in order to find out issues with CSO and with targets... and the city is somewhat not really recently announcing anything important or strategic related to wastewater. So, it hasn't been incorporated into community issues

Indicator: 5.3: Management cohesion

For FR is a +

It is working side by side within regional and geographic alignment, with staff and resources at the provincial mandate, even if this is a different "" of government. All of this aligns for flood risk management

For a WW is –

The reason why is opposing sectoral policies, actually see at first hand, any WW rate issue v/s conservation, for example reducing W footprint or reducing WW discharge, these are also rate issues, so from a broader city perspective they offer conservation programs because you know is good to have and is a good story that a company decides to put in measures to reduce the footprint, but there aren't many companies that reduce their footprint, they actually reduce their overall revenues. So, within operational staffing, the conservation program staffs, with I work directly with, actually get a lot of challenges from their own operational team. Because their work is actually to reduce overall revenue, essentially, or perceived to be that way. And because of that lack of sectorial alignment within their own municipal programs, this is a contrast that I always see now across the province, for every municipality that is wanting to consider a conservation program, which is what I work on. Definitely a – for WW... In al north America this is a problem. I've been trying to help facilitate one conservation program for almost 10 years now and any municipality of any particular size that has a large scale industrial revenue stream, they don't want to reduce how much water or WW is used by the industrial sector, because it is a financial revenue stream for that, a very consistent one too. So as long as they can charge the right price for it, and not scare the businesses away, they are not encouraging businesses to save water. And there are no regional shortages in Ontario, nor in Canada, this is not a problem. So, this is the one that I've always think is a big challenge.

Indicator 6.1: Entrepreneurial

For FR is a 0. Mainly because, as much is been progressive based on regional awareness, and from community awareness for all the insurances claims of the floods themselves, there hasn't really been a way to facilitate innovation or new installations or increase best practices that are beyond of what is already is in place, so it is still really risk aversion from a flood risk management side.



Few ones where the WW is a +. This is typical from a large-scale municipality is that WW treatment equipment has a life cycle that you can easily plan for. So, if you'd like to maintain the treatment capacity of your system and replace the system when the timing is right, by a multi-million-dollar machine, or upgrade the technology is easily justified based on tax per rates. Because you don't want to ever be at risk of having a not compliance in a WW side. So they easily can justify those types of things. So entrepreneurial wise, they are always adjusting the rate changes to be able to anticipate capital implementation changes. More space for innovation in WW side

Indicator 6.2 Collaborative

For FR is a +. Mainly because this is the typical issue that is facing a lot of large municipalities, especially those looking at climate change risk and looking at climate emergencies, declaring climate emergencies

For WW is 0. Here is really focus on conventional collaboration "We are only going to improve what we can" as much as there are planning for innovation, implementation and capital budgeting. This all they're really doing

Indicator 6.3: Visionary

For FR is a +. I've really keen on looking into the flood communication style. One of the things that I've noticed regionally within the province, there has been a lot of awareness for flood risk for homeowners, dictated by the insurances bureau of Canada, the IBC, where a lot of insurances providers now, have provided enhanced insurance coverage for flood risk, when 10 years ago never existed. So now you are paying a premium for something that should really be part of your own insurance cover that exist. So now you are paying for something that was always covered under house insurances, now they are adding premium coverage for something that it should have been already covered. That has been embedded in the policy side and the municipality side, because all the municipal programs seem to be funded by, or at least collaborative funded by, an insurance for member, as the IBC member where is ... flood risk mitigation opportunities for homeowners, and rather than building resilience for the municipality itself. The ownership of the issue now is push it back to the individual owners, the properties owners, from a commercial side rather than from a whole scale for the community itself. Which is kind of weird, I find it counterintuitive. Is this a big issue, are they complaining about it? Actually, is being masked, because the homeowners are scared of this happening to them at some point in the future. And rather than challenging the fact that municipality is prepared for whatever may come down, they are more building in like "let's just pay for more insurance and protector". So, it's becoming more an individualistic perspective rather than at a collective level, which is the municipality would have the better resources to fix their own problems. So is a company or a homeowner deciding to put into their own ... V&P's?? if the neighbour doesn't have good V&P's, it doesn't really help them. It's not going to really change anything. Is the municipality put some systems in place to address the large-scale regional problem? This is the better approach. But it's being influenced by the insurance sector. I'm seeing the insurance sector at every stage of engagement. That is actually a negative form my perspective for the long term resilience capacity of the city. Everybody view this as a positive, I actually see it not as negative issue, but is definitely not the right influence.

Look at initiatives of the IBC, more specifically the intact water centre. There is an intact insurance as a Canadian insurance company, they created kind of their own advisory group for the University of Waterloo, called the intact water centre. It's focused on flood related risks, so there is a bunch of analyst there working for the university of Waterloo, but is primarily funded by the insurance companies. It is essentially to validate the need for better insurances rates for businesses and homeownerships, but because of the clouded message, it's actually being the only message that people hear here. So when you validate it based on and then controlling the message to their own benefit, as much there is a third party academic institutional arm, to their own benefit it actually influences what gets into place in policies at the municipal and provincial level. And is starting to now happen federally. So, where I see the issue is when the flooding happen in Calgary for example the first thing that the Intact water centre did was do media related to this could have been avoided if people have better insurances. And the better

insurances would only pay for the damages afterwards. It doesn't actually protect you for ever getting damages in the first place. So, it's a vacuous message. So yes, you can recruit your cost and you can protect yourself for losing everything, if that ever happen to you... but if you live in a place that is always flooded... but it should be something to build capacity to protect you from the municipal level. Is the wrong message to tell people. And we experienced that here in TO with the island. There are 10,000 people living there, they are now constantly at risk every summer with the rising lake level. And that is something that they never experienced over the last 30 years. Maybe just in the last 5. So, the Intact centre and the IBC have been focusing, well this people need better insurance options, and that is true, but they also need to mitigate the fact that they live there. So, the insurances companies, the IBC, they have more volume in messaging. They have marketing dollars. They have the ability to do a very "" press releases and media interviews and they do a lot of industry networking. So, there is a lot of influence for the IBC, so represents the stakeholders (SH) which is the large national (multinational) insurance company, to influence the message. But the ultimate message should be actually resilience. And not necessarily better or higher insurance coverage. So it is the wrong message. When we talk side by side with the IBC, representation is always *unguarded* perspective, because it doesn't share the same angle as to why this needs to be done and in which way. They just have other ways to do it, and that is part of the challenge.

For a WW is a 0. The status quo

Indicator 7.1: Room to manoeuvre

For flood risk it would be a +

In the short term is a 0. Moving towards a +, but is a 0 today. Limited room for innovation and collaboration.

Indicator 7.2. Responsibility

FR is a +. There is a direct relationship between the CA (ourselves, credit valley, lake Simcoe... the 3 cover all the GTA) and the municipalities. At the municipal level they value this partnership. But the challenges why this is not a ++, is that at provincial level we're scaling back the resources for this. So, we are under the conservation view right now for the province. That may limit the budget for moving forward of how much we have to do.

WW is -. More of a gap between intern departmental. I don't think they are actually reaching that level of collaboration and governance within their own operation. This is an observation for the 3 municipalities of the GTA. They are all having this kind of push back with their Conservation programs.

Indicator 7.3. Authority

They both are 0 at this point.

The political side of it is very influential for the FR side. Mainly because of the storm programs that TO has been pushing through to get installed. If this was installed, it would be a plus at least for FR. But is a 0 for WW.

Indicator 8.1: Affordability

FR side this is a 0. The awareness of flood risk is there but there isn't any infrastructure budgeting for this right now. On a financial basis this is the hardest to justify implementation capital resources. Yes, the easiest to see. When they see a flood, the city is under water, the subway is completely flooded in they can see it. The amount of infrastructure cost in order to get this back to where it should be in adapting to what happening, they don't know where to get this money. So, the financial ability to afford it is definitely going to be challenging from that side

WW is a +. They already started the recovery rate increases 5 years ago. And they are going to do it for more 4 years of it. So, by the end of the 9 years of rates increases, they will have now the financial capacity to address their aging infrastructure pipeline. Not necessarily all of them, but to at least have

the proper financial capacity to plan for that and any WW expenses, it's really just when they're going to do them and how, that is limited in terms of understanding, but at least they have the money, to be able to do that.

A lot of angry people because is going up every year. (about the 9% increase). For the residential homeowner in the grand scheme of things it doesn't actually account for that much money in the end, so over the 9 years, it's not going to be ended up as much money, they can absorb that as homeowners. But in businesses owners, which is the big revenue potential for that, the ICI sector is going to hit really hard with it, and it hits hard through it right now. The uptake on a conservation program in TO comparatively to PL in York, the TO program has been increasing quite a bit but is still a very small program, we do about maybe 15 companies a year, if you think out of thousands of companies in TO, that's not a lot of people in the end (for conservation credits). So the fact that they have that program available, and is still on the limited in how many people participate, it shows to you that there isn't an awareness for the conservation programs, there is no real way around reducing your water footprint, unless you proactively pursue it. Unless you decide to move, which some companies have chosen to do, they are really at the will to cancel because of the raise of the rate for prices for the next 4 years.

Indicator 8.2: Consumer willingness to pay.

For FR is a -. As much as there is a top mind awareness, the council decision to stop and pause the SW charges is representative of the community focus in terms of voters... they don't want to pay more taxes in order to protect themselves for flooding. So as much as this is being... that actually also align with why there is the increased demand now for flood insurances. People will rather have their money go to towards the potential risk of protecting themselves v/s having to pay more taxes to build up the capacity for the entire municipality. I don't have any way to validate that, it's definitely anecdotal. If you research that you can see that is consistent in terms of why a lot of these charges haven't gone through, but there is still an increasing demand for flood risk insurances.

Stopping the flood charges was a political reason. In Toronto it definitely was. It is actually the same reason why Mississauga passed them. Same political reason that the major of Missi before she retired acknowledged that hey, we haven't been able to really keep up with the growth in the city including the actual SW capacity that is required. And then when the big storm hit in 2013 a good part of self Missi was completely damaged by the big storm they had in the TO area. It shows at first hand that hey we're about to release this charge in Missi, look what happened, because we don't have one... as a result of that, the political will said that let's put one in, because we don't want this to happen again. So that was the justification of approving it at that council. On the flood side in TO, is yeah because none wants to pay more, it's a heavily taxed municipality already, and to have to pay more for a service, I think the notion is that people just think it should already be provided by the city.

On WW is a 0. They had the chance to challenge it 5 years ago and it never got challenged. I think it was the right business case, which pitch to say we haven't been raising the rate for the last 30 years... we keep up with the demand and the infrastructure requirements for master planning, so we are really doing this to catch up. So, none really had a choice, they just kind of win with it.

Indicator 8.3: Financial continuation

For FR is -. Infrastructure costing doesn't exit. We don't know how to adjust our financial planning in order to account for something that has been built for 100 years. You neither think that we are never meant to upgrade it or replace it, or maintain, so when you thinking of 75 years or 100 years planning for infrastructure, how are you going to adjust that in real time knowing that is built. You are looking at massive multi billion dollars infrastructure needs. They don't know where the money will come from, even the SW charge won't pay for that. I could actually be a -- but is a - because everybody acknowledge is there. From a municipality level, the smallest municipalities all the way up to a place like TO, all needs this, and a city with a constituent base as TO has the capacity to recover those costs if they really wanted to, with multi means within the city. If the city of a size of 25,000 people or less or maybe 50,000 people or less, they don't have the tax base in order to pull up any infrastructure cost of this nature to



pay for it. They can't build in without going into debt and they can't build in because there isn't enough demand for it to really justify the cost. So a good example within the TRCA, it had an ice jam that happened in Caledon, which is one of the municipalities within our jurisdiction, just last Christmas in 2019, 2018...it's a known issue with our floodplain mapping that this part of Caledon, which is a small municipality of 20,000 people, was at risk of ice jam and rising level of the Humber river, because is built up in the floodplain. But because is built there, it doesn't mean that anything can be done and when the ice jam happened because of the random winter, we ended up getting massive flooding in these areas, that happened also in Waterloo similarly just a month ago. These are things that you can't avoid now, this is going to happen, so the alternative is to try to predict it and try to build the capacity to protect against it or again, increase the insurance coverage to be able to at least recover your cost if happened. Because of that, the lack of financial resources to really build in a resilience that has been identified, I'm really fearful that this is an exercise to show you how much of a gap there is. Because there won't be a lot of financial investments to potentially protect the largest populous in this type of approach. When they get more data, they realize how big the gap is. What I fear, it will be discouraging or even it won't be addressed, because then the focus will be in short terms issues, so the look and feel of that, it's going to end up identifying something that would almost feel "... in terms of something that could be address as an actual problem, so flood risk. I think insurance companies are way more steps ahead in anticipating that the end result maybe just ends up being people having to pay more to protect themselves rather than relying in municipal-governmental-federal to find the way to protect them. Because, once is prove it that there isn't the capacity financially to ever build in a way to properly and effectively mitigate flood risk, the governmental perspective will be like let's just move on from that. That is really pessimistic, but as an analyst, the strategies for prior from the business side, that also how I'm thinking so I'm focusing on how to build resilience for a water perspective... and that focus is more in reduction and energy maximization, utility maximization and none of that actually fall in SW. I work at TRCA and yet my focus is still conservation and utility management and it's mainly because I think this is going to be the shift going back to that. And flooding it's going to be just part of what people deal with. The way a look at it, is similar to people who live close to hurricanes zones, similar to people that live in the US that live in the Tornado Alley, they don't move because the live-in places like that. And earthquakes in California same exact thing, right. They just know that this at some point is going to impact them. But rather to worry about it or rather than the municipality do something about it... I think flood risk related to climate change is going to turn into a similar kind of, the lack of a better term, not wanting to actually deal with the problem itself. That is maybe coming, we can talk about that in maybe 10 years, and you can say you were right. It's my pessimistic view of it, it's how I feel it right now. Especially for a city as the Toronto size comparatively with a city like Stratford, Ontario which is 25,000 people or like Caledon here in TRCA jurisdiction. Caledon is so small with 10,000 people they don't have a way to pay for this, but they're built around a massive floodplain, and you are not going to move an entire city of people to another place. And they can't pay for the upstream impact that someone else is causing to them and the regional mitigation impact of their own floodplain issue, they are really at a point that the only thing that they can do is possibly save money, put it aside for when this happen regularly now, which is going to happen looking forward, or to encourage the municipality the stakeholders or the businesses owners to just get better insurances. When the insurance companies started to trend this way, I started to see they are anticipating well this is going to be inevitable, we don't have any way to actually fix it, rather just find the way to recruit the money and assume that at some point their houses are going to get damaged. This is a bad way of thinking.

For WW is +. Mainly because what I mentioned before

Indicator 9.1: Policy instruments

Despite all that I said, for FR is a +. Is a very short-term perspective in terms of really leveraging what's available, leveraging the SW charges that are happening across the country. The GTA has 2 in the works, potentially 3 by the next year. So, we have at least an acknowledgement that we need to build the financial capacity to do this and to implement that.



WW is also +. They anticipated that in the city of TO it and they built it in, even though they got a lot of flacks, for municipality focus on constituent who are really challenging the price rate increases, they still got a pass.

Indicator 9.2: Statutory compliance

FR is 0

WW is a 0.

Right now, there isn't anything like really for a regulatory or legislative push, for either FR management, especially for the province side, it became very conservative and focus less on this.

On the WW side, which there hasn't been any increased compliance regulations coming out of the province, the municipality hasn't been increasing the compliance inspections rates and noncompliance discharge issues. So, everything is quite status quo from a regulatory side, which isn't a bad thing, but it was moving towards more progressive policies and regulations over the last 5 years and they just kind of hit a wall now with the new government

Indicator 9.3: Preparedness

FR is a +. There is definitely a lot of awareness.

From a fragmented side for the FR side, is at the top of mind, every season weather changes, every major extreme event, TRCA is right at the front of flood warnings and flood notifications. Anything that happens is on the news, when something happens in TO is always super popular. So, thousands or millions of people will see it every time something bad happens. It is viewed as the centre of the Canadian universe. Is not the capital city but is where everything is, kind of. So, there is a lack of preparedness, but the pursuing of wanting to be more prepare is definitely a +

WW it would pri more a negative on an overall action plan basis. This is coming from my original comment right at the beginning. There isn't a lot of kind of an industry or municipal awareness from just the common person for any CSO or infrastructure issues for WW side. The only thing that is really being hold on or something with value is the rate increases. There has to be a reason for the rate increases. The full transparency should be why they are increasing the rate. There isn't really anything that is pushing people to really be concern about it. They are only concern about the fact that it's expensive. That lack of information from that side or the lack of communication on the other side. It's resulting in ok we are only doing this to pay for things, we are not doing this because we need it. We are not doing this because there is a demand for it.

Transcript of interview***respondent TGP-2******interview date 19 February 2020******interviewer Sebastian Rivadeneira******transcript by Sebastian Rivadeneira***

The questions related to each indicator are those that appear in the GCF questionnaire. Some information has been removed to prevent identification of the respondent. Information indicated with quotation marks (“”) and italics represents the standardized answer given by the GCF (This is included when the respondent provided just the score by agreeing with the standardized answer). Particularly, this interviewee provided answers for the general assessment of the governance capacity and the IWRM, but also some insights on the wastewater and flood risk water challenges.

Scores:++ : *plus plus*+ : *plus*0 : *zero*- : *minus*-- : *minus minus*

This is my personal opinion based on my expertise, they do not represent the comments of my employer (Ontario Provincial government). Professional opinion only and separate from those of the employer.

A scale from 1 to 5 is preferred instead of -- ; - ; 0 ; + ; ++

Urban heat island in my opinion is important in Toronto, it should be on the top of mind of people. Toronto gets really warm in summer.

Indicator 1.1: Community knowledge

I think the answer is close to a 3 (zero). And the reason I think that, is there's something on people's minds, But I wouldn't say it's an ongoing thing on people's minds. So, it's something that comes up day to day. The average person wouldn't think of that. It's something that comes up depending on what people are doing, like they want to go swimming, they want something that involves water recreation, or drinking water, or they pick up their utility bill and they see wastewater. I think it's only in those moments when it (water issues) really has impact. I think it's a momentary thing, on that day kind of thinking.

Mhh maybe I would go with the 2 (-), because I don't think the risks are fully understood. At least not by the community as a whole. They have an understanding of just specific things. Water utility bills, going swimming, some specific aspects, the one that affect their lives directly.

Indicator 1.2: Local sense of urgency

I would probably say 1, maybe 2 but I think it is 1 (-- maybe -). So, this is about the people in the community and their understanding of an issue that comes up. And the capacity to address an emergency issue like connecting a Garden to water, correct? I would say that the average person wouldn't have a clue what to do in an emergency situation.

But from the perspective of the willingness to spend money and resources due to an urgent issue, people would feel a sense of urgency and would expect the government to clean up/address the issue.

So, my answer would be between 3 and 4 from that perspective.

But in terms of what will be the anticipated response by the community in terms of a water emergency, I would say that would be quite local.

Indicator 1.3: Behavioural internalization

I would say this is probably between 3 and 4 (0 and +). When their water is threatened, they do respond fairly quickly. As soon as they know about it, they respond, and is all about knowing about it (awareness). But sometimes municipal and provincial governments don't say anything when they probably should – in my professional opinion (Walkerton tragedy is a very real example of this). Issues are public when a lot of results are going bad. So, if there is a risk the media will expose the issue, they (governments) are going to be forced to say something (and hopefully do something too).

So, the answer depends on when the individuals know about the issues and how they individually and collectively respond. I'm assuming that the community understands what is happening, not exactly when it is happening but when they know that it happens.

Indicator 2.1: Information availability

My answer would be 2 (-). Info is not that available at the community level, is more at governmental levels. The responsible regulatory bodies, being the municipal provincial and Federal governments, it depends on them if they are putting that info out there. And right now, I see something. Like the public health unit post information about swimming conditions (water quality information – e.g. e-coli concentration in water). There are drinking water reports too. There are multiple levels of information provided of different waters, whether it's drinking water, or swimming water (raw/natural water bodies), or even fish health. There are multiple sources of info. The question is how relevant is this information and how current is it. And how accessible is it. Does the public in general have access to it in a practical sense? I'm not sure if the public does.

Indicator 2.2: Information transparency

I would say 2 again (-). I don't think gets timely access or even access to expert information available or non-expert information or decision-making rationale, I think this lack of transparency is somewhat dysfunctional. At least what I can tell you from a provincial level perspective as a staff member. Like many politicians, I suspect my minister doesn't have a good understanding of what happens in the water world (unless there is a crisis on their doorstep). Yes, I'm not saying that they're not capable of governing, it's just this issue is not on the radar. Good politicians surround themselves with knowledgeable advisors, who in turn ideally seek expertise at the staff level of the public sector. And they and these advisors they are often non-experts in the environmental issues.

Indicator 2.3: Knowledge cohesion

I would say again 2 (-). For example, at the municipal level you have competing interests for limited resources in the water sector (e.g. drinking water, wastewater and storm water). The municipality is responsible for drinking water, SW, and WW. And they also have a role in source water protection (in Ontario). Like Source water protection for drinking water supply. They do have a role in Source water protection. But most of the role regarding source water protection is under the conservation Authorities. So, there's an overlap in this role. So, there are different people looking after their source water protection. At the end of the day, those 3 water sectors under municipal control (e.g. DW, SW and WW) are competing for the same municipal pot of money. And personally, I don't think there is an internal conversation going on at the municipal level between the maintenance people, the operation people and capital works department people. I just don't see integration of the 3 different water systems staff engagement. If it is taking place it is not sufficient/adequate to optimize outcomes and savings. I think it is improving, and the municipalities are doing a better job in integrating the 3 different water source departments. They are doing smart planning nowadays. Like if we are going to do a road reconstruction and we are going to rip this out, let's do all the pipe (sewers and water mains) work as well. Let's do all necessary upgrades at the same time. I think it's improving at the municipal level but as a whole I don't see a lot of integration regarding the needs of all three competing water sectors.

I don't think it is cohesive, I think it is still somewhat segregated.

Indicator 3.1: Smart monitoring

If you talk about drinking water, I think that the monitoring system is sufficient, there is a lot of information and it is helpful and makes a difference. Clearly drinking water is a priority for human health.

In considering sanitary and combined sewer systems, I think they are insufficiently monitored/ assessed. There are a lot of problems with the sewer system because we are getting numerous combined overflows to the natural environment and due to old pipes with I and I issues (inflow and infiltration, which costs municipalities tens of millions of dollars annually in treating excess amounts of water at sewage treatment plants). So, it takes place with leaky pipes. And that contaminates groundwater and the opposite, it leads to excess groundwater in sewers. And a lot of the problems have to do with poor construction of the sewers and sealing joint connections of the pipes. And there is a lack of onsite inspections during the construction phase. So, there is a real push by municipalities to ensure when development is taking place, we need to be on top of quality control for installing sanitary sewers and sanitary services to sewers. We need inspectors on top of that to make sure that we are meeting the standards because we are losing millions of dollars in WWTP due to poor quality work. There are also concerns with unaccounted for overflows from combined sewer systems with direct discharges to the natural environment.

So, there is a lot of monitoring that needs to be done and reported/recorded regarding Wastewater, especially CSOs (combined sewer overflows).

So, at the provincial level, at the ministry, where we are hoping to move towards, we are looking to include combined sewers as part of the province's 'Environmental Plan' commitments. So, it's not happening now but it will likely happen soon. Then it will be informative and helpful.

And then when it comes to that stormwater monitoring, I think it's woefully inadequate, very poor, because no one is where monitoring is most critical for environmental health of communities. There is monitoring going on but it is of the Conservation Authorities doing this role in some areas. CAs get some money from their watershed municipalities, and their municipalities say 'you look after the monitoring – we will participate in funding the monitoring projects (if deemed a priority), You take care of the monitoring of the river, you check on these different stormwater systems that are discharging into the river, and then let us know your results. There are significant gaps, because the Ontario ministry of environment is not doing its job (in my opinion) in terms of water quality responsibilities under the Ontario Water Resources Act. This has led to the CAs filling a significant water quality policy gap provincially by undertaking water quality activities to complement their water quantity monitoring request in addressing flooding. The reality is without monitoring how can municipalities possibly fulfil their responsibilities to the Provincial Policy Statement, which guides the sustainable watershed development process under the province's Planning Act? That is why, basically the job of monitoring falls to the conservation authority largely due to municipalities needing to meet the requirements of the PPS.

So, there you have three different water systems with different levels of monitoring.

There's a lot of monitoring going on in WTPs and WWTPs themselves, but regarding the things that we don't know of in WWTP discharges like how much pharmaceuticals, CEC, antibiotics, all of these things we don't know enough about. We don't know what happens when they are combined together when they are discharging into the natural water bodies like lakes and rivers, what is the effect of that? We have a lot of work to do still.

So overall DW is doing well, WW is inadequate in the system monitoring and SW is really poorly monitored system. Ontario has one of the toughest DW regulatory systems in the world

Indicator 3.2: Evaluation

I would say it is 3 (0). There are some things that are going on, for example in Toronto they are trying to make a difference, they are trying to do research, putting in pilot projects to check the stormwater. Probably not in drinking water because probably Ontario has the best drinking water in the world and is very strictly regulated.

But in terms of the SW, unfortunately with the current provincial government in place there does not appear to be to be much priority for environmental issues. Even the province's Environmental Plan is very general and lacking substance on a practical level. So, a lot of the environmental restrictions are being 'streamlined' or removed, which is unfortunate. The priority is on 'Open for Business' but this seems to miss the opportunities for sustainable business with environmental lens, which has already been proven to be economically viable. This brand of politics doesn't seem to have caught up with the new reality yet.

Maybe at the municipal level there is some improvement.

Indicator 3.3: Cross-stakeholder learning

I would say yes, most are open to this. But it depends on whether it's at the municipal or provincial level. But generally, I would say that people are open to have a conversation with other stakeholders. So, there is a desire to do so. The question is whether the political system allows it. For example, at the Ontario level, our government doesn't seem to support a lot of engagement by staff, but this might ease as the government sees the benefit of staff being informed as opposed to being disconnected with what is happening elsewhere. For instance, travels are being restricted and so have external training been severely curtailed. So, going out and talking with other stakeholders has been challenging due to budget restrictions. So again, it's about the municipal versus provincial level.

In summary, the provincial level in Ontario from a stakeholder perspective is open for learning but from a political perspective budgetary constraint overshadow the need to have a well-informed public sector in my opinion. People who work in that area are open for that engagement. I just think the system doesn't really enable it. The desire is there but it's not happening the way it should, and this engagement should be happening much more frequently and in some cases – should just be happening as it isn't currently.

Also, there are different levels of responsibility when you talk about the Municipal, provincial and Federal governance structures. Maybe I have a broader perspective because I do have a lot of (virtual) interaction with people working in the municipal sector and also in the federal government. And I pursue that kind of engagement. It makes me a more informed public servant.

So, municipal level +

Provincial -

Indicator 4.1: Stakeholder inclusiveness

Are they part of the decision-making process? I would say no. I think it is probably between 1 or 2 (-- or -). I would say -.

“Not all relevant stakeholders are informed and only sometimes consulted. Procedures for stakeholder participation are unclear (with the exception of the Environmental Registry, but even with this the Ontario government was found guilty of breaking its own laws when it cancelled the carbon cap and trade program without posting it on the ER for public consultation). . If involved, stakeholders have but little influence”

Indicator 4.2: Protection of core values

Protection in a very limited way. For example, when the province is doing something that has an impact, they post that on the environmental registry (ER).

I think somewhere between 2 or 3 (- or 0) is an accurate reflection.



2: *“The majority of stakeholders are engaged, but the level of engagement is low (informative or sometimes consultative). There is a low influence on the result which invokes resistance, for example on internet platforms and newspapers”.*

3: *“As stakeholders are consulted or actively engaged for only short periods, alternatives are insufficiently considered. Influence on end-result is limited. Decisions comply with the interests of the initiating party - primarily. There are no clarity existing in the engagement process”.*

Indicator 4.3: Progress and variety of options

I would say 2 to 3 again (- to 0).

Generally speaking, I would say it is a dysfunctional process right now.

2: *“Informative and consultative approaches are applied, according rigid procedures with low flexibility. The period of decision-making is [typically] short with a low level of stakeholder engagement. These unilateral decision-making processes may lead to slow and ineffective implementation. The latter can be observed from critique via public channels”.*

3: *“There is a clear procedure for consultation or short active involvement of stakeholders, but the opportunities to consider all relevant alternatives is [typically] insufficient. Decisions are therefore still largely unilateral and solutions suboptimal. The suboptimal character of a solution can be observed from evaluations or differences in opinions”.*

Indicator 5.1: Ambitious and realistic management

I would not say goals are ambitious. I think there is a culture of caution and risk aversion at the public sector side of government, especially among staff. We consider that we do well in risk analysis, but I don't think that is actually happening in all areas. I don't think people fully understand what risk analysis (and risk mgmt.) are, they know the concept, but they don't understand what it implies in order to arrive at informed decisions.

I would say 2 (-).

“Actions and goals mention sustainability objectives. Actions and goals are “quick fixes” mainly, not adhering to a long-term vision or sustainable solutions. Uncertainties and risks are largely unknown”.

Indicator 5.2: Discourse embedding

I don't think so, there might be elements of that. Maybe Conservation Authorities. Yes, from a historical perspective maybe just conservation authorities have this discourse embedded. but aside from that I would say no, so 2 (-).

“Actors feel reluctant to execute current policy as it conflicts with their norms and values. Provincial policy does not appear to take the local context and existing discourses into account – at least as I see it. And the policy does not appear to correspond with much of societal demands. This may lead to distrust between actors, inefficient use of resources and ineffective overall implementation”. [A good example of this is current policy – Open for Business' seems at odds with existing Environmental laws – so the government appears to be adjusting or removing laws that get in the way of business and development. This is counter intuitive to what most public servants and many in society would deem as sustainable environmental regulatory reform. It serves the needs of business but often at the expense of the environment. This is not always the best course of action and environmental policy decision making should have a goal of being in harmony with Open for Business just as Open for Business should be in harmony with the needs of the environment.]

Indicator 5.3: Management cohesion

I would say no again, so this is 2 again (-). *“Overall water and climate adaptation policy is characterised by fragmentation and imbalance between sectors. The majority of resources are spent on the dominant policy field and overlap between sectors lead to inefficient use of resources”.*

**Indicator 6.1: Entrepreneurial**

I would say no, is 2 again (-). So, for example I work in my Unit here in the ministry, we do work across various sectors; we work across different Ministries. So, our division works with other divisions of the Ministry and other Ministries of the government. And we also work with Municipal, Federal Governments and conservation Authorities. So, we are the exception to the rule. We do have multiple stakeholder engagement and we are enabled due largely to our specific senior management team. So, for instance we sometimes work with the Dutch Consulate contact, for example if we have a Dutch company that is interested in how to incorporate a new technology in Ontario. The Dutch consulate will reach out to us and ask if we can meet with reps from the Dutch company and provide them insights into how to promote their technology in Ontario. The Dutch company will often have pilot projects that they are looking to do. So, one or more of our team will help in understanding how approval for such pilot projects works in Ontario, and who to connect with in the approval engineering units or connecting to the approval's groups. We help them to understand what they will need to do and give insights. So, we are kind of outliers doing that type of work. But it supports the government's priorities for Open for Business AND enables environmental technology development in Ontario. I feel lucky because we are doing that kind of work, but we are the exception not the norm. Like supporting entrepreneurial innovative approaches.

On average, I would say 2.

Indicator 6.2: Collaborative

Again, I would say 2 (-). I think it can happen, but it is hard to find the right people. For example, to find someone like me it can take a little work. You have to find the right people, who know what our team is doing. It's not an easy process. Even if they find us it doesn't mean that it is all done because of all the bureaucracy. But that is governments in general. Our team has been quite effective in moving initiatives forward regardless of circumstances.

“There is insufficient opportunity for agents of change to [usually] go beyond conventional collaboration. The current collaborations are deemed sufficient to deal with the water challenge whereas the vision is limited to ad hoc command and control approaches”.

Indicator 6.3: Visionary

I would say 2 again. We are the exception; one of my colleagues and I, are working with the other ministry colleagues and with external stakeholders to potentially create what we call municipal system-wide approvals for their SWM, WWTPs and related sewer system Works. There already is an exists approval/license for municipal DW systems in Ontario. This initiative is an example where (if done properly) and approved to proceed, could streamline regulation and improve effective infrastructure projects for municipalities. Having said that, my colleague and I have been pushing hard to include things like monitoring and use of stormwater management master planning reports as part of this potential approval process, including the requirement for asset management plans that are currently required in 2021. Also, all the things related to master plans that also currently required in 2021 to 2023. So, we're pushing hard to include these requirements now as we consider turning over responsibility to municipalities for approvals management of their Works. and a few people are pushing back, and they say, 'no no no', we're not there yet. And we say 'no - you need to include it now, because they are coming into effect anyways.'

From that perspective it's just a few people doing that, we are thinking ahead, we are creating this potential approval framework as we move from site specific to system-wide systems. Now is the time. But it is only still in the proposed thinking because continue to push hard for such inclusion of these requirements. Ultimately, we can only recommend – the decision lies with the decision makers.

And also, my personal observation is that developers are interested in streamlining environmental approval processes, but society does not appear to share that view.

Indicator 7.1: Room to manoeuvre

I would say 2 (-). There is limited autonomy. And this is also happening at the municipal level. The municipalities have to meet the province's minimum requirements but on top of that they may add their own requirements. And it can be very restrictive. So as much as we have our restrictions in place as the ministry, the municipalities are maybe even more restrictive. And they are even more bureaucratic than the province is in some ways.

“Only a few actors receive some degree of freedom, there are limited opportunities to develop alternatives, and there is hardly any opportunity to form partnerships with unconventional actors”.

Indicator 7.2: Clear division of responsibilities

I think that is an oxymoron. Because when there is clear division of responsibilities, what actually happens is that nobody takes responsibility for the system as a whole. Often, I hear that people say that's not my responsibility, I'm responsible for this piece and only this piece. And what ends up happening is that people start building their fences around what they consider to be their responsibilities. They don't take ownership or partial/shared ownership for the bigger picture. So, you don't get the integrated responsibility, this siloed responsibility process is not effective. I have also seen the concept used at senior management where multiple directors would be asked to participate in the decision-making process. It was seen as a 'shared responsibility', but many staff saw this as 'share the blame' just in case the collective decision was frowned upon by the decision makers. Regardless it was a collaborative approach and I personally see it as the better way to get to integrated responsibility for a given initiative.

My answer is 2 (-). Is poor, because people are really concerned about just their piece of responsibility, nobody cares about the big picture, it is a paradox.

So, people usually say 'my responsibility stops here', And my answer is 'not actually - your responsibility goes beyond that'. So the division of responsibilities is clear but it leads to inefficiencies.

So, I think this question should be broken down into two questions in order not to miss the bigger picture of what you are trying to assess.

“Cutting off your nose to spite your face”

Indicator 7.3: Authority

If there is a clear delineation of power and authority, I would say no. Let me answer that again. There is a delineation of power and authority, but I don't find them being followed. There is political interference and bureaucratic process. So, this is one of those grey areas Where you see an erosion or deterioration of those delineations.

I would say again 2 (-).

Indicator 8.1: Affordability

I will say again 2 (-) I don't think they are available, and this goes back again to politics.

So, for instance the municipalities have the responsibility for the frontline they are responsible for delivering those types mandates. And the federal government has a role in saying what is the general direction at the federal level this is what we should be doing. And then the province to municipalities we should be going in this direction. But behind the scene what's happening is the province saying "there is a need to have climate change action plans I may be some kind of best practice guidelines that we should be looking at" But it doesn't matter what political party is in the province anyway they don't want to go too far down in that role, they keep at very high level. Because if they list those responsibilities then the municipalities are going to come looking for money from the province. So, there would be some kind of expectation from municipalities that the province will give money. So, the province keeps requirements for actions at a high level and not really effective in terms of direction. So, it's still a lot of work, but the province just says 'okay climate change is happening and is a very challenging thing to deal with'. But if you see the action plans that do not actually have concrete measures to deal effectively

with the effects of CC. And the reason for that as I understand it, is the province doesn't want to be responsible for funding such CC action items Basically, the municipalities are left to address such CC issues by themselves. When it comes to climate change (CC), they have to figure out how to address CC impacts to meet the needs of their citizens. It's a dysfunctional system in my view.

And my answer is 2 (-).

Indicator 8.2: Consumer willingness to pay

I think in principle there's a willingness, the public would pay, if they see that they're tax dollars are well spent. So, for example in a small town, the municipality did a great job in cleaning the streets and removing snow from the sidewalks in a timely manner. So even though the taxes are very high in the town, people don't complain that much, because they get good services by a large. Basically, the different municipal services were in place in an efficient way. So, people would be willing to pay more when they see that the municipalities are doing good work.

I would probably say 3 (0) maybe 4 (+). Just have to keep in mind – whether federal, provincial or municipal taxes, there is only one taxpayer and as federal download to provinces and provinces download to municipalities, the buck stops at the municipalities. They can't download. Need to have a look at restructuring tax system in Canada in my view.

Indicator 8.3: Financial continuation

I think in the past no, but it's getting better. So, for example for stormwater in the late 90s they introduced a fund to manage stormwater ponds, they didn't consider long-term operational and maintenance costs and resources. And neither the eventual replacement of them. So now this implies a significant amount of money that they have to spend. So, they are getting smarter now. They say, 'we did it that way last time, do it better now'. So, they are scheduled to do Asset Management now and also putting Financial plans around those things. I'm charging more money to the developers to not just build these ponds you also have to maintain and replace them when needed. There is now a shift to a stormwater treatment train, which will lead to a reduction of SWM Wet Ponds and more LID works with a dry pond (for quantity control).

After the Walkerton crisis there were a lot of recommendations to look at the water system as a whole. The government that was in place didn't consider that recommendation in its entirety, but the new government they took a lot of those recommendations and addressed them, but again not completely. If they had, all development in Ontario would be based on watershed development principles with protection for the environment and monitoring programs for stormwater systems. But they didn't do the watershed approach in its entirety. They did a lot of this recommendation but not all of them. So, for example they took the source water protection planning and created source protection boards and committees, but only went so far as to look at raw water from a drinking water impact view.

So, what happened after the Walkerton crisis was that the drinking water rates went up very significantly. For example, in Quebec they pay 100 dollars for the whole year, while in Ontario we pay about two hundred dollars for two- or three-month periods. So does money come in and people say, "okay you should be putting this money to rebuild the watermain system of drinking water infrastructure". But what is happening is municipalities are using that money for other water issues like stormwater or sanitary sewers, and maybe even somewhere else in the municipality's infrastructure Works. What should be happening is the money being spent in at least one of the waters related areas. A 'One Water' approach at the municipal level. Within a One Water approach, a water related aspect.

you can see on the municipal budget where the money goes but there should be restrictions regarding where the money should go, and it should be a municipal water related issue. Something like you cannot use that money in something that is not part of the One Water System.

So, I would say 2 (-). The money is being collected but is not being spent where it should be.



Indicator 9.1: Policy instruments

I would say it is 2 (-). I think there are policy instruments in place, but I don't think they are effective enough. And I don't think the public is aware. I don't think people fully understand. For example, if you take an average person's tax load, I don't think they will understand how much money is spent on water related issues overall, Like water infrastructure, water improvements, those types of things. For instance, Pumping Stations make up about 17% of a municipality's overall energy consumption (on average). I don't think the municipalities have the capacity to effectively communicate that type of thing (aside from a water and wastewater utility bill – which most people pay and understand).

“Instruments are being used without knowing or properly investigating their impacts beforehand. The set of instruments actually leads to imbalanced development and inefficiencies that are hardly addressed”. [Great example of this is development for new subdivisions where there is no capacity at the WWTP or possibly the WTP either. Yet municipalities often proceed anyways despite this disconnect in planning properly or strategically].

[One last note – there is a hodge podge of water management policies at the provincial level, but inadequate stormwater policies or integrated One Water policy strategies. This is especially true when it comes to water quality of SWM – provincial responsibility, which many CAs have tried to address the gap but are now getting push back by the provincial gov't who says it is not their core business. Some perceived hypocrisy here by the province].

Indicator 9.2: Statutory compliance

I would say it is 2 (-) as well. *“The division of responsibilities of executive and controlling tasks is unclear. Policy and related legislation are incomplete meaning that certain gaps can be misused. There is often trust issues in local authorities due to inconsistent enforcement /compliance typically highlighted by unions or NGO's”.*

Indicator 9.3: Preparedness

I would say 2 (-). They are getting better. For instance, in the town of Peterborough there were two 100-year storm events in one week. And it cost over 5 million dollars in damage Because they have a river that runs through the centre of Peterborough. So, when their water level came up there was no place where the water could go. So, the question was how we can deal with this in the future. So, what the city did was to put a lot of the budget towards investments in resilience, to build resistance. But that was a reactive approach. But I think a lot of municipalities saw what happened and they started to be more proactive. So, some municipalities started to look and say, ‘we have a responsibility here’. When did climate change start to affect more and more how are we going to address it? Because for instance the problems are getting more and more localized and intense storms. So, for example in Toronto you have a storm that affects a very small portion of the city but caused extensive damage and losses (about half a billion dollars).

I would say it is limited, but there are some municipalities that are trying to rebuild their infrastructure to address climate change impacts through creating capacity for CC resiliency. It's more focus into the infrastructure side that's basically what they're trying to do. (example of the storm sewers). This is happening in the (Towns and Cities) in different municipalities. I've seen it in different places. As the town gets bigger and bigger the people in the town think if my house has a curb and gutter, like a curb and then they put a sewer system in underneath the road, if they replace that and they put a curb and then a storm sewer they think that is more civilized, that my neighbourhood looks nicer, is cleaner and therefore is worth more (curb appeal). But they don't realize that this is making it worse for SWM due to climate change, as a swale/ditch system may well convey more water and clean the water better too as it transports on route to the river or lake. But they suggest this (curb and gutter) as an improvement on the look of the neighbourhood. So, is the aesthetic versus the function of the system more important?

Similar to these there are a lot of other unsustainable practices being used in municipalities across Ontario. my whole point is we're not doing enough to communicate this information to the community as a whole. Again, I would say 2 (-).

**Transcript of interview****respondent TGP-3****interview date 26 February 2020****interviewer Sebastian Rivadeneira****transcript by Sebastian Rivadeneira**

The questions related to each indicator are those that appear in the GCF questionnaire. Some information has been removed to prevent identification of the respondent. Information indicated with quotation marks (“”) and italics represents the standardized answer given by the GCF (This is included when the respondent provided just the score by agreeing with the standardized answer). Particularly, this interviewee provided answers for both wastewater and flood risk water challenges.

Scores:++ : *plus plus*+ : *plus*0 : *zero*- : *minus*-- : *minus minus*

Contamination of the drinking water system is not listed there, but I can talk about it.

I will be focusing on challenges n° 2 and 3.

We don't have any problem with water scarcity. Although more than 50% of the water in the GTA comes from aquifers, not from the lake. But in the city, it comes from the lake.

I will be focusing more in the GTA, including the surroundings and suburbs.

Background: water resources engineer, master's in environmental. Field of expertise, water contamination. Nutrients. Pollution in surface and groundwater. Working in the Ministry of the Environment in source water protection. Developing a framework to assess the risk of contamination of drinking water sources.

Indicator 1.1: Community knowledge

I would say -. Fragmented knowledge.

“Only a small part of the community recognizes the risks related to the water challenge. The most relevant stakeholders have limited understanding of the water challenge. As a result, the issue is hardly or not addressed at the local governmental level”

Indicator 1.2: Local sense of urgency

For flooding I would say +. Because it affects the people directly and this is always in the media.

“There is increasing understanding of the causes, impacts, scale and urgency of the water challenge. It leads to general sense of urgency of the need for long-term sustainable approaches. However, measures requiring considerable efforts, budget, or substantial change with sometimes uncertain results are often receiving only temporal support. The water challenge is a main theme in local elections”.

For wastewater I would say -. Not too many people are aware of WW issues.

“A marginalized group (e.g. the most vulnerable, environmentalists, NGOs) express their concerns, but these are not widely recognized by the general public. Adaptation measures are not an item on the political agenda during elections”.



(For urban heat island I would say -).

Indicator 1.3: Behavioural internalization

I would say -. Basically, what I'm trying to say is, regardless of what is happening they are not going to change their behaviour.

“There is unawareness of the water challenge with hardly any understanding of causes and effects or how current practices impact the water challenge, the city or future generations”.

Indicator 2.1: Information availability

I would say +. In terms of information, there is a lot of information being provided.

“Strong effort is put in providing integrated information from various fragmented sources. Information gaps are identified and attempted to be bridged. This may be clear from extensive documentation on the long-term process. Also, citizen knowledge may be taken into account”.

Indicator 2.2: Information transparency

I would say again +.

“All interested stakeholders can access information. Action has been taken to make knowledge increasingly understandable. Still, it is a time-consuming search through a maze of organizations, protocols and databases to abstract cohesive knowledge and insights”.

Indicator 2.3: Knowledge cohesion

This would be -. People in different institutions don't connect the information. Even between the ministries of the provinces, we are all disconnected in our communication.

“Information that is found is sector specific and information is inconsistent within and between sectors”

Indicator 3.1: Smart monitoring

I would say +. Useful to recognize underlying processes

“The abundant monitoring provides sufficient base for recognizing underlying trends, processes and relationships. Reports of monitoring will display discrepancies between assumptions and real process dynamics. Acting upon these findings by altering the underlying assumptions characterizes this level of smart monitoring. Often also system boundaries are re-defined, new analysis approach introduced, priorities are adjusted, and new aspects are being examined”.

Indicator 3.2: Evaluation

I think it is 0. Improving routines, very conventional and following the protocols. You take the same report, the same wording and just changing the numbers.

“The identified problems and solutions are evaluated based on conventional (technical) criteria. Current practices are improved. This becomes clear from information of the used and existing criteria, the small changes recommended in reports and short-term character”.

Indicator 3.3: Cross-stakeholder learning

It is 0. (Are they open for cross learning at least?) There are interactions every week (laugh). There is a lot of communication, sharing information but not too much learning into practice. It is hard to change the current situation.

“Stakeholders are open to interaction, though not much learning is going on due to the informative character of the interaction. Often, a number of stakeholders, that do not necessarily share interests or opinions, are involved in the decision-making process”.



Indicator 4.1: Stakeholder inclusiveness

It is a 0. There is consultation, but the feedback is really low. It isn't 0 influence but is quite low.

“Stakeholders are mostly consulted or informed. Decisions are largely made before engaging stakeholders. Frequency and time-period of stakeholder engagement is limited. Engagements are mainly ad hoc consultations where stakeholders have low influence on the end-result”.

Indicator 4.2: Protection of core values

This is also 0. Suboptimal protection of core values

“As stakeholders are consulted or actively engaged for only short periods, alternatives are insufficiently considered. Influence on end-result is limited. Decisions comply with the interests of the initiating party primarily. There are no clear exits in the engagement process”.

Indicator 4.3: Progress and variety of options

Yeah, again 0. Consultation or short active involvement

“As stakeholders are consulted or actively engaged for only short periods, alternatives are insufficiently considered. Influence on end-result is limited. Decisions comply with the interests of the initiating party primarily. There are no clear exits in the engagement process”.

Indicator 5.1: Ambitious and realistic management

I would say +. I'm thinking about floods and wastewater. There are really clear strategies and long-term goals. However, all the targets in the short term are not realistic, even though there is a long-term ambition.

“There is a long-term vision that incorporates uncertainty. However, it is not supported by a comprehensive set of short-term targets. Hence, achievements and realistic targets are difficult to measure or estimate. Visions are often found online as an organization's strategy. They often entail a description of the water challenge and need for action”.

Indicator 5.2: Discourse embedding

I think I would say ++. I think there is a kind of know-how, a long-term ambition. There is understanding and clear procedures.

“Local context is used smartly to accelerate policy implementation. Innovations are subdivided into suitable phases which are more acceptable and effectively enable sustainable practices. Effective policy implementation is enabled by a general consensus that long-term integrated policy is needed to address the water challenge”.

Indicator 5.3: Management cohesion

I would say -. Even if you think about policies for flooding, or for wastewater. There is a total fragmentation. When it comes to implementation there is really fragmented. Each one is going to take care of their own issue. When you get to the point of adaptation policies, each one is going to address its own box. The majority of the money and resources are going to the dominant issue.

“Overall water and climate adaptation policy is characterised by fragmentation and imbalance between sectors. The majority of resources is spent on the dominant policy field and overlap between sectors lead to inefficient use of resources”

Indicator 6.1: Entrepreneurial

Ok, I would say +. When you think out of the box, or new technologies, ways of dealing with the issues, it's really hard to get “” the pilots. But when you want to extend those projects to a larger geographic area, a larger community is very challenging. So, there are pilots everywhere, totally disconnected. But



the extrapolation is hard. But there is enough room for innovation but challenging to implement. So, for example for flooding's, there is a lot of innovation, green infrastructure, LID, blue green infrastructure and design, but to move forward as a provincial approach, or a city wise approach, this is maybe even impossible. Same thing with WW treatment, you have reuse of biosolids, treatment innovations, nutrients recovery, a lot of pilots for that. But when you want to extrapolate, there is a lot of push back. Because of the regulations and the status quo.

“There is a growing understanding of the water challenge’s uncertainty, complexity and need for innovative approaches that entail a certain level of risk. Tentative experimental projects set in but are paid by conventional resources. Projects are small-scale pilots”.

Indicator 6.2: Collaborative

I would say 0. Very conventional collaboration. I mean collaboration happens, but each stakeholder has to really fight to be listened to.

“Traditional coalitions are preserved to maintain the status quo. There is trust within these coalitions. There is limited space to create new collaborations. If new collaboration occurs solutions are still mostly sectoral and short- to mid-term”.

Indicator 6.3: Visionary

I may go to the plus. Long-term vision with flawed communication. When innovative solutions come to the table, then the representors of the traditional way, they just try to avoid the responsibility, to say just let's take a look at it, let's think about it.

“There is a clear long-term, integrated and sustainable-oriented vision. There is still some discrepancy between short-term targets and implementation strategies and the long-term vision from visionary agents of change. This means that agents are not always clear in their formulation regarding the effect and impact of envisioned strategies”.

Indicator 7.1: Room to manoeuvre

This is a +. There is room for innovation in management.

“There is recognition that a high degree of freedom is necessary to deal with complex situations in the form of experiments and looking for new unconventional collaborations. There is a dynamic mix of cooperative partnerships and a redundant set of diverging alternative solutions. A clear overall vision to steer research is however lacking”.

Indicator 7.2: Clear division of responsibilities

Actually, this is ++. There are clear definitions and understanding of roles and responsibilities. Everyone knows clearly their responsibility. (discussing about rigid responsibilities).

“There are many synergetic cooperation’s within the urban water network that can provide solutions for the water challenge. The roles and responsibilities are clearly divided amongst actors. These cooperation’s are dynamic and result in fit-for-purpose problem solving necessary to solve complex, multi-level and unknown challenges”.

Indicator 7.3: Authority

I would say 0. Because the + is not totally correct. We don't really have “Legitimate authorities are assigned to coordinate long-term integrated policy and implementation”. It's because of the politicians, because priorities change every 4 years, after the election periods.

“The water challenge is addressed as long as the status quo is not questioned. Long-term policy visions are limited, and new policy mainly needs to fit into existing fragmented structure. This means small (technical) changes are occurring”.

**Indicator 8.1: Affordability**

I would say 0. Unaffordable climate adaptation. People are able to pay for basic services but not for climate adaptation.

“Basic water services are affordable for the vast majority of the populations, however poor people and marginalized communities have much difficulty to afford climate adaptation measures to protect themselves against impacts such as extreme heat, flooding or water scarcity”.

Indicator 8.2: Consumer willingness to pay

I would say - . There is a mistrust. Like the funding for large sewer projects? It doesn't mean that is the best option. Like how they are addressing the water challenges and climate adaptation is very controversial (people think). Even you have this kind of people that think that the climate is not changing.

“There is a high level of mistrust in decision making of resource allocation. At this level financial decisions are based on prestige projects, projects that benefit small groups or specific interests. As expenditures often do not address the actual water challenges, there is a high degree of resistance regarding resource allocation”.

Indicator 8.3: Financial continuation

I would say 0. I mean they are thinking about the present, and although there is an understanding about what can happen in the future, when you get to the financial issues and funding's is not simple. It's hard to think about to fund future solutions when the existing infrastructure is already inefficient. When you talk about floods, is all aging infrastructure or inefficient structure right now. Or lack of treatment, there is no tertiary treatment. So, when you talk about funding, it is kind of short term.

“Financial resources are available for singular projects regarding basic services of the water challenge. The allocation of financial resources is based on past trends, current costs of maintenance and incremental path-dependent developments. Costs to deal with future water challenges are often not incorporated. Limited resources are assigned for unforeseen situations or calculated risks”.

Indicator 9.1: Policy instruments

I would say +. Profound exploration of sustainability instruments

“Instruments to implement principles such as full cost-recovery and polluter-pays principle, serve as an incentive to internalize sustainable behaviour. The use of various instruments is explorative and therefore not yet optimized and efficient. The use of instruments is dynamic. There are a lot of simultaneous or successive changes and insights”

Indicator 9.2: Statutory compliance

Ok, 0. Strict compliance to fragmented legislation. People say this is the way we do it, this is the status quo. So, it is really a compliance of the status quo.

“Legal regulations regarding the water challenge are fragmented. However, there is strictly compliance to well-defined fragmented policies, regulations and agreements. Flexibility, innovations and realization of ambitious goals are limited. Activity may be penalized multiple times by different regulations due to poor overall coordination”.

Indicator 9.3: Preparedness

A +. Fragmented preparedness.

“A wide range of threats is considered in action plans and policies. Sometimes over-abundantly as plans are proactive and follow the precautionary principle. Awareness of risks is high, but measures are scattered and non-cohesive. They may be independent or made independently by various actors. Allocation of resources, staff and training may therefore be ambiguous”.

***Transcript of interview******respondent TGM-1******interview date 28 February 2020******interviewer Sebastian Rivadeneira******transcript by Sebastian Rivadeneira***

The questions related to each indicator are those that appear in the GCF questionnaire. Some information has been removed to prevent identification of the respondent. Information indicated with quotation marks (“”) and italics represents the standardized answer given by the GCF (This is included when the respondent provided just the score by agreeing with the standardized answer). Particularly, this interviewee provided answers for both wastewater and flood risk water challenges, but also some insights on the general assessment of the governance capacity and the IWRM at the city level.

Special Note about this transcript:

At the request of this interviewee, the transcript of the raw interview has been removed from this appendix, and only the score for each indicator is provided. In case is needed, the verbatim transcript is available for review upon request.

Scores:**++ : plus plus****+ : plus****0 : zero****- : minus****-- : minus minus****Indicator 1.1: Community knowledge**

0: “Most communities have a basic understanding of the water challenge. However the current risks, impacts and frequencies are often not fully known and underestimated. Future risks, impacts and frequencies are often unknown. Some awareness has been raised amongst or is created by local stakeholders and communities”.

Indicator 1.2: Local sense of urgency

0: “There is growing public awareness and increasing worries regarding the water challenge. However, the causes, impact, scale and urgency are not widely known or acknowledged leading to the support for only incremental changes. It is a side topic in local elections”.

Indicator 1.3: Behavioural internalization

-: “The water challenge is partly recognized, mainly due to external pressure instead of intrinsic motivations. There is no support to investigate its origin or to proceed to action or changing practices”.

Indicator 2.1: Information availability

+: “Strong effort is put in providing integrated information from various fragmented sources. Information gaps are identified and attempted to be bridged. This may be clear from extensive documentation on the long-term process. Also citizen knowledge may be taken into account”.

**Indicator 2.2: Information transparency**

+: *“All interested stakeholders can access information. Action has been taken to make knowledge increasingly understandable. Still, it is a time-consuming search through a maze of organizations, protocols and databases to abstract cohesive knowledge and insights”.*

Indicator 2.3: Knowledge cohesion

0: *“Data collection within sectors is consistent and is sustained in multiple projects for about two to three election periods. Knowledge on the water challenge, however, is still fragmented. This becomes clear from different foci of the stakeholders as stated in their organisation’s strategies and goal setting”.*

Indicator 3.1: Smart monitoring

+: *“The abundant monitoring provides sufficient base for recognizing underlying trends, processes and relationships. Reports of monitoring will display discrepancies between assumptions and real process dynamics. Acting upon these findings by altering the underlying assumptions characterizes this level of smart monitoring. Often also system boundaries are re-defined, new analysis approach introduced, priorities are adjusted and new aspects are being examined”.*

Indicator 3.2: Evaluation

0: *“The identified problems and solutions are evaluated based on conventional (technical) criteria. Current practices are improved. This becomes clear from information of the used and existing criteria, the small changes recommended in reports and short-term character”.*

Indicator 3.3: Cross-stakeholder learning

+: *“Stakeholder interaction is considered valuable and useful for improving policy and implementation. Various initiatives for cross-stakeholder learning have been deployed, yet the translation into practice appears difficult. The programs may not be structural and the learning experience may not be registered and shared”.*

Indicator 4.1: Stakeholder inclusiveness

+: *“Stakeholders are actively involved. It is still unclear how decisions are made and who should be involved at each stage of the process. Often too many stakeholders are involved. Some attendants do not have the mandate to make arrangements. Stakeholder engagement is abundantly done for often overlapping issues”.*

Indicator 4.2: Protection of core values

Between 0 and +.

0: *“As stakeholders are consulted or actively engaged for only short periods, alternatives are insufficiently considered. Influence on end-result is limited. Decisions comply with the interests of the initiating party primarily. There are no clear exits in the engagement process”.*

+: *“Stakeholders are actively involved and expected to commit themselves to early outcomes in the process. Hence relevant stakeholders may be missing in contractual arrangements as they do not want to commit themselves to decisions to which they have not yet contributed. At this point involved stakeholders have influence on the end-result and therefore the output serves multiple interests”.*

Indicator 4.3: Progress and variety of options

Between 0 and +.

0: *“There is a clear procedure for consultation or short active involvement of stakeholders, but the opportunities to consider all relevant alternatives is insufficient. Decisions are therefore still largely*

unilateral and solutions suboptimal. The suboptimal character of a solution can be observed from evaluations or difference in opinions”

+ : “Stakeholders are actively involved and there is sufficient room for elaborating alternatives. Procedures, deadlines and agreements are unclear. There is no or few specification on deadlines in terms of dates. Due to inexperience with active stakeholder engagement, decisions are taken too early in the process leading to the exclusion of argument and solutions. Hence, decisions may not be fully supported”.

Indicator 5.1: Ambitious and realistic management

+ : “There is a long-term vision that incorporates uncertainty. However, it is not supported by a comprehensive set of short-term targets. Hence, achievements and realistic targets are difficult to measure or estimate. Visions are often found online as an organisation’s strategy. They often entail a description of the water challenge and need for action”.

Indicator 5.2: Discourse embedding

0 : “Current policy fits the local context. The water challenge is increasingly identified, framed and interwoven into local discourse, but the disregard of uncertainty prevents a sense of urgency that is necessary to adopt adequate adaptation measures. Decision making often results in very compromised small short-term policy changes”.

Indicator 5.3: Management cohesion

Between 0 and +.

0 : “Policy is fragmented and based on sector’s specific scope and opportunities for co-benefits are hardly explored. However, effort may be made to balance the resource allocation between sectors”.

+ : “There is cross-boundary coordination between policy fields to address the water challenge. Policies are cohesive, but have not yet resulted in broad multi-sectoral actions. Efforts to harmonize different sectors are evident by employee functions or assignments and protocols”.

Indicator 6.1: Entrepreneurial

Between 0 and +.

0 : “Entrepreneurial agents of change are better able to seize low-risk opportunities. Therefore opportunities for innovative approaches and synergies are hardly pursued. Small changes can be observed”.

+ : “There is a growing understanding of the water challenge’s uncertainty, complexity and need for innovative approaches that entail a certain level of risk. Tentative experimental projects set in but are paid by conventional resources. Projects are small-scale pilots”.

Indicator 6.2: Collaborative

+ : “There is an understanding that water challenges requires long-term and integrated solutions. Hence, wide-spread collaborations between a variety of stakeholders and sectors are being established. New collaborations with unconventional actors, result, more and more, in valuable new insights and effective networks:”

Indicator 6.3: Visionary

Between 0 and +.

0 : “The visions of the existing agents of change are limited to promoting the business as usual. They do not oppose nor promote long-term, integrative thinking. Interest or employment in trend analysis is limited”.



+: *“There is a clear long-term, integrated and sustainable-oriented vision. There is still some discrepancy between short-term targets and implementation strategies and the long-term vision from visionary agents of change. This means that agents are not always clear in their formulation regarding the effect and impact of envisioned strategies”.*

Indicator 7.1: Room to manoeuvre

Between 0 and +.

0: *“Actors are given the means to perform predefined tasks for dealing with problems that are framed with a narrow, short-term and technical-oriented scope. There is limited room to deviate. Solutions are sought in own sectoral field and expertise”.*

+: *“There is recognition that a high degree of freedom is necessary to deal with complex situations in the form of experiments and looking for new unconventional collaborations. There is a dynamic mix of cooperative partnerships and a redundant set of diverging alternative solutions. A clear overall vision to steer research is however lacking”.*

Indicator 7.2: Clear division of responsibilities

0: *“Responsibilities are divided over a limited set of conventional actors. Opportunities for new cooperation and more effective division of responsibilities are not seized or even recognized. Sometimes conventional actors get more tasks to deal with new water challenges”.*

Indicator 7.3: Authority

Between 0 and +.

0: *“The water challenge is addressed as long as the status quo is not questioned. Long-term policy visions are limited and new policy mainly needs to fit into existing fragmented structure. This means small (technical) changes are occurring”.*

+: *“There is recognition of the need for long-term and integrated approaches by both the public and the political arena. Sustainability approaches regarding the water challenge are now implemented as declarations of intent and sustainability principles in policy and regulation. Legitimate authorities are assigned to coordinate long-term integrated policy and implementation”.*

Indicator 8.1: Affordability

Between 0 and +.

0: *“Basic water services are affordable for the vast majority of the populations, however poor people and marginalized communities have much difficulty to afford climate adaptation measures to protect themselves against impacts such as extreme heat, flooding or water scarcity”.*

+: *“Serious efforts are made to support climate adaptation for everyone, including vulnerable groups. There is often recognition that poor and marginalized groups are disproportionately affected by the water challenge. This is increasingly addressed in policy and regulation”.*

Indicator 8.2: Consumer willingness to pay

Between 0 and +.

0: *“There is support for the allocation of resources for conventional tasks. There is limited awareness or worries regarding the water challenge. Most actors are unwilling to financially support novel policies beyond the status quo. Generally, there is sufficient trust in local authorities”.*

+: *“Due to growing worries about the water challenge, there are windows of opportunity to increase funding. However, the perception of risk does not necessarily coincide with actual risk. Financial principles, such as polluter-pays principle, may be introduced. Due to inexperience, implementation is*

often flawed. Focus groups decide on priority aspects regarding the water challenge, but there is confusion regarding the extent and magnitude of the water challenge”.

Indicator 8.3: Financial continuation

++: “There is secured continuous financial support for long-term policy, measures and research regarding the water challenge. These costs are included into baseline funding. Generally, both economic and non-economic benefits are considered and explicitly mentioned”.

Indicator 9.1: Policy instruments

Between 0 and +.

0: “Policy fields or sectors often have similar goals, but instruments are not coherent and may even contradict. Overall instrumental effectiveness is low and temporary. There is sufficient monitoring and evaluation leading to knowledge and insights in how instruments work and actors are getting a more open attitude towards improvements”.

Indicator 9.2: Statutory compliance

+: “New ambitious policies, agreements and legislations are being explored in a “learning-by-doing” fashion. Most actors are willing to comply. Some targets may be unrealistic and requires flexibility”.

Indicator 9.3: Preparedness

+: “A wide range of threats is considered in action plans and policies. Sometimes over-abundantly as plans are proactive and follow the precautionary principle. Awareness of risks is high, but measures are scattered and non-cohesive. They may be independent or made independently by various actors. Allocation of resources, staff and training may therefore be ambiguous”.

Transcript of interview**respondent TGM-2****interview date 26 February 2020****interviewer Sebastian Rivadeneira****transcript by Sebastian Rivadeneira**

The questions related to each indicator are those that appear in the GCF questionnaire. Some information has been removed to prevent identification of the respondent. Information indicated with quotation marks (“”) and italics represents the standardized answer given by the GCF (This is included when the respondent provided just the score by agreeing with the standardized answer). Particularly, this interviewee provided answers mainly for the challenge of wastewater and for the general assessment of the governance capacity.

Scores:++ : *plus plus*+ : *plus*0 : *zero*- : *minus*-- : *minus minus*

Background: civil technologies

Field: municipal linear developments, sewer water mains, road construction, designing sewer. SW management.

Consulting industry and development industry (Before joining the City)

Working now in technical guidelines, bylaws, eco-green roofs. Technical with working groups if green infrastructure.

Indicator 1.1: Community knowledge

I would say - . I would say fragmented knowledge.

Just the key actors that have a complete understanding of what's going on, while the General Public doesn't. For example, in Stormwater management.

Just less people are involved.

“Only a small part of the community recognizes the risks related to the water challenge. The most relevant stakeholders have limited understanding of the water challenge. As a result, the issue is hardly or not addressed at the local governmental level”.

Indicator 1.2: Local sense of urgency

I would say 0. Moderate willingness for small changes.

So, the general public understands the need but it is a slow process. There is a willingness across different stakeholders, but we are not there yet.

“There is growing public awareness and increasing worries regarding the water challenge. However, the causes, impact, scale and urgency are not widely known or acknowledged leading to the support for only incremental changes. It is a side topic in local elections”.

Indicator 1.3: Behavioural internalization

I will say zero. There are some communities that they are starting to look at... and it depends on the area. There are some areas where they are trying to develop more sustainable solutions, like avoiding the conventional gardens and reuse the water as much as possible. It is growing, it is incremental, but we are not there yet. There are incremental changes in terms of actions.

“There is a growing awareness, often as a result of local, exploratory research regarding the causes and solutions of the water challenge. There are only incremental changes in actions, policy and stakeholder’s behaviour”.

Indicator 2.1: Information availability

I would say Information scarcity and limited quality, so -.

There is some information available for professionals. But the information is not easily accessible and there are also gaps. For example, one of the gaps is the information for how well implemented are the green roofs, the operation and maintenance. There's nothing available. So, for some aspects there's no info at all.

“Limited information is available which does not grasp the full extent of the water challenge. In some cases, not all information is of sufficient quality to generate a comprehensive overview”.

Indicator 2.2: Information transparency

Information is scarce, limited and with a lack of details. So, for example people doing research and trying to look at precipitation and evaporation data is not that easy to complete. So, the information is there but it's not easy to get to.

“Information is sometimes shared with other stakeholders. However, information is inaccessible for most stakeholders. Furthermore, knowledge is often technical and difficult to understand for non-experts. The water challenge may be addressed on local websites”.

Indicator 2.3: Knowledge cohesion

There is some info there but is not well connected as much as we'd like. Is 0. Insufficient cohesion between sectors. The info is there, but is not cohesive, it's not that transparent and it's hard to get to. Like some people have it but it's not general knowledge.

“Data collection within sectors is consistent and is sustained in multiple projects for about two to three election periods. Knowledge on the water challenge, however, is still fragmented. This becomes clear from different foci of the stakeholders as stated in their organisation’s strategies and goal setting”.

Indicator 3.1: Smart monitoring

I would say reliable data but limited coverage, so -. For example, the rain gauges, we have rain gauges for the city. They are not bad, but they're also limited, for example with rainfall we don't know what happened exactly during the winter. We don't know how exactly the snow melt works on the system.

We don't have extensive monitoring in our sanitary system. There is data in the pump stations. But in the network, there are gaps in the info, and are not all linked. And I think we need to do more. For the water mains system the monitoring is really good. Maybe it's not real time but there's something there. Generally speaking, the monitoring systems are not real time. Maybe in certain places but not everywhere. The non-mechanical systems don't have real time data. While the mechanical systems (like pumps) do.

“Monitoring occurs; however, the monitoring system does not cover all facets of the water challenge, with sometimes incomplete description of the progress and processes of technical and policy measures. Monitoring is limited to singular effectiveness or efficiency criteria and cannot identify alarming situations”.

**Indicator 3.2: Evaluation**

I would say Improving routines, so 0. We're always trying to improve and get better. We do evaluation of the work that we are doing trying to move forward (But doesn't go beyond that).

"The identified problems and solutions are evaluated based on conventional (technical) criteria. Current practices are improved. This becomes clear from information of the used and existing criteria, the small changes recommended in reports and short-term character".

Indicator 3.3: Cross-stakeholder learning

I would say -. Small coalitions of stakeholders with shared interest. It's basically generally always the same people. And even we try to foster the interactions is just a small sector that participates. Not everybody participates, but some do. Like just some people try to look at other people's perspectives. Maybe there is a willingness to share knowledge, but it is hard to materialize.

What I see is what we call silos.

"Interaction occurs in small coalitions based on common interests. Opinions of those outside the coalition are generally withheld. Only information for the shared point of view is sought. This is evidenced by the finding of only one perspective regarding the water challenge or few perspectives that are supported by means of circle-referencing".

Indicator 4.1: Stakeholder inclusiveness

Because of the nature of a lot of our work, it's very technical, so to engage different stakeholders in that and make them part of the decision-making process is not easy. So, the community and the non-governmental organizations are there; they are consulted but they are not part of the decision-making process. There are opportunities for external stakeholders to provide inputs but in my opinion, they are not able to have a high influence in the decisions. But anyway, there is some consultation and they participate in the environmental assessment process.

So, I would say 0. Untimely consultation and low influence.

"Stakeholders are mostly consulted or informed. Decisions are largely made before engaging stakeholders. Frequency and time-period of stakeholder engagement is limited. Engagements are mainly ad hoc consultations where stakeholders have low influence on the end-result".

Indicator 4.2: Protection of core values

I would say 0. There are small opportunities to participate. There is a suboptimal protection of core values.

"As stakeholders are consulted or actively engaged for only short periods, alternatives are insufficiently considered. Influence on end-result is limited. Decisions comply with the interests of the initiating party primarily. There are no clear exits in the engagement process".

Indicator 4.3: Progress and variety of options

I would say 0. Consultation or short active involvement. Maybe it happens in other environmental issues, but not too much in water related. I think in water issues there is a short-term involvement.

"There is a clear procedure for consultation or short active involvement of stakeholders, but the opportunities to consider all relevant alternatives is insufficient. Decisions are therefore still largely unilateral and solutions suboptimal. The suboptimal character of a solution can be observed from evaluations or difference in opinions".

Indicator 5.1: Ambitious and realistic management

I would say 0 again. Action wise is confined.



“There is a confined vision of the water challenge. Ambitions are mostly focused on improving the current situation where unchanging conditions are assumed and risk and scenarios analyses are lacking”.

Indicator 5.2: Discourse embedding

A 0 again. Low sense of urgency embedded in policy. Is very sporadic. Is not that bad but is not really interwoven in policies.

“Current policy fits the local context. The water challenge is increasingly identified, framed and interwoven into local discourse, but the disregard of uncertainty prevents a sense of urgency that is necessary to adopt adequate adaptation measures. Decision making often results in very compromised small short-term policy changes”.

Indicator 5.3: Management cohesion

0. Fragmented policies. So, this is not negative per se, the policies are effective and are there, but are kind of fragmented.

“Policy is fragmented and based on sector’s specific scope and opportunities for co-benefits are hardly explored. However, effort may be made to balance the resource allocation between sectors”.

Indicator 6.1: Entrepreneurial

I think it is 0. Conventional and risk-averse entrepreneurship. There are not too many opportunities. It’s quite conventional.

“Entrepreneurial agents of change are better able to seize low-risk opportunities. Therefore, opportunities for innovative approaches and synergies are hardly pursued. Small changes can be observed”.

Indicator 6.2: Collaborative

I would say 0, again is quite conventional. Agents are enabled to enhance conventional collaboration.

“Traditional coalitions are preserved to maintain the status quo. There is trust within these coalitions. There is limited space to create new collaborations. If new collaboration occurs solutions are still mostly sectoral and short- to mid-term”.

Indicator 6.3: Visionary

I would say something between 0 and -, but closer to 0. Defence of status quo and unilateral short-term vision.

0: *“The visions of the existing agents of change are limited to promoting the business as usual. They do not oppose nor promote long-term, integrative thinking. Interest or employment in trend analysis is limited”*

- : *There is a unilateral vision regarding the water challenge, which considers a limited group of actors. The vision often has a short-term focus, with a maximum of 3 to 4 years*

Indicator 7.1: Room to manoeuvre

I would say +. Redundancy to address uncertainty. We are reacting that way. There is some room and freedom to manoeuvre.

“There is recognition that a high degree of freedom is necessary to deal with complex situations in the form of experiments and looking for new unconventional collaborations. There is a dynamic mix of cooperative partnerships and a redundant set of diverging alternative solutions. A clear overall vision to steer research is however lacking”.



Indicator 7.2: Clear division of responsibilities

I would say 0. Inflexible division of responsibilities.

“Responsibilities are divided over a limited set of conventional actors. Opportunities for new cooperation and more effective division of responsibilities are not seized or even recognized. Sometimes conventional actors get more tasks to deal with new water challenges”.

Indicator 7.3: Authority

I would say +. Clear and legitimate authorities. There is a recognition for long-term solutions.

“There is recognition of the need for long-term and integrated approaches by both the public and the political arena. Sustainability approaches regarding the water challenge are now implemented as declarations of intent and sustainability principles in policy and regulation. Legitimate authorities are assigned to coordinate long-term integrated policy and implementation”.

Indicator 8.1: Affordability

I would say +. Limited affordability of climate adaptation services. Water is very cheap in the city. The city is already subsidising some flooding mitigation. However, there are some shortages in some areas. We are moving towards more sustainable solutions, but we are not there yet.

“Serious efforts are made to support climate adaptation for everyone, including vulnerable groups. There is often recognition that poor and marginalized groups are disproportionately affected by the water challenge. This is increasingly addressed in policy and regulation”

Indicator 8.2: Consumer willingness to pay

I think there is willingness, I would say a +. For Climate change especially. An increase of 9% for 9 years was approved for water rates. And the decision was generally supported.

“Due to growing worries about the water challenge, there are windows of opportunity to increase funding. However, the perception of risk does not necessarily coincide with actual risk. Financial principles, such as the polluter-pays principle, may be introduced. Due to inexperience, implementation is often flawed. Focus groups decide on priority aspects regarding the water challenge, but there is confusion regarding the extent and magnitude of the water challenge”.

Indicator 8.3: Financial continuation

A + again. There is abundant financial support. Currently this is not really an issue (there are some pressures to reduce the costs).

“Abundant financial resources are made available for project-based endeavours that are often exploring new solutions but lack long-term resource allocation or institutionalized financial continuation. Hence, long-term implementation is uncertain”.

Indicator 9.1: Policy instruments

I would say 0. Fragmented instrumental use. Water supply is not a big issue in the city. WW collection is generally not a big issue either at this time There are some areas WW collection is problem. The WW plants do not have issues.

So, are policy instruments effectively used? I would say is not as consistent.

“Policy fields or sectors often have similar goals, but instruments are not coherent and may even contradict. Overall instrumental effectiveness is low and temporary. There is sufficient monitoring and evaluation leading to knowledge and insights in how instruments work and actors are getting a more open attitude towards improvements”



Indicator 9.2: Statutory compliance

I think for Drinking water we are there.

For WW we are trying to apply that. In general, we are complying, in a “mid-term” fashion.

Maybe better than other municipalities.

So, I would say 0, Strict compliance to fragmented legislation.

“Legal regulations regarding the water challenge are fragmented. However, there is strictly compliance to well-defined fragmented policies, regulations and agreements. Flexibility, innovations and realization of ambitious goals are limited. Activity may be penalized multiple times by different regulations due to poor overall coordination”.

Indicator 9.3: Preparedness

I would say fragmented preparedness, it depends on the sector. But I'd say a +.

“A wide range of threats is considered in action plans and policies. Sometimes over-abundantly as plans are proactive and follow the precautionary principle. Awareness of risks is high, but measures are scattered and non-cohesive. They may be independent or made independently by various actors. Allocation of resources, staff and training may therefore be ambiguous”.

Transcript of interview**respondent TGF-1****interview date 19 February 2020****interviewer Sebastian Rivadeneira****transcript by Sebastian Rivadeneira**

The questions related to each indicator are those that appear in the GCF questionnaire. Some information has been removed to prevent identification of the respondent. Information indicated with quotation marks (“”) and italics represents the standardized answer given by the GCF (This is included when the respondent provided just the score by agreeing with the standardized answer). Particularly, this interviewee provided answers mainly for the the general assessment of the governance capacity and the IWRM at the city level.

Scores:++ : *plus plus*+ : *plus*0 : *zero*- : *minus*-- : *minus minus***Indicator 1.1: Community knowledge**

I would say overestimation. So +. I think the key groups have the knowledge, but I'm not sure about the community, they just want solutions, right. Maybe for flooding they have more knowledge.

“The community is knowledgeable and recognizes the many existing uncertainties. Consequently, they often overestimate the impact and probability of incidents or calamities. The water challenge has been raised at the local political level and policy plan may be co-developed together with local communities”

Indicator 1.2: Local sense of urgency

I think it is a plus. I'd say that for the city of Toronto, Because with the Remedial Action Plan, wet weather flow management master plan one of the first documents that was developed by the city, to these days almost 20 years later we are still moving on it. So, it was pretty progressive by those days across the country, so they recognized the urgency and as a result Toronto Water was created. I think it is pretty good, they have a plan and they are following it. They report to their remedial action plan about what they are doing.

So, I would say a + for this one.

Indicator 1.3: Behavioural internalization

I think it's moderate. I'd say that because the city of Toronto is a big city, and in the sense of promoting awareness and progress and incentives I think we did a lot of that. And still goes out today, but we did promote water conservation, water management is a lot with the conservation authority trying to get people involved. But of course, flooding is more noticeable and appears more in the media.

And it is really captured in the policies, definitely.

Indicator 2.1: Information availability

In Ontario what we have is an environmental assessment process, And any major public works goes through it, and they present formation and there are maybe two or three stages, to define different options

and then they consult the public regarding the different options. So, it presents opportunities for the public to participate in decision-making. I don't know if for example general information is shared to the public. We did a lot of that in comparison when I was involved in the committee. That was pretty heated. But that's a really long time ago. But again, I was part of the environmental assessment program and when there was incineration at that time there were opportunities for Different stakeholders. It was pretty heated. So, I think when it comes to any kind of important infrastructure the public is involved. So, people who are affected would be there. And also, at the beginning of any project the information is there available.

So, let's give it a +. Is definitely not a 0.

Indicator 2.2: Information transparency

Let's give it a +. I think there's always information. And particularly for the city related type of information it can come from everyone right? It can come from the city itself; it can come from the province, it can even come from our program. So sometimes for the public it is difficult to decide which one to rely on and which one really be comfortable with in terms of the challenges in the city. Because the city is... by provincial regulations. But if you look up data from Academia or from the federal government, or the province could be more comprehensive. So, it could be a challenge for the public.

Indicator 2.3: Knowledge cohesion

Is still a +, just for the reasons that I mentioned.

“Sectors cooperate in a multidisciplinary way, resulting in complete information regarding the water challenge. Besides multiple actors, multiple methods are involved to support information. Too many stakeholders are involved, sometimes in an unbalanced way. Knowledge about effective implementation is often limited”

Indicator 3.1: Smart monitoring

I think we are pretty good in Toronto. They are doing amazing you know modelling, and predictive future models. I've seen that.

I would say a +.

“The abundant monitoring provides sufficient base for recognizing underlying trends, processes and relationships. Reports of monitoring will display discrepancies between assumptions and real process dynamics. Acting upon these findings by altering the underlying assumptions characterizes this level of smart monitoring. Often also system boundaries are re-defined, new analysis approach introduced, priorities are adjusted, and new aspects are being examined”

Indicator 3.2: Evaluation

This is about policy, right?

I'd say a 0. Improving routines. At the city level.

“The identified problems and solutions are evaluated based on conventional (technical) criteria. Current practices are improved. This becomes clear from information of the used and existing criteria, the small changes recommended in reports and short-term character”

Indicator 3.3: Cross-stakeholder learning

This is a tricky one. I think it's actually +. I know the city collaborates a lot with universities, they collaborate with Remedial Action Plan. But I'm not sure with this particular aspect. I think it is ok, I was thinking more in terms of helping with monitoring. But I'd say a + for this.

“Stakeholder interaction is considered valuable and useful for improving policy and implementation. Various initiatives for cross-stakeholder learning have been deployed, yet the translation into practice

appears difficult. The programs may not be structural, and the learning experience may not be registered and shared”

Indicator 4.1: Stakeholder inclusiveness

It's a +. They are actively involved. It could be better of course. Actually ++ is probably better, is more specific. The city would arrange to meet with everybody.

I would say transparent involvement.

“All relevant stakeholders are actively involved. The decision-making process and the opportunities for stakeholder engagement are clear. It is characterised by local initiatives specifically focussing on water such as local water associations, contractual arrangements, regular meetings, workshops, focus groups, citizen committees, surveys”

Indicator 4.2: Protection of core values

We can have a lot of involvement... but sometimes politicians change their minds, you can see that happens.

Probably a + again. But you know this is related to the environmental assessment process. There has been a lot of changes since I was involved.

So, in the Province all the projects have to go through the environmental assessment process and some cities go beyond that. And sometimes it is a condition for the public to continue consulting the public. I don't have specific examples, but it depends on projects itself.

I just know with the weather flow management that went through a lot of public consultation.

“Stakeholders are actively involved and expected to commit themselves to early outcomes in the process. Hence relevant stakeholders may be missing in contractual arrangements as they do not want to commit themselves to decisions to which they have not yet contributed. At this point involved stakeholders have influence on the end-result and therefore the output serves multiple interests”.

Indicator 4.3: Progress and variety of options

I will give it a ++. Yeah, they are doing a lot of this and sometimes it gets delayed but there is a lot of engagement. So, I'd say active engagement.

And sometimes it depends on the group and how diverse the group. Some people are very educated on these issues.

“There is active engagement of all relevant stakeholders and clarity of participation procedure and realistic deadlines. The range of alternatives is fully explored, and selection of the best alternatives occurs at the end of the process. Reviews of stakeholder meetings provide the alternatives addressed. Stakeholders are engaged throughout the whole process as specified in contractual agreements”.

Indicator 5.1: Ambitious and realistic management

Realistic and ambitious strategy (++). I point at the municipal wastewater, they have a master plan basically for sewage treatment and stormwater and wet weather flow, so they are following it. It takes time but is ambitious.

“Policy is based on modern and innovative assessment tools and policy objectives are ambitious. Support is provided by a comprehensive set of intermittent targets, which provide clear and flexible pathways. Assessment tools and scenarios analyses identify tipping points that may be found in policy documents”

Indicator 5.2: Discourse embedding

We do try to be sustainable, right. Maybe the industrial processes, it is something that is kind of different. Even with the WWF master plan it was there, it dealt things related to climate change, and they are addressing it now. We still don't have enough good regional climate change models. But I think for the city there is really a plan for the future. And even now for the present scenarios.

So, I think something between 0 and +.

Indicator 5.3: Management cohesion

Currently it'd be a -.

Because at the federal level we don't have policies, number one. I think there is a lot of uncertainty right now, a lack of cohesion. The Conservation Authority does a lot of stream regulations, and they try to make the process simple and easy. but it takes time to change. So, between the city and the conservation Authority it's hard to be cohesive.

“Overall water and climate adaptation policy is characterised by fragmentation and imbalance between sectors. The majority of resources is spent on the dominant policy field and overlap between sectors lead to inefficient use of resources”

Indicator 6.1: Entrepreneurial

This is a --. I would say insufficient.

“Ignorance for risk and threats leads to ineffective rigid governance and lack of opportunity for entrepreneurial agents to enable improvements. Moreover, distrust by other actors and potential investors, further decrease access to resources”

Indicator 6.2: Collaborative

This is a -. Insufficient opportunities.

“There is insufficient opportunity for agents of change to go beyond conventional collaboration. The current collaborations are deemed sufficient to deal with the water challenge whereas the vision is limited to ad hoc command and control approaches”.

Indicator 6.3: Visionary

I think it is a 0. Defence of status quo. I mean everybody is just doing their job.

“The visions of the existing agents of change are limited to promoting the business as usual. They do not oppose nor promote long-term, integrative thinking. Interest or employment in trend analysis is limited”

Indicator 7.1: Room to manoeuvre

We do have people that can come up with ideas and collaborate, but I think that is not enough in the city. It just takes so much time for some projects; they are still promoting old projects (in TW). Is kind of slowing down with innovation, we used to have a lot of innovation. But that was because we have a strong Federal-provincial-Municipal collaboration. And even in our program we said no more Innovation because we wanted to finish the work that we were doing. So, we don't do a lot of innovation, we support it a lot, but.

So, the leadership from the federal government is in another way now and we are not doing too much innovation now.

There is limited room for innovation, so 0.



Indicator 7.2: Clear division of responsibilities

Is something between 0 and +.

0: *“Responsibilities are divided over a limited set of conventional actors. Opportunities for new cooperation and more effective division of responsibilities are not seized or even recognized. Sometimes conventional actors get more tasks to deal with new water challenges”*

+: *“Actors recognize that knowledge and experience are scattered within the local network. Therefore, extra effort is made to bundle the scattered expertise and to reach fit-for-purpose division of clear roles and responsibilities. New cooperation compositions are explored”*

Indicator 7.3: Authority

Is 0. Restricted authority.

“The water challenge is addressed as long as the status quo is not questioned. Long-term policy visions are limited, and new policy mainly needs to fit into existing fragmented structure. This means small (technical) changes are occurring”

Indicator 8.1: Affordability

I don't think anybody's suffering really. With our policy framework in terms of social justice. Like people not being able to pay for water or services.

So, is at least +.

“Serious efforts are made to support climate adaptation for everyone, including vulnerable groups. There is often recognition that poor and marginalized groups are disproportionately affected by the water challenge. This is increasingly addressed in policy and regulation”.

Indicator 8.2: Consumer willingness to pay

I think it is a 0. Recently the city of Toronto imposed a tax increase.

“There is support for the allocation of resources for conventional tasks. There is limited awareness or worries regarding the water challenge. Most actors are unwilling to financially support novel policies beyond the status quo. Generally, there is sufficient trust in local authorities”

Indicator 8.3: Financial continuation

Is a 0.

“Financial resources are available for singular projects regarding basic services of the water challenge. The allocation of financial resources is based on past trends, current costs of maintenance and incremental path-dependent developments. Costs to deal with future water challenges are often not incorporated. Limited resources are assigned for unforeseen situations or calculated risks”.

Indicator 9.1: Policy instruments

It must be a 0. Fragmented instrumental use

“Policy fields or sectors often have similar goals, but instruments are not coherent and may even contradict. Overall instrumental effectiveness is low and temporary. There is sufficient monitoring and evaluation leading to knowledge and insights in how instruments work and actors are getting a more open attitude towards improvements”.

Indicator 9.2: Statutory compliance

I think it is a 0, we are pretty good in terms of compliance. Or maybe something between 0 and +. Because you know we have the green policies and people are ambitious.



0: *“Legal regulations regarding the water challenge are fragmented. However, there is strictly compliance to well-defined fragmentized policies, regulations and agreements. Flexibility, innovations and realization of ambitious goals are limited. Activity may be penalized multiple times by different regulations due to poor overall coordination”.*

+: *“New ambitious policies, agreements and legislations are being explored in a “learning-by-doing” fashion. Most actors are willing to comply. Some targets may be unrealistic and requires flexibility”*

Indicator 9.3: Preparedness

Is fragmented, I think is a +. Yeah, I'm thinking about when the province put the “” protection plan, and you know recently we had a false alarm in Pickering plant the nuclear spill around. So, all the municipalities are kind of strong in protection plans. So that is a response to those incidents, like the Walkerton crisis.

“A wide range of threats is considered in action plans and policies. Sometimes over-abundantly as plans are proactive and follow the precautionary principle. Awareness of risks is high, but measures are scattered and non-cohesive. They may be independent or made independently by various actors. Allocation of resources, staff and training may therefore be ambiguous”.

Transcript of interview

respondent TI-1

interview date 05 February 2020

interviewer Sebastian Rivadeneira

transcript by Sebastian Rivadeneira

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Scores:

++ : *plus plus*

+ : *plus*

0 : *zero*

- : *minus*

-- : *minus minus*

Indicator 1.1: Community knowledge

I would give this a +. I think the general public is pretty aware of the water issues.

“The community is knowledgeable and recognize the many existing uncertainties. Consequently, they often overestimate the impact and probability of incidents or calamities. The water challenge has been raised at the local political level and policy plan may be co-developed together with local communities”.

Indicator 1.2: Local sense of urgency

Score is a +. For example, with the flooding's in Toronto Islands, the community is pretty active.

“There is increasing understanding of the causes, impacts, scale and urgency of the water challenge. It leads to a general sense of urgency of the need for long-term sustainable approaches”.

Indicator 1.3: Behavioural internalization

I think it's a 0. People are aware, but I don't think they are doing enough about it. And at the community level for example people are flushing stuff in the toilet, that they shouldn't. So, at many levels they are not acting. I think people realise what they need to do but actions are lacking not words. And that's kind of lacking

Indicator 2.1: Information availability

I think this one is between a plus and a double Plus. So, I will say +. I think it's not perfect but there is enough information if you are looking for it. You may look in a variety of sources, but you know it is there, or should be there. Most of the information is available online whether in the website of the city of Toronto or in the original conservation authority or the province.

Indicator 2.2: Information transparency

I think this one is a double Plus. I think the stuff is there and it is pretty simple stuff.

“Information is easily accessible on open source information platforms. There are multiple ways of accessing and sharing information. Information is often provided by multiple sources and is understandable for non-experts”.

Indicator 2.3: Knowledge cohesion

I think it's Plus. I think people try to look at what other people are doing, it's not fully integrated yet. But it's not a plus plus, we don't have a ministry of the water, I mean we have three levels of government, then information is fragmented, so I think almost by definition it's not co-created. So, I feel more comfortable with plus.

“Sectors cooperate in a multidisciplinary way, resulting in complete information regarding the water challenge. Besides multiple actors, multiple methods are involved to support information. Too many stakeholders are involved, sometimes in an unbalanced way. Knowledge about effective implementation is often limited”.

Indicator 3.1: Smart monitoring

I don't know if it's really the case here in Toronto. I'm either to skip the question or give it a poor score. Because a lot of the things are beyond the control, right?. For example, the flooding risk with Toronto Island is more about the amount of rainfall, snowfall, than my behaviour. So, I'm not sure what can I do about it. So, a lot of the things that people need to change are of long-term nature. For example, pharmaceuticals in the toilets, there are using wipes, That shouldn't be used. That is a long-term application process, I don't think anything that could be picked up by anyone will change certain behaviour.

So, I would say it's a -.

So, for example if something is happening in a water treatment plant, people on that spot will take action, I don't know if the pH changes, they will adjust the formula. But at what level does it come to politicians? I just don't see if there is anything irregular that would create... I don't know.

Reliable data but limited coverage.

Indicator 3.2: Evaluation

I'm not sure with this one. I don't think this is a question for me. Ask somebody that is using policies. I'm only looking from the outside.

Indicator 3.3: Cross-stakeholder learning

I'd like to think that is either Plus... yes, plus. I would say plus. For example, what we had during the symposium last week, different stakeholders from different sectors, is a good example of it.

“Stakeholder interaction is considered valuable and useful for improving policy and implementation. Various initiatives for cross-stakeholder learning have been deployed, yet the translation into practice appears difficult. The programs may not be structural, and the learning experience may not be registered and shared”.

Indicator 4.1: Stakeholder inclusiveness

I think I would go with a plus by kind of default. I think it's not perfect. I don't want to give it a ++, But I think it is definitely better than 0. But also, I think the definition of plus is a little bit negative. So it's kind of somewhere, it is ok. It's not perfect but I will say a plus. (is not a ++ because) I don't think there are things like regular meetings for example, with all stakeholders, Including the community. I mean the things come up, there is information available, Information like, I don't know, water, water diversion and stuff, but it's more like in an ad-hoc basis. And a little bit fragmented.

Indicator 4.2: Protection of core values

I think is somewhere between 0 and +. I'm almost looking at this as a community member, An educated community member, and how much influence do I have on it?, I am being consulted, But I'm not sure if it makes a difference at the end of the day. So yeah let's say a 0.

“As stakeholders are consulted or actively engaged for only short periods, alternatives are insufficiently considered. Influence on end-result is limited. Decisions comply with the interests of the initiating party primarily. There are no clear exits in the engagement process”.

Indicator 4.3: Progress and variety of options

I'm not sure I don't know what happens. I think this is more for somebody that is working at the policy level, I think.

Indicator 5.1: Ambitious and realistic management

I think it's definitely a plus.

“There is a long-term vision that incorporates uncertainty. However, it is not supported by a comprehensive set of short-term targets.”

Indicator 5.2: Discourse embedding

I think this is also a +. The standardized answer describes quite well the situation.

“There is a consensus that adaptation is required, but substantial effort is necessary as there is little experience in addressing the water challenge in a long-term integrated approach”

Indicator 5.3: Management cohesion

I'd like to think it's +. The problem is that we have three levels of government. A lot of cook in the kitchen. I think that is part of the problem here. And I think this is mostly provincial vs municipal, I mean, the city of Toronto is pretty much liberal, and the provinces more conservative. And yeah, a city like Toronto which is overwhelmingly liberal, so a little bit more socialist. And then now you have a (provincial) government which was pretty much elected by the whole province except for Toronto, it's like a rural government, elected by the rural Ontario. And they have different ways of, is more laissez faire, is more business-oriented, they are open for business which means like (neoliberal?) not neoliberal, let's say neo-conservative. It's like less government is better, less oversized is better. They're trying to deregulate some of the Industries. So, is more open to the market and it means less regulations.

Indicator 6.1: Entrepreneurial

I think it's +.

“There is a growing understanding of the water challenge's uncertainty, complexity and need for innovative approaches that entail a certain level of risk. Tentative experimental projects set in but are paid by conventional resources. Projects are small-scale pilots”.

Indicator 6.2: Collaborative

This is a +.

“There is an understanding that water challenges require long-term and integrated solutions. Hence, wide-spread collaborations between a variety of stakeholders and sectors are being established.”

Indicator 6.3: Visionary

I think it's a plus, but I'm kind of confused. It's not double +, that is for sure. Yeah, I agree with the answer here.

“There is a clear long-term, integrated and sustainable-oriented vision. There is still some discrepancy between short-term targets and implementation strategies and the long-term vision from visionary agents of change.”

Yeah, all the environment of entrepreneurial it's not perfect but it's pretty well developed here.

Indicator 7.1: Room to manoeuvre

Yeah this is definitely a +.

“There is recognition that a high degree of freedom is necessary to deal with complex situations in the form of experiments and looking for new unconventional collaborations”

Indicator 7.2: Clear division of responsibilities

I would say +.

“Actors recognize that knowledge and experience are scattered within the local network. Therefore, extra effort is made to bundle the scattered expertise and to reach a fit-for-purpose division of clear roles and responsibilities”

Indicator 7.3: Authority

This one is double +. I think it's pretty clear who is in charge, I mean it's not ideal, but this is definitely pretty clear. Like everybody has their task to do, is known. It doesn't mean it's perfect, but for everybody it is clear, you know for the municipality, the conservation authority. I think this is well understood.

Indicator 8.1: Affordability

This is a complicated one, because the people that are most susceptible to flooding, are people that have a nice property close to the river, or the Toronto island which are rich people, or privileged people.

Yes, I think this is a double +, like for everybody is equal, for sure.

Indicator 8.2: Consumer willingness to pay

Double + for this. I think in general there is willingness to pay. Here you know in Toronto the user pays. We had a recent case in Nova Scotia where ... paper factory was exposing the water, and they were warned many times to address it, and they never did so they shut it down. So that kind of polluter pays, and if you don't want to pay, they can't operate.

Indicator 8.3: Financial continuation

I think this is a plus. I'd like to think there is a long-term plan that it's not depending on the people elected. And we better do. maybe I'm making assumptions.

“Abundant financial resources are made available for project-based endeavours that are often exploring new solutions but lack long-term resource allocation or institutionalized financial continuation”

Indicator 9.1: Policy instruments

This is a +. The answer describes quite well what it's happening.

“Profound exploration of sustainability instruments”. “Instruments to implement principles such as full cost-recovery and polluter-pays principle, serve as an incentive to internalize sustainable behaviour. The use of various instruments is explorative and therefore not yet optimized and efficient”

**Indicator 9.2: Statutory compliance**

Is definitely not double +. I think the plus describe quite well. I mean is not ideal but, I'm thinking mostly about waste and wastewater. I think we are not recycling enough; we don't recycle from apartments buildings. A lot of the stuff that we recycle gets burned, which is kind of no? purpose. Do you know the recycling bins on the street, you know we're sorted but then everything goes together In the same truck, is mixed together. So, you create kind of good behaviour, but after all everything is... You know I saw it once, And I said does this really matter? Because at the end everything is going to end up in the same place. It's a little bit of b*****.

Indicator 9.3: Preparedness

I think it is +. Yeah, I mean sometimes I am a little bit confused with the definitions in your answers but overall, I think this indicator is a plus. Like fragmented preparedness sounds a little bit negative, but I'm giving a B, when I say + I mean is a BB+. (in a scale from 1 to 5) is a 4. So, when I say 0, I mean 3. Like 0 is average, is baseline, like not doing too bad not doing great.

So, in general I will give Toronto a B+. I mean it's not ideal, it will be more integrated, it could be better, but I think given the circumstances it is pretty well. I think it is different to compare with other cities in the world, for example with cities in the Netherlands maybe we are not there but we are trying. For example, this was the first city to do compost, pretty good. I mean at the city level, is pretty ambitious. We've had recycling for a long time. I think they are trying to do the right stuff. And you have to consider there are a lot of constraints, different levels of government, overall, I would say that I'm proud of what they are doing. It's not the best in the world but is pretty good. there's a really strict protection with the ravines, they are trying to divert water away from the sewer system, they are trying to reduce salt. So I think there are in general a lot of efforts to improve the water system. So definitely I will give it a B+. They passed my test.

Suggestions:

- Definitions are sometimes too negative.
- The questionnaire is too wordy.
- Sometimes agree with the first part of the answer but not with the second.
- It's little bit academic to be honest.

Transcript of interview

respondent TA-1

interview date 31 January 2020

interviewer Sebastian Rivadeneira

transcript by Sebastian Rivadeneira

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Scores:

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(about the water challenges)

- Number 2, the flood risk, is the one which is most on people's minds.
- Water scarcity is not a consideration. Toronto is lucky to have a huge freshwater body (Lake Ontario).
- I think wastewater treatment is something that generally people feel as managed on their behalf and they don't worry about it. With small groups better concerned with things like Wastewater effluents. In Toronto we have combined sewer, so there are opportunities for CSO, so there are environmental advocates that are really concerned about that. (Is there a plan to separate the combined sewer?) I don't think there is a master plan to separate existing sewer, the way I understand it is, in future there will be no more combined sewer. But what is already in the ground, and all the infrastructure built around there, they are not going to end up separating that.
- About solid waste treatment I think people is not worry about that
- Urban heat Island. It hasn't had a lot of discussion. Broadly speaking. It doesn't have a lot of discussion in the general public. Where it gets the most discussion is in sort of Municipal And maybe academia. Is more from the social perspective. If you can have more green infrastructure, then one of the benefits will be, Reducing urban heat Island effect. In general, I don't think, even for cities, cities that have extreme heat warnings, People tend to not think about it.

Indicator 1.1: Community knowledge

So, I would read this as fragmented knowledge. I think if I consider the large population. The large population doesn't have an understanding at all. Whereas people specifically in charge, with the responsibility of knowing about water, Water system, water cycle...We have better knowledge. But overall, I think there's only a portion of the community That recognises these risks. So, I would read this as fragmented knowledge.

Indicator 1.2: Local sense of urgency

I will read this as a zero. I think the standardized answer provides an accurate representation. I think the 0 represents well the public awareness. When you talk about strong demand for actions and sense of urgency, I think that only exists among a small level of advocates that are related to the issues. So, I think for the general population it works as a 0.

Indicator 1.3: Behavioural internalization

So, in terms of answering this from a perspective of what would people do or change their behaviour around flooding in the water challenge, I think it is towards a plus, a moderate internalisation. I would say that because There has been a lot of guidance from the municipality in terms of how to mitigate your flood risk If you are a homeowner in Ontario. And insurance companies have also been doing that type of protection as well, so people know How to properly grade their properties to take water away from their houses. So, there is awareness about you should keep litter and leaves away from catch basins, so they don't clog up. So, I know that people do start to know which actions they can take.

Indicator 2.1: Information availability

I'm going towards the “-” here. Again, I think what happens is some of these water challenges that are listed, they have a localised area where they manifest. So, for example flooding in the city of Toronto is quite well-known because there is some history. There is also mapping of where events will happen, and where the low-lying areas are, some predictive modelling Available. But then elsewhere, It's not necessarily the case. So I'm going to put it towards the - .

(Just based on what happens in the city). I will say the zero then 0. Information is available. I don't think there is a huge supply of Integrated information from different sources. I think information is somewhat fragmented. And this is from historical observations the people have.

So, I would say for the city a zero and for the region a minus. I'm thinking of this from the perspective of the general public as opposed to from the perspective that somebody actually has invested expertise in the challenge. If somebody works actually in the field for example the GIS department of Toronto Water, they probably have much more awareness and understanding about the Information available and how well is integrated and so on. So, I think the level amongst technical experts, there it will be more probably close to a plus, but I think for the general Population of Toronto it'd be towards a zero.

Indicator 2.2: Information transparency

Clearly is not a plus. Because this is not the situation (about the standardized answer). I think it is still hard to bring up all this information together. Is not cohesive. I think again I feel more towards a zero. So, if you have technical knowledge, if you have some expertise, I'm sure you can get through it, and you're able to access it. And it is reported in local websites. So once again I think this is a 0.

(Maybe I'm going to be in the middle of the road of everything)

Indicator 2.3: Knowledge cohesion

I think this is low cohesive knowledge. That's a -. So, information tends to be too specific and inconsistent among sectors. I think it is towards there (to zero). Because in the zero talks about sustained projects for two or three election periods. Is interesting that the election periods are mentioned here, Because it shows, One of the impediments to actually having good information about water and sustainable is having a deep politicized view, And when things are politicized you know you are in the wrong way. Instead of having long-term answers you have short term answers going to the next election period (Thinking about specifically for the city of Toronto).

Indicator 3.1: Smart monitoring

So, thinking about monitoring systems implies that you will have a real-time understanding? (Ok that would be the ++). So, I will go with the - here. I think that is accurate what is occurring. The monitoring system is not covering all the assets related to the water challenges. Sometimes there are incomplete Descriptions. So, I would say when it comes to the built environment, the part that has civil engineering, the part where you have your channels, the pumps, the pipes, And so on. Those typically have useful and well understanding of the monitoring. but when then you get more into the natural ecosystem, the more natural Environment, there is some information about water levels, but the two systems are not brought together into somewhat like a single water observation network, Interrelated to, (for example) flows in a river with the chance of bypassing to the treatment plants, and yet there isn't strong connectivity between those different datasets. So, I will go with the -.

Indicator 3.2: Evaluation

So, this is about the evaluation and improvement of current policies. I don't feel like a strong comfort with this question actually. May I skip this one? Yes, I don't feel confident answering this one.

Indicator 3.3: Cross-stakeholder learning

So, for this one I think this is a little bit more positive. I think there is an openness, maybe this is a reflection from the position that I am in, In terms of the approach that we are taking to Sustainable water at Ryerson, is highly interdisciplinary. So, we are trying to get a lot of cross connection between different places in the water cycle. So, I think these stakeholder interactions are considered valuable and useful in policy. So, I will write this as a plus.

Indicator 4.1: Stakeholder inclusiveness

So, I think this is different at the provincial level or at the City level. But generally, I think this is a plus, In Ontario when there is a new policy Being implemented is posted In the Environmental bill of rights for a period time for public consultation, so there is a lot of opportunities there. Also, I think for many waters related projects there is an environmental assessment process. Mandates of consultation processes with the public. So, I think there are opportunities to grade this as a plus.

(are you also thinking about first nations here?). So, this is a little out of the range actually. Is actually an interesting one? One of the things that can happen in the consultation process Is that you're open and transparent and you allow opinions to be expressed, but at the end of the day is somebody else making the decision, So just because it's a transparent process it doesn't necessarily mean that Everybody is happy At the end of the day. So, which is what can happen with the first Nation communities. So, there are different forms of approaches to water governance, And I didn't really consider it in my previous answer, The First Nations. So, First Nations when they think about Governance of water is a lot more driven by somewhat spiritual beliefs in terms of the approach. So, I think if you have an interview with somebody from A First Nations Community, representatives, I think the answer might be different. They have a different perspective on this matter.

Indicator 4.2: Protection of core values

I realised that in a number of these questions, it can depend on your perspective. So in general in politics you have, for example the polarization around climate change, some leaders can believe that is a manmade phenomenon, and you have to tackle that, While others can think that we have to adapt it with mitigation... So, you have a polarization and that is typically, it tends to be the right vs the left political parties. And then you can have on the top of that the perspective of First Nations as well. And they will all have somewhat different core values. So the challenge about core values is not everybody has the same set of core values, and a lot of times If we look for example at the core values of the right wing,



the core value is the economy, and if you are more left wing often the core value is more Environmental, And that is the same with First Nations.

So, I think in general I would go with a 0 in this one, the decisions comply with the interests of the initiating primary party. I think that is true for many decisions. I will go with a 0 in this one.

Indicator 4.3: Progress and variety of options

I would tend to go with a - in this here. So rigid procedures limit limited scope. I think a lot of the approaches that are taken in this are quite proscriptive so low flexibility.

“Informative and consultative approaches are applied, according rigid procedures with low flexibility. The period of decision-making is short with a low level of stakeholder engagement. These unilateral decision-making processes may lead to slow and ineffective implementation. The latter can be observed from critique via public channels”.

Indicator 5.1: Ambitious and realistic management

So, going back on the flooding, as one of the major water challenges, I think there is one long-term ambitious goal, so that is a plus. So, I'd say that because I think about there are major projects in Toronto to realign the Don river, which is one of the sorts of key watersheds, where a lot of the water from Toronto is managed. It has the flooding risk towards sort of the Southeast portion of downtown Toronto, and there is a long-term plan to realign that, to create burns, a contained managed flooding, with a really long term vision of possible severe weather events over the next 100 years. And this is currently ongoing.

Indicator 5.2: Discourse embedding

In this one I'm going to go with the 0. So, the current policy fits into the local context, But I do find a lot of times the decision-making is based on the election cycle and not on the long-term cycle. The water Toronto project that I just mentioned in the previous question, Is a bit of an exception to that. I am not sure why that is. Maybe it relates to the fact that how water for Toronto is not necessarily a political “animal”? to begin with. But there are many other decisions around projects in water challenges that relate to the elections in municipal councils.

Indicator 5.3: Management cohesion

I would say this is quite fragmented, so we have different levels of responsibility, for different levels of Government. So a lot of times decision making tends to focus on political boundaries, which are inconsistent with watersheds boundaries, and you have different stakeholders and different levels making decisions that relate to where they are in terms of, are they within a municipality, or are they within a lower-tier vs a higher-tier municipality. And there is a role for conservation authorities to play in terms of source water protection, and those are focused on watershed boundaries. And sometimes, almost always, Municipal boundaries intersect the watershed boundaries. So, I found this is quite fragmented.

Indicator 6.1: Entrepreneurial

This is a really tough question as well because it depends where in the water challenge the entrepreneurial is. So, for example if the entrepreneur has a solution related to flooding, that could be more quickly adapted with more opportunities, for them to come up with innovation, capitalise on it. But if you go into the regulatory part of the water challenges, like providing safe drinking water, that regulatory regime is so strict, that entrepreneurial have a hard time Doing anything different, because nobody wants to change the current system. I would lean to a plus on this.

**Indicator 6.2: Collaborative**

So is somewhat between a + and 0. I will go with a +. I don't know if you come across an organisation called Partners and Project green. They come out of the Toronto and region conservation authority. And they created these Partners and project Green, is an eco business around the Pearson Airport, for bringing together all types of various stakeholders, to create sustainable water practices, in terms of managing water demand, in terms of managing stormwater. So, this is actually an example of an agent of change making collaboration Between stakeholders. so, I will grade this with a plus.

Indicator 6.3: Visionary

I find that in general there tends to be a defence of the status quo. So that is a 0.

“The visions of the existing agents of change are limited to promoting the business as usual. They do not oppose nor promote long-term, integrative thinking. Interest or employment in trend analysis is limited”.

Indicator 7.1: Room to manoeuvre

I believe this is a 0, With limited room for innovation and collaboration. Of course, it depends on where in the water challenge, but overall, I think It's really hard to change the status quo. And so that's why it's a 0.

Indicator 7.2: Clear division of responsibilities

So, I think these responsibilities in general are quite clearly defined (Specifically for the city of Toronto). Yeah, I think it's quite clear the responsibilities for most of the actors. I will go with the plus on this, I think the answer is appropriate. I do think one of the things that creates a clear division of responsibilities, Is there the amount of regulations around the water challenges.

Indicator 7.3: Authority

So, I think for this one is a + which is stirring authority. And especially when it comes to the flooding challenge, I think there is a recognition of “greener “solutions there.

“There is recognition of the need for long-term and integrated approaches by both the public and the political arena. Sustainability approaches regarding the water challenge are now implemented as declarations of intent and sustainability principles in policy and regulation. Legitimate authorities are assigned to coordinate long-term integrated policy and implementation”.

Indicator 8.1: Affordability

I think it's pretty clear that there is no level of fairness here, in terms of like so many times the poorest are the least protected in terms of severe weather events. So, I don't think that, there is not a good connection between how water services are paid for and what the true cost is, and then who pays... It's quite complicated here in the city of Toronto because drinking water wastewater and stormwater are paid all together through the water rate. So what that means is that you live in a detached property, with a big yard, and you get a lot of rainfall, And you have a lot of hard surfaces; you pay for stormwater management the same that somebody that lives In a high-rise rental apartment with a very little footprint in terms of the water, And yet the way that stormwater management is paid for Is actually throw the rate of your water consumption, the drinking water. So that is intrinsically unfair. And then in Toronto quite a lot of the population actually lives in dense High-rise accommodations. So, I think it's a 0.

**Indicator 8.2: Consumer willingness to pay**

This is a minus, fragmented willingness to pay. There was a survey done a couple of years ago, around 2011, and they asked people if they knew what they pay for cubic metre of water. So basically, the question was do you know so what the water rates are? Most people did not know. Would you be ok to increase your water rate? And everybody said no. So, they didn't know how much the rate was, so it shows inconsistency.

A lot of municipalities are doing this differently, so some of them have a flat rate for the first so many metres, and others would have a rate that increases based on the more you consume the higher the rate is, others have declining rates. And then there is a differential some treat industry differently than the treat in homeowners. So yeah there is no consistency in this. But I think generally you can find that information on the municipal websites. So, if you see a Toronto water bill it should be broken down there.

So, I think there are just a few people that can be honest and say ok tell me what it cost and I'm willing to pay for it.

Indicator 8.3: Financial continuation

I think in general this is a plus. The revenue model, especially in the city of Toronto, the revenue model for Toronto water is a projected consumption times what we were just talking about, the rate. And the city of Toronto over the past 10-years has been dramatically increasing the water rate to get the price sustainability, to try to gain as much infrastructure as possible into a state of good repair. And they have a really steady revenue stream. I think they have abundant financial support. So, this is a plus.

Indicator 9.1: Policy instruments

So ok with respect to full cost recovery and polluters pay principle, we are in trouble getting to that, so we don't have those instruments (so it's not a +). So, I'm going to conclude that this one is 0 based on the standardized answers. Fragmented instrumental use.

"Policy fields or sectors often have similar goals, but instruments are not coherent and may even contradict. Overall instrumental effectiveness is low and temporary. There is sufficient monitoring and evaluation leading to knowledge and insights in how instruments work and actors are getting a more open attitude towards improvements".

Indicator 9.2: Statutory compliance

I would say in general in Ontario and Toronto this is a ++. Ontario, since the Walkerton crisis, we got almost the strictest regulatory environment in the world, very punitive. So, I think it generally, there is very good compliance. So, I'm going to give that a ++.

Indicator 9.3: Preparedness

I think in general this one is pretty good as well. So, for example if this is only related to drinking water, I will say this is a ++. But when it comes with the other water challenges it might be different. I will go with fragmented preparedness (so is a +). There is a pretty good level of preparedness, and also pretty good awareness, but I don't think it's enough to get to the comprehensive preparedness.

Transcript of interview**respondent TA-2****interview date 12 February 2020****interviewer Sebastian Rivadeneira****transcript by Sebastian Rivadeneira**

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Scores:++ : *plus plus*+ : *plus*0 : *zero*- : *minus*-- : *minus minus***Indicator 1.1: Community knowledge**

On the community knowledge I would say 0. There is some understanding but, it's not widespread, there are some efforts among stakeholders and the community, though.

Indicator 1.2: Local sense of urgency

0 again. Moderate willingness for small changes.

“There is growing public awareness and increasing worries regarding the water challenge. However, the causes, impact, scale and urgency are not widely known or acknowledged leading to the support for only incremental changes.”

Indicator 1.3: Behavioural internalization

I would say -. Actually, I would say somewhere between 0 and the -. Because you know there are some changes. But yeah. (the standardized answer represents well what happens)

Basically, there is very slow implementation of any changes.

(clarifying) My answers are based in Toronto because there are differences across the province, and Toronto is kind of unique, it is the largest municipality in the country, so it is different from (the rest of municipalities).

“The water challenge is partly recognized, mainly due to external pressure instead of intrinsic motivations. There is no support to investigate its origin or to proceed to action or changing practices”.

Indicator 2.1: Information availability

I would say 0.



“Information on the water challenge is available. Knowledge on understanding or tackling the water challenge is progressing and is produced in a structural way. Knowledge gaps are hardly identified due to lock-in into existing disciplines and policy. This is apparent from the quantity of factual information, but the causes, risks and impacts of long-term processes are lacking behind”

Indicator 2.2: Information transparency

I'm not sure about this one I would say -.

“Information is sometimes shared with other stakeholders. However, information is inaccessible for most stakeholders. Furthermore, knowledge is often technical and difficult to understand for non-experts. The water challenge may be addressed on local websites”.

Indicator 2.3: Knowledge cohesion

minus. Low-cohesive knowledge within sectors.

“Information that is found is sector specific and information is inconsistent within and between sectors”.

Indicator 3.1: Smart monitoring

Definitely -.

My view is that monitoring system are incredibly useful to gain detailed understanding of water resource is an issues, and guide their regulatory issues, however currently there is monitoring that is done by multiple agencies with regard to water, wastewater, stormwater, and some data is available but not nearly to the extent that we can identify... and data availability is generally poor, So for example the only data that is relatively accessible online are streamflows, from local stream gauges. Precipitation is not available in real time. When you try to obtain historical information from Environment Canada, which is the Federal Entity, it's not actually available, you have to go through a process. For example, you say I need historical data for rain gauges, for weather stations, typically for my work I need precipitation data, and it's not relatively available. we're very backwards in some things. There is an ongoing battle with regards to water quality in Lake Ontario, because we have 12 or so beaches in the Toronto area, so the task of monitoring the water quality is given to the Department of Public Health where they basically sample the water at the beaches for E coli, because that is the blue flag criteria, for the flag status of the beach, and a report but only on those locations. But there are a lot of recreation activities that take place on the Harbour front and Toronto Island (but are there people in contact with water?) well there are kayaking and different water sports, not swimming but water quality there is never reported, and it's terrible because a lot of the CSO are in the harbour area. So, the NGOs have been fighting this for years, and there was even a directive issue to the city by the Ministry of the environment, to start reporting this and they have done nothing about it and, there are no consequences. So, you know there are gaps, real gaps.

And my current project is about smart green infrastructure, not just resilient water, but drilling down to green roofs, so small pieces of infrastructures, using the LID concept. But it is kind of the other stream work. Actually, I have another project with open data to analyse sewer blockages with limited success. So, open data is growing but is kind of slow. They are expanding the data sets, there are some open data initiatives. So, it is a formal initiative from many municipalities and also in the city of Toronto, but it is being kind of slow in implementation.

Indicator 3.2: Evaluation

It's 0. There are some bright spots but the whole process is slow. And this is not just this city because there are multiple levels of governance involved, there is the municipality, then the conservation Authorities and then the provincial government and then the Federal government doesn't have much to say other than fishery, and multiple provincial Ministries As Natural Resources, Environment, and so

on. Is very slow in all those levels. For example, the new stormwater management criteria have been in the works for the past 2 to 3 years, going to consultation processes and this is just one aspect. And then if we talk about Integrated Water Management that is not even on the people's minds. Just some Progressive municipalities have that in their strategies, but that is just the high-level document.

Stormwater management criteria is providing the guidelines, is setting the requirements for controlling for discharges. The MECP is in charge of that. They had the climate change on their name and then with the change of government they changed that name.

Indicator 3.3: Cross-stakeholder learning

There is stakeholder engagement and maybe that's part of the reason why this is so slow. Because these committees tend to have 15, 20, 30 people from different institutions. So, it is open for cross stakeholders learning.

And then we have the whole environmental assessment process, which dictates the Stakeholder engagement in public consultations. But what is put into practice that's another story. But the pace is slow. But yeah you can argue that he's double plus because there is a lot of consultation that takes place.

++

Indicator 4.1: Stakeholder inclusiveness

Is ++ again. We have something called the Environmental Bill of Rights (EBR). Environmental Registry process is an engagement process. So basically, any new compliance approval goes through Public consultation, so everything is published here, and anyone has the opportunity to comment. The stormwater document is supposed to be here. So any new Environmental Compliance approval, so this is for example new Solid Waste operation, this is for a township small community official plant so this is the grow plant, this is the harmonizer greenhouse-gas reporting requirements, so this is maybe a provincial regulation being proposed. This is a mining company that wants to do some exploration in the North. This is all of the provincial level. So, any new provincial regulation, policy regulation, other instruments, etc.

Because this process is very engaging to stakeholders and anyone can go, and anyone can comment. So this is the low impact development stormwater management guide and menu, that is the one that I mentioned before, this was proposed in June 2017, and is going through a consultation process and is being revised base and that but is almost three years and it is still being discussed. Anyways it is transparent and involves everyone basically.

Indicator 4.2: Protection of core values

Again, due to this process I would give a +. Because each of these documents resides for a short period of time, a month or two months.

"Stakeholders are actively involved and expected to commit themselves to early outcomes in the process. Hence relevant stakeholders may be missing in contractual arrangements as they do not want to commit themselves to decisions to which they have not yet contributed."

Indicator 4.3: Progress and variety of options

Yeah +. Their active involvement but the deadlines are unclear because you know you can go through these consultation processes and then nothing happens in months and months. Decisions are taken too early in the process? But not because what is sad here, here says "Due to inexperience with active stakeholder engagement, decisions are taken too early in the process leading to the exclusion of argument and solutions" It's the other way around, the process is long and all the stakeholders inputs are addressed but it's maybe just a comment but it doesn't really change the directions. I mean some comments are unreasonable too, if It's open to the general public, People would comment (laugh) you



can imagine right? Decisions might be not fully supported, yeah this is +. And of course, it's really hard to reach a consensus in environmental issues.

Indicator 5.1: Ambitious and realistic management

This is kind of in the flux.

Flooding is really not an issue here; you may get it that so far. (About the flooding in the island) but that is Mother Nature. Lake Ontario is regulated but the outflows, because of the size of the lake, and the Saint Lawrence River is small, the flow is relatively small. I teach hydrology and yesterday I was talking to my students. You're trying to enter a bathtub with a pipette, it takes a long time, that is the situation. (water levels) It's been changing, we had extreme high levels, going back 30, 40, 50 years, But now they're occurring more frequently because climate is changing particularly winter climate is changing, if you look there's not much snow in the ground. Two or three weeks ago we had big rainfall events that didn't used to happen in the winter. You would basically get the snow and stay cold the whole winter. You may have like one melt or 2 but now you have multiple melts. That is changing the water levels. Maybe this is going to be an issue for the future but it's of limited impact because you have the waterfront properties and there are set back so there's not really a high risk of catastrophic flooding that used to be back in the days Is more the erosion of the shoreline with regards to river pluvial flooding. We had Hurricane Hazel that occurred in the 50s that basically led to Mapping out the floodplains and prohibiting the development in the floodplains and that's why we don't have big impacts In contrast to other communities in Canada where they are still building in the floodplains.

If you look at all of the rivers that are around, they're all in these big ravines, so there is no development there. (there are some developments in the Don river allowed) But there is flood proof, and it's not residential and it's for commercial and institutional use. You can apply you can still apply to build in a floodplain but it has to be flood-proof, so basically you can build an elevated house where the walls break a wing...So you're not affecting the channel but it's very difficult to get those approvals and to build such houses is very uneconomical. So, it's complex and you can have those basements but anyways it doesn't happen generally.

There is long-term vision call Mom if you look for an example, there is this Toronto wet weather flow master plan, so this would be an example of a long-term ambitious goal, that was developed in 2002 to 2003 It's a long-term strategy to dealing with wet weather, but this is primarily with regards to you know sewer cost flooding's and CSO. So, this identifies the long-term strategy that is being followed today. I worked on it when I was in Consulting. Yeah this was first developed in 2003 and this one is the last update 2017, it has a long decision history. It outlines the expenditures. And now there are a lot of tunnel projects dealing with CSO.

So, I'd say A plus. Again, the implementation is slower than the ambition.

Indicator 5.2: Discourse embedding

Is something between 0 and + there are elements of both, but there are elements of - as well. Yeah, the reluctance to execute current policies. Example is the Harbourfront water quality, where local population and NGOs have been fighting hard the city to implement some sort of monitoring system, alerting system to recreational water uses in the harbour, this has been going on for decades. They are doing some samples, they go there and sample the water, analyse it and find extremely high levels of e-coli (because of the rainfall events).

Indicator 5.3: Management cohesion

+. Their efforts to harmonize across different sectors. This is again with that multi-level governance.

Sometime this is confusing, like practical confusion regarding jurisdiction, so one example is the fact that National streams that used to exist have largely been converted to pipes, sewers. But there are instances where you have a stream that is then converted to sewer and then is daylighted again, so it

continues as a stream. So, the city is in charge of sewers and the conservation Authority looks after the streams, so who looks after this? (laugh) Is a stream that is converted to a sewer and then again, a stream. Municipality maintains the sewer. So, for example erosion of the national parks is in the domain of the conservation Authority, they look after you know they have the erosion control, plans and mitigation and so on. But the jurisdiction overlaps because this is not a stream and not a sewer, not of each.

As I said, Just a hold there's do get together in fact I've been in this field for decades and it's actually not a very big community, there are key stakeholders from the conservation authority, from the ministry, and we see each other in all the conference all the workshops, meetings, so there is a constant dialogue.

Indicator 6.1: Entrepreneurial

There's a little bit of this distrust. I think it's a struggle, so minus. Is very key specific. I think it has to do with the fact that the whole process, kind of planning, design, And construction and operation of water infrastructure, and here, I mean I think in the Netherlands there is more like in-house capacity to do design, maintenance, but here in the municipality is basically a contract everything else to consultants, so when they need to do any sort of a project, or even planning, the wet weather Master Plan was executed by a consulting company. Now, consulting companies are in the business of making money, and they are always looking for more business, right? There are interests but the actors in the municipality are not always willing to engage in an open way with Consultancy, because if you do in that way with one company you disadvantaging another one, If you are giving information to one company that the other doesn't have, so as a result they are very kind of close. So, if you come in as an entrepreneur, if you propose something new, in addition they've always been kind of harassed by new products, new services. So, for entrepreneurs to propose new ways is always very difficult. As a result of this whole culture the water industry is notoriously cautious. And there are natural reasons and practical reasons for that. There are some bright spots, so for example the Enwave cooling system that is a success story, there was a clear engagement between the Private Industry and the Municipal Water. (there was a real necessity for that?) Necessity? (laugh) I guess there was because the energy grid was suffering its capacity because of all the air conditioners. So that is a success story. So actually one of the key players in that success story is now trying to form a new company to recover energy from sewers and he's finding a very receptive audience in Toronto water, which kind of surprised me, but at the same time there are personal relationships that are also, which also surprised me. So, this city has been receptive, but this is one of the exceptions. One of the obstacles that entrepreneurs find, whenever you talk to someone in Toronto, even in Ontario, if you come with a proven solution that you have demonstrated elsewhere, they are not comfortable with adopting until it is proven locally, which doesn't make any sense to me. Because if you proved it in another cold country with similar climate, if it works there so why it wouldn't work here. So, they engage us to do pilot projects to demonstrate that to local people that it works. It doesn't always work you know because entrepreneurs make outlandish claims all the time, so you know they have a point there, but I think we are too cautious with adopting even simple things. There are technologies that seem to have been demonstrated to work elsewhere successfully that we never adopted here, so you know for small entrepreneurs that is particularly a challenge because you know the resources are very tight so you can't be lobbying and spending resources that you just don't have. And Toronto has this reputation of not being really adoptive of new technologies.

Indicator 6.2: Collaborative

+. There are new initiatives, a new collaboration particularly with the industrial sector. I will give you an example. There is an initiative called partners and project green, where they are engaging the business community on the energy, waste and water issues, there has been some success. I think they are a kind of house in the Toronto region conservation Authority.

**Indicator 6.3: Visionary**

The word integrated needs interpretation here. So, what is here integrated thinking, it is across institutions? Across sectors across governance levels? (About IWRM) So we are not there.

Yeah, a 0. We are very compartmentalized, thinking about water, urban water cycle. Defence of status quo.

“The visions of the existing agents of change are limited to promoting the business as usual. They do not oppose nor promote long-term, integrative thinking. Interest or employment in trend analysis is limited”.

Indicator 7.1: Room to manoeuvre

Yeah plus, there is a high degree. Research is a kind of side activity. No, I shouldn't be so harsh. There is research particularly with regard to the Conservation Authority, they engage with colleges and universities and have a lot of collaborative projects and they share resources. The city of Toronto on the other hand is less keen on Research. But it's kind of changing, this culture of engagement and then sharing resources and so on, I find it is much more threatened by the bind of the operation management, when you talk to the operators and they are very keen to do something. But they don't have the support of the management, nothing happens. So, if you have someone driving for action, like a champion, then things do happen. Staffing at that level is changing in the city of Toronto, there have been some retirements so there is hope for the future. I'm not even talking about politicians. I'm just talking about the management of the water department in Toronto water, obviously they are governed by the politicians. And politics in Toronto are very disjointed. The city council has a lot of narrow-mindedness. They are just looking after their interests, Not actually thinking in the big picture, so this is leading to inefficiencies in planning. So, I don't see any good things from the side of politicians. Oh, there is less corruption compared to other parts of the world, so that's a positive, the city hall when it's come to Lobby, there is a registry if you want to become a lobbyist. There are over 1600 registered lobbyists just in the City Hall. How much influence do they have in the decisions I don't know, But I think there are some. But it is really structured. We had a couple of scandals way back about how the contracts were arranged, so the city has become very sensitive to any implication of corruption and there's more awareness about that.

Indicator 7.2: Clear division of responsibilities

The Conservation Authority and the city are working quite close together.

I think +.

“Actors recognize that knowledge and experience are scattered within the local network. Therefore, extra effort is made to bundle the scattered expertise and to reach fit-for-purpose division of clear roles and responsibilities”.

Indicator 7.3: Authority

I think there is fragmentation, unfruitful attempts, so is a - . Maybe I'm too harsh. In the wordy if this is very specific.

“The water challenge is put forward by individuals or a group of actors, but there is only little interest which is also fragile due to poor embedding of sustainability principles in current policy mechanisms, interests, and budget allocation. The challenge may have been mentioned in reviews or reports but left unaddressed”.

Indicator 8.1: Affordability

We don't have really much marginalized communities when it comes to water. It's still cheap and the services are provided pretty uniformly across the served population without any real differences. But this also talks about climate adaptation and again when it comes to water it's not the issue of marginalized communities being in higher risk. So generally, water is universally available, I'm talking about the city of Toronto, not Canada, it is not overly expensive, provision is pretty uniform regardless of population's characteristics. If there is a basement flood, it could be a multimillion-dollar property or it could be for a house, so there is no difference. The difference is from when you happen to leave in the system, I think it's affordable too all. I'd say ++.

Indicator 8.2: Consumer willingness to pay

+. You know in the municipal government there are budgets for different things, police, schools, Toronto water it's kind of a self-sufficient Department in the city, so they entirely finance all their operation and capital expenditures through fees. Yeah without Prophets. So that is the first item of the budgets that gets approved every year. And it's recognized that they're doing kind of diligence on planning and identified a huge shortfall in funding several years ago, and as a result they implemented a, I think a 9% annual increase in water charges. That was approved, because it was demonstrated that this money is needed, that was the only way to finance it. (It is 3-4% increase every year?) Yeah now is less but is still above inflation. But it got passed. With regards to polluter pays principle, so you know the way that Toronto Water is financing is entirely through billing for water, with drinking water. So, they are going to say you know you are going to pay \$3.50 per cubic meter and then wastewater treatment takes like \$4.10. So, there are two arguments, so one is that in the summer a lot of people use a lot of water for irrigation, that water is never returned to the sewer, so why do I have a sewer charge? That is why residents have been complaining about it. And secondly it completely disregards the stormwater, which is quite often in North America being recognized as the orphan child when it comes to funding. Stormwater generation is not related to water use at all. An example of you take an apartment building for example 400 residents paying their water bills, but stormwater they generate, if you divide the footprint is tiny, yet the more the money they are paying goes to stormwater. On the other hand, you could have I don't know a shopping centre with big parking and there are maybe just 2 washrooms, and that is all the water they use, but the stormwater contribution is enormous. So, you have high density residences subsidising impervious properties. There was an effort to introduce stormwater fees, but it failed the first time they tried, but it comes again. And that's the polluter-pays principle you know, The stormwater fee was based on a lot size not impervious area, You have a big lot that is all grass area you will be paying a lot for stormwater but you are not discharging that, and you next neighbour may have a big parking lots. So, they didn't do it right the first time. The program was supposed to be revenue neutral, so TW would remain the same, it just they shifted more of the SW charges onto these large property owners, and these guys have lobbyists. They vote. And for some is a huge amount of money.

Indicator 8.3: Financial continuation

Yeah ++. Actually, I don't know. The + is too negative though. Yes ++.

“There is secured continuous financial support for long-term policy, measures and research regarding the water challenge. These costs are included into baseline funding. Generally, both economic and non-economic benefits are considered and explicitly mentioned”.

Indicator 9.1: Policy instruments

The wording is (laugh). Mhh 0.

“Policy fields or sectors often have similar goals, but instruments are not coherent and may even contradict. Overall instrumental effectiveness is low and temporary. There is sufficient monitoring and

evaluation leading to knowledge and insights in how instruments work and actors are getting a more open attitude towards improvements”.

Indicator 9.2: Statutory compliance

This is also a 0. There are some good examples and some bad examples so overall is 0.

“Legal regulations regarding the water challenge are fragmented. However, there is strictly compliance to well-defined fragmentized policies, regulations and agreements. Flexibility, innovations and realization of ambitious goals are limited. Activity may be penalized multiple times by different regulations due to poor overall coordination”

Indicator 9.3: Preparedness

Fragmented preparedness, +.

“A wide range of threats is considered in action plans and policies. Sometimes over-abundantly as plans are proactive and follow the precautionary principle. Awareness of risks is high, but measures are scattered and non-cohesive. They may be independent or made independently by various actors. Allocation of resources, staff and training may therefore be ambiguous”

Transcript of interview**respondent TA-3****interview date 14 February 2020****interviewer Sebastian Rivadeneira****transcript by Sebastian Rivadeneira**

The questions related to each indicator are those that appear in the GCF questionnaire. Some information has been removed to prevent identification of the respondent. Information indicated with quotation marks (“”) and italics represents the standardized answer given by the GCF (This is included when the respondent provided just the score by agreeing with the standardized answer). Particularly, this interviewee provided answers mainly for the the general assessment of the governance capacity and the IWRM at the city level.

Scores:++ : *plus plus*+ : *plus*0 : *zero*- : *minus*-- : *minus minus***Indicator 1.1: Community knowledge**

I think it is fragmented knowledge. So, - .

“Only a small part of the community recognizes the risks related to the water challenges. The most relevant stakeholders have limited understanding of the water challenge. As a result, the issue is hardly or not addressed at the local governmental level”.

Indicator 1.2: Local sense of urgency

Raising of awareness by small groups. So, again - .

“A marginalized group (e.g. the most vulnerable, environmentalists, NGOs) express their concerns, but these are not widely recognized by the general public. Adaptation measures are not an item on the political agenda during elections”.

Indicator 1.3: Behavioral internalization

Unawareness. So, --.

“There is unawareness of the water challenge with hardly any understanding of causes and effects or how current practices impact the water challenge, the city or future generations”.

Indicator 2.1: Information availability

I would say 0.

“Information on the water challenge is available. Knowledge on understanding or tackling the water challenge is progressing and is produced in a structural way. Knowledge gaps are hardly identified due to lock-in into existing disciplines and policy. This is apparent from the quantity of factual information, but the causes, risks and impacts of long-term processes are lacking behind”.

Indicator 2.2: Information transparency

I find this one difficult to answer because I don't know who is sharing what information. I don't have a full understanding of who all the interested stakeholders are and what kind of struggles they are having. Are they struggling with accessing information? So, I find this issue around transparency difficult because mainly I don't know who the stakeholders are, Because I think there are differences depending on whether you're talking about wastewater treatment or whether you are speaking about a sliding situation. I think the stakeholders first and the information is different. For example, a situation of emergency, while in wastewater, does everyone here in Toronto realize that we have combined sewer overflow?

So, I can't comment on that.

I support transparency, however. I can't. The statements make some assumptions that make it difficult to answer this one.

Indicator 2.3: Knowledge cohesion

0, Insufficient cohesion.

“Data collection within sectors is consistent and is sustained in multiple projects for about two to three election periods. Knowledge on the water challenge, however, is still fragmented. This becomes clear from different foci of the stakeholders as stated in their organisation's strategies and goal setting”.

Indicator 3.1: Smart monitoring

Again, I'm critical about it. I get the idea of continuous learning, but to what extent...?

Well, we have a lot of databases but neither of these databases are interconnected in any way. So, we have monitoring, and monitoring is going on, but is irregular, it occurs. I will say somewhere between - and - . I mean they're monitoring systems, but they are not integrated and if they are not integrated you will have very limited learning and the social learning is limited to those who are the experts on the monitoring. It's not social learning within a community and is very narrowly defined. However, maybe narrowly defined to allow management, that being government and policy makers, to be able to manage the objective of the project itself. So, create a water plant, for instance on the clean water act, that very much there is only certain parameters that they look at because what is defined in the legislation, that's it. So, you are not having a broad view, you just learn what you are required to learn about, the data that collects, but that's it.

The data that is reliable but it's fragmented, it's just basically a bunch of people doing different monitoring.

Indicator 3.2: Evaluation

Insufficient. So, --.

“There is no evaluation of technical or policy measures regarding the water challenge. Otherwise it is not documented”.

Indicator 3.3: Cross-stakeholder learning

Plus, I would say in water governance in the province. Because it's based on a participatory governance model. I mean there is learning but it doesn't mean that anything is done with that. And is limited participation.

“Stakeholder interaction is considered valuable and useful for improving policy and implementation. Various initiatives for cross-stakeholder learning have been deployed, yet the translation into practice

appears difficult. The programs may not be structural, and the learning experience may not be registered and shared”.

Indicator 4.1: Stakeholder inclusiveness

0. Because under the water governance in the province, under the clean water, is already prescribed what issues, what are...to water... is already prescribed.

So, in the engagement process itself, Regulations they say exactly who to engage with, who can come to the table, they don't have to come to the table, but they say exactly who can participate.

“Stakeholders are mostly consulted or informed. Decisions are largely made before engaging stakeholders. Frequency and time-period of stakeholder engagement is limited. Engagements are mainly ad hoc consultations where stakeholders have low influence on the end-result”

Indicator 4.2: Protection of core values

So, speaking at the provincial level there are the provincial objectives that need to be reached, So from the Clean Water Act it explicitly says protecting current and future sources of drinking water, so it's source water protection.

- A particular case study that I look at Lake Erie, source water protection committee, where local citizens were concerned with aggregate extractions and the impacts of gravels, the extraction of gravel from, the impact of that activity would have on the drinking water source, and they don't have any influence on the process, at the decision making process. It was the community members. The aggregate industry, the gravel, had a great influence, so it depends on who has the power, who owns the power relations.

Indicator 4.3: Progress and variety of options

So again, is the wording here, as much as I would there is active engagement of stakeholders, I would say no, even though I would say ++ on this active engagement, who are the relevant stakeholders are not always identified. You look at the Lake Erie The Source water protection committee, those citizens concerned around aggregate extractions which was a major issue in the city, they made their presentation but they were not part of the engagement with the process however the committee itself was rigid. There is active engagement but is rigid. There is limited influence.

Indicator 5.1: Ambitious and realistic management

Short term goals. So, -

“Actions and goals mention sustainability objectives. Actions and goals are “quick fixes” mainly, not adhering to a long-term vision or sustainable solutions. Uncertainties and risks are largely unknown”.

Indicator 5.2: Discourse embedding

I personally think that policy mismatched because if you are doing a water plan, I think It's really much risk management oriented approach to water governance based on 19 prescribed risk that are human activity oriented but doesn't take into account things like climate change, doesn't take into account water scarcity, doesn't take into account First Nations issues, doesn't take into account political context of water itself. Water is political. Our water governance planning in this province was a response to the Walkerton incident, when seven people died as a result of E coli caused, the Walkerton commission enquiry which then developed in legislation. So, it was responsive to an incident and then drafted based on that, but it was not future thinking, it wasn't thinking of the challenges that we face of water. The city of Guelph can suffer drought conditions, has contamination. Even though is localized, it wasn't localized. So, water governance is always a response to an event.

Indicator 5.3: Management cohesion

Well, first of all it depends on the challenge that you're talking about. If your challenge is climate change, everything is done on a watershed basis, and these people are local in water, we need to understand what happens on the local level, you need to understand the influence in a wider area. And in addition to that, when it comes to administrative boundaries of watersheds, the federal government, because they have jurisdiction over first nations stay away from the table, and therefore, you have FN communities like it's fragmented, none is responding, because everyone says that is federal jurisdiction, not us in the province. So, in that way is fragmentation across government levels.

So, I would say 0.

Indicator 6.1: Entrepreneurial

I have no comment on this (Out of my expertise). Each issue is different.

Indicator 6.2: Collaborative

Well the whole idea of water governance in Ontario, and across multiple provinces, is now participatory governance, It's supposed to be based on collaboration, and the legislation explicitly says that Business government and other sectors come to the table right so it is based on this idea of collaboration... but for sharing knowledge.

Minus, insufficient opportunity...there are insufficient opportunities for Agent of Change to go beyond the conventional collaboration, plus the collaboration is established by the parameters of the legislation. So, it's very restrictive about what you can do and what you can't. And also, collaboration is very discouraging if you think about Opportunities to share and build trust.

So, you're in between - and --, insufficient, so lack of collaborative agents.

Indicator 6.3: Visionary

0. Defence of status quo.

"The visions of the existing agents of change are limited to promoting the business as usual. They do not oppose nor promote long-term, integrative thinking. Interest or employment in trend analysis is limited".

Indicator 7.1: Room to manoeuvre

Limited autonomy, -.

"Only a few actors receive some degree of freedom, there are limited opportunities to develop alternatives, and there is hardly any opportunity to form partnerships with unconventional actors".

Indicator 7.2: Clear division of responsibilities

0. Inflexible division of responsibilities.

"Responsibilities are divided over a limited set of conventional actors. Opportunities for new cooperation and more effective division of responsibilities are not seized or even recognized. Sometimes conventional actors get more tasks to deal with new water challenges".

Indicator 7.3: Authority

Unfruitful attempts. - again.

“The water challenge is put forward by individuals or a group of actors, but there is only little interest which is also fragile due to poor embedding of sustainability principles in current policy mechanisms, interests, and budget allocation. The challenge may have been mentioned in reviews or reports but left unaddressed”.

Indicator 8.1: Affordability

I can't comment. I don't know about the financial aspects.

Indicator 8.2: Consumer willingness to pay

I don't know again.

Indicator 8.3: Financial continuation

I don't know. I don't know how this administration addresses the financial aspects.

Indicator 9.1: Policy instruments

Unknown impacts of policy instruments, because I can't say that Instruments implement principles such as full cost-recovery and polluter-pays principle, no, definitely no.

Yeah, I would say unknown impacts.

We created a water plan, but we don't really know who is doing the monitoring. Each region, each watershed created its water plans and I don't know what is tested again, not the area that I study in my doctor work, so.

Indicator 9.2: Statutory compliance

I would guess that we are in the moderate to poor. Yeah, I don't know. I need data to make a decision about this one.

Minus.

“The division of responsibilities of executive and controlling tasks is unclear. Legislation is incomplete meaning that certain gaps can be misused. There is little trust in local authorities due to inconsistent enforcement typically signalled by unions or NGO's”.

Indicator 9.3: Preparedness

At the provincial level I would say limited preparedness, I don't know the city.

“Action plans are responsive to recent calamities and ad hoc. Actual probabilities and impacts of risks are not well understood and incorporated into actions or policies. Reports can be found on how the water sector deals with recent calamities”

All my answers are in the context of the province.



APPENDIX IV

Interviews Coding for the FUNqyWATER project

12 June 2020

SEBASTIAN RIVADENEIRA
MASTER'S THESIS



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Note:

This appendix presents the results of the analysis using ATLAS.ti software as part of the FUNqyWATER assessment. Specifically, the quotation tables from the interviews transcripts are shown, for current water uses, future demands and the underlying drivers of change.

Interview coding for FW-1

FUNqyWATER code name: respondent S10 (SP1)

interview date 4 October 2019

interviewer Suzanne van der Meulen (SP2)

transcript by Uitgetypt and Suzanne van der Meulen

Information that has been removed to prevent identification of the respondent is indicated with [...].

Table 1: Current Use FW-1

ID	Quotation Content	Codes
8:116	Our drinking water comes from Lake Ontario.	CU1-Water extraction for drinking water production
8:117	the Enwave deep water-cooling system	CU1-Thermal energy extraction
8:118	Just recreational	CU3-Primary contact recreation CU3-Recreational boating CU3-Recreational fishing CU3-Secondary contact recreation

Table 2: Future Demand FW-1

ID	Quotation Content	Codes
8:1	<p>SP2: The first section consists of provisioning use functions. This relates to products that we can retrieve, goods that we can retrieve from the surface water system. The first category is nutrition. I think a very obvious one is we can consume fish from the rivers, lakes and ponds. I found some information about that: there's sports fishing occurring in Lake Ontario but also in the rivers and in fish ponds and there are people who consume this fish so they take it home for consumption. Do you think demand for fishing for consumption will change towards 2040?</p> <p>SP1: The first thing to say here is that this section is low in Toronto. I don't think there's really much commercial fishing in Lake Ontario. There's a little bit maybe. It's not known for that on our side anyway, on the Canadian side around Toronto. The same even with personal fishing; people do fish in the Rouge and the Humber especially, and probably in some other areas, and those are the healthier, two big watershed systems. TRCA will be able to tell you more specifically but this idea of commercialisation of some of the products available in water systems, I'd say that's low in Toronto now, except for drinking water. The reason is because there's always been a perception the water wasn't clean enough maybe to be doing that and not because it didn't have a good fishery. We actually do have salmon runs in some of the water courses and I can imagine there's a whole myriad of fish out front but it's a perception that maybe it's polluted. Also, it's so urbanised. There's a lot of recreational stuff happening on Lake Ontario immediately in front of the city of Toronto so that's not where you'd tend to see commercial fishing happening. It probably would be way out further, so it might be happening out there but it's not something that would be close to the city beaches. In terms of how that changes, it could only improve, except that the water courses may degrade over time with climate change.</p> <p>SP2: And do you expect that the demand for this, there are people who increasingly want to fish commercially?</p> <p>SP1: I have no idea.</p> <p>SP2: If you think about sport fishermen, taking the fish for consumption?</p> <p>SP1: It's not a big thing here. It's a very low, low thing here in terms of interest to some people. Even the salmon runs, there's not many people know about that we have salmon runs here. You'd have to talk to commercial fishing organisations to find out what their perception is. As a planner, my perception is it's very low in terms of how much of that goes on.</p> <p>SP2: You say: For commercial fisheries, I don't have information how that will change. Do you have any information how this will change with respect to sports fishing and consumption?</p> <p>SP1: No, that's something I'm not involved with at all.</p>	U1-Fishing for consumption purposes
8:2	No, that's something I'm not involved with at all.	No information



ID	Quotation Content	Codes
8:3	<p>SP2: Do you know if there's catch of other water-related animals for consumption? SP1: Like what? SP2: Maybe birds, crab? SP1: What was the first one? SP2: Water birds. SP1: For consumption, no. We have protected habitat areas for cormorants and things like that and we have a lot of naturalist groups that are very interested in the migratory birds we get, so protection but not for consumption. There are small migratory birds anyway. SP2: Do you think that will change? SP1: There's nothing to eat, it's not the kind of species we have. SP2: So you think it will not change? SP1: Right. SP2: How certain are you this will not change? SP1: Well, there isn't anything you'd consume. What would you consume? None of the species we have. SP2: With every question, I would like to know how certain you are of the increase in demand or the decrease, or you think it will not change. I'd like to use four categories: are you very certain; somewhat certain; somewhat uncertain or very uncertain. SP1: I'm certain. SP2: Are you somewhat certain or very certain? SP1: We have no consumption of bird species. If you're talking about fishing then I don't know. This isn't really my area. So, I'm pretty certain.</p>	U1-Catch of other aquatic animals for consumption
8:4	<p>SP2: So you think it will not change? SP1: Right.</p>	T-No change
8:5	<p>I didn't find any examples of that but do you know if there is a harvest of aquatic plants or algae for consumption? SP1: Not that I know of, not for consumption. SP2: Do you think the demand for this will change in the future? SP1: No. Well, I don't know. As I say, the commercialisation idea is not something that's prominent here at all in Toronto for water species, in general.</p>	U1-Harvest of aquatic plants or algae for consumption
8:6	<p>No. Well, I don't know.</p>	No information
8:7	<p>You already mentioned surface water is being extracted for drinking water production from Lake Ontario-, SP1: Yes, but that's the city's water source. SP2: Yes. I think also from Humber River there's some extractions for potable water? SP1: I don't know. SP2: Do you think demand to extract surface water for drinking water production in Toronto will change? SP1: It will change based on the fact our population continues to rise so we continue to grow. SP2: What does this mean for the demand? Will it increase or stay the same, or maybe decrease? SP1: Yes, it's going to increase because Toronto continues to get bigger. SP2: How certain are you this will increase? SP1: I'm very certain.</p>	U1-Water extraction for drinking water production
8:8	<p>I'm very certain.</p>	C-Very certain
8:9	<p>It will change based on the fact our population continues to rise so we continue to grow.</p>	D-Population growth
8:10	<p>Yes, it's going to increase</p>	T-Increase
8:11	<p>There can be water extractions for other uses like agricultural use for irrigation of crops or livestock watering-, SP1: Toronto's a really dense, urban place so we don't have agricultural here. SP2: I found in the Humber there are some extractions, but it's probably outside of the city? SP1: Yes. SP2: It's not happening today in Toronto. Do you think that will change towards 2040? SP1: Well, this is always going to be, like it says, the fourth largest city in North America, so I don't really see us converting our settlement areas to agriculture. SP2: So that will stay the same? SP1: So the agriculture will be in the belts around us, the green belt. SP2: How confident are you that this will stay the same? SP1: I'm confident. SP2: Very confident? SP1: Yes.</p>	U1-Water extraction for irrigation of food crops or livestock watering
8:12	<p>So that will stay the same? SP1: So the agriculture will be in the belts around us, the green belt.</p>	T-No change
8:13	<p>SP1: Well, this is always going to be, like it says, the fourth largest city in North America, so I don't really see us converting our settlement areas to agriculture.</p>	D-Densification



ID	Quotation Content	Codes
8:14	SP1: I'm confident. SP2: Very confident? SP1: Yes.	C-Very certain
8:15	If we think about irrigation of other types of vegetation, so not for agricultural use but irrigation of parks, gardens or golf courses. I found there's quite some extractions of surface water for golf courses in Humber, Don and Rouge. Do you think that that will change towards 2040? The irrigation. SP1: It probably will decrease because we won't be able to-, I mean unless we come up with a sustainable way of doing it we wouldn't be able to irrigate as much because one of Toronto's big weather changes is heat, for example, in summers of periods drought, things like that so we may not be able to irrigate in the same way over time as our water levels decrease. So, for things that are not essential, like we might need to be focusing on the use of water for priorities like drinking water as opposed to irrigation, so it could decrease. SP2: How certain are you this will decrease? SP1: Somewhat certain.	U1-Water extraction for irrigation of other vegetation
8:16	It probably will decrease	T-Decrease
8:17	Somewhat certain.	C-Somewhat certain
8:18	I mean unless we come up with a sustainable way of doing it we wouldn't be able to irrigate as much because one of Toronto's big weather changes is heat, for example, in summers of periods drought, things like that so we may not be able to irrigate in the same way over time as our water levels decrease.	D-Dry periods longer and/or more frequent due to climate change
8:19	No, that's something I'm not too close to	No information
8:20	Is there any industrial use of the water? I didn't find any information about industrial process water being extracted from the surface water system, but maybe you know more about that? SP1: No. I'd ask TRCA and Toronto Water about that. SP2: Yes. Do you have information about the future use, or is that also something to ask TRCA? SP1: No, that's something I'm not too close to. We do have industries that would use processed water and our own treatment plants will be, so Toronto Water will be the best to talk to about that.	U1-Water extraction for industrial processes
8:21	Do you know if the water is used for firefighting? SP1: Yes, it's the same water system for everything from Lake Ontario. SP2: Yes, but is that potable water or is it surface water that's directly used for fighting? SP1: Potable water. SP2: It's potable water. Do you think maybe in the future surface water will be used for firefighting directly, so not as potable water but untreated water? SP1: I don't know.	U1-Water extraction for fire fighting
8:22	I don't know.	No information
8:23	I also found that surface water, for example, in the Don watershed is extracted to fill aesthetic ponds and fishponds, also in Humber and Rouge there are some examples. I must say these figures are 10 years old so I don't know if they're still valid. Do you have any idea if this demand will change? SP1: The way that works is just when you create, you dig a pond, the groundwater is providing a source of water in it so if you dig a pond near the water table then it becomes filled so it's indirectly surface water but it's actually groundwater that becomes surface water. The negative side of that is that you can be impairing the groundwater table by whatever the quality of the water in the surface pond you've created. Generally, I think the conservation authority frowns upon the creation of those kinds of surface ponds for that reason. I don't know in the city that they're very prominent because, again, it's extremely urban. Outside of the city, conservation authorities don't like them very much. SP2: But do you think the extractions of surface water to fill the ponds, so not by filling them with groundwater but by filling them by pumping up water from a river or lake and pump it to the ponds, will change? SP1: I think what's going to increase is the use of green infrastructure to manage flood waters within the city, so that means creating storm water management ponds that have to deal with extreme and heavy rainfall. That would be the source of water, in that case, as opposed to coming from existing rivers or lakes; it will be integrating them into the city to manage water better during flooding to retain water on the sites or if it's storm water- SP2: So it's for another reason. SP1: - the green infrastructure we hope to increase substantially over time. It's part of our climate change plan. SP2: Do you know about any other extractions of surface water, that water pumped is up for other reasons? SP1: No, not really. SP2: But do you expect this to change in the future? SP1: I think you'd better ask these questions to TRCA and Toronto Water. SP2: Yes, okay. I will. I speak to many different organisations. SP1: It's not really something I'm any closer to, but I don't really know of any other ones.	U1-Water extraction for filling ponds
8:24	It's not really something I'm any closer to, but I don't really know of any other ones.	No information



ID	Quotation Content	Codes
8:25	<p>Do you know if there is any extraction of biomass for non-food purposes? We already discussed biomass is not extracted.</p> <p>SP1: No, there's no extraction.</p> <p>SP2: What do you expect for the future?</p> <p>SP1: Well, extracting biomass do you mean like dredging?</p> <p>SP2: I mean like plants or algae, so living organisms.</p> <p>SP1: We don't want to extract those because that's interfering with the natural system and it would be degrading the system. If you wanted to grow algae for commercialisation purposes, I don't know if somebody will come up with that in the future, they might but generally I don't think it's something we would want to be doing.</p> <p>SP2: Apart from if you would think it's a good idea, do you think there's a growing demand for this in society?</p> <p>SP1: No, we're trying to protect our river and water system to keep algae levels low. Algae means you have a eutrophic water system and that's not healthy. They have looked at extracting algae off Lake Ontario, you can ask Patrick about that, and using it for something, but the fact that the algae is there is an indicator the water isn't healthy-,</p> <p>SP2: Yes, it's a nuisance.</p> <p>SP1: - but they have looked at using it somehow but I'm not sure how.</p> <p>SP2: How certain are you that the demand for this will not change, that it's not happening now and it stays the same?</p> <p>SP1: I'm somewhat certain.</p>	U1-Harvest of biomass for non-food purposes
8:26	<p>SP1: generally I don't think it's something we would want to be doing.</p> <p>SP2: Apart from if you would think it's a good idea, do you think there's a growing demand for this in society?</p> <p>SP1: No,</p>	T-No change
8:27	I'm somewhat certain.	C-Somewhat certain
8:28	<p>Is there any extraction of abiotic materials to use them, like sand or clay?</p> <p>SP1: No, only if we have to dredge the channels for flood control purposes.</p> <p>SP2: But not to retrieve building materials, for example?</p> <p>SP1: No, not in the city. And it's very damaging to habitats; it disturbs the floras of the river systems like that. We have a very strong habitat protection framework here. I think you'll find when you talk to the TRCA, those kinds of things would, again, be frowned upon at provincial levels, municipal levels and conservation authorities.</p> <p>SP2: But is there a clear demand?</p> <p>SP1: You get all sorts of aquatic life in those sediments so you don't want to be digging them out.</p> <p>SP2: Apart from the fact you think it's not a very good idea because it's degrading the ecology, do you think that there's a change in demand of parties who want to do this?</p> <p>SP1: No, because the policy's already strict about it. The federal fisheries act as well. Why would we want the demand to increase? Why are you asking that question?</p> <p>SP2: I'm just wondering if this is happening, the extraction of abiotic materials because in some waters it happens. I'm wondering if there's a demand for this. Sometimes you don't want it but still there's a demand, for example, from society. That's why I try to distinguish these two things.</p> <p>SP1: Yes, I'm just trying to understand where you're going with your research on it. What are you wanting to show? What's your central question?</p> <p>SP2: I want to know what are the demands that society puts on the urban water system.</p> <p>SP1: We have a really strong protectionist, kind of value system here, I'd say, which is good.</p> <p>SP2: You say because it's so protected no-one will think about doing this?</p> <p>SP1: Right.</p> <p>SP2: Well, that's a clear reason. How certain are you there will not be a change in this demand?</p> <p>SP1: I'm pretty certain.</p> <p>SP2: Is that somewhat certain or very certain?</p> <p>SP1: Mhm.</p> <p>SP2: Sorry, is it somewhat or very certain?</p> <p>SP1: Somewhat, yes.</p>	U1-Extraction of abiotic materials
8:29	<p>SP1: I'm pretty certain.</p> <p>SP2: Is that somewhat certain or very certain?</p> <p>SP1: Mhm.</p> <p>SP2: Sorry, is it somewhat or very certain?</p> <p>SP1: Somewhat, yes.</p>	C-Somewhat certain
8:30	No, not in the city	T-No change



ID	Quotation Content	Codes
8:31	<p>You already mentioned the deep lake water cooling system. I didn't know that they also used the water for heating. You said it's for heating and for cooling and it's also combined with producing potable water.</p> <p>SP1: Well, I guess technically it's just cooling, if you want to say that.</p> <p>SP2: It's only cooling.</p> <p>SP1: I don't know if they'll look at how they could use it for heating or not yet.</p> <p>SP2: Yes, it's interesting that it's combined with drinking water. I know it's been assessed in The Netherlands as well but the decision was it's not possible here. But it's a good decision it happens here. It's interesting. I know they're using lake water from Lake Ontario. I didn't find any other examples in Toronto of these kinds of thermal energy extraction. Is that correct?</p> <p>SP1: Yes, I think so.</p> <p>SP2: Do you think the demand for this will change?</p> <p>SP1: The demand is changing definitely to expand the deep lake water cooling system into a larger geography in Toronto because it's a natural resource we have.</p> <p>SP2: What drives this increase indemand?</p> <p>SP1: Yes, it will be increasing.</p> <p>SP2: What drives this increase? What are the reasons, do you think?</p> <p>SP1: Because we're trying to find more carbon energy sources, and that's one of the easy ones we have nearby, a sustainable renewable resource of cold, particularly because the lake at the bottom is very cold.</p> <p>SP2: How certain are you of this increase?</p> <p>SP1: I'm very certain.</p>	U1-Thermal energy extraction
8:32	The demand is changing definitely to expand	T-Increase
8:33	Because we're trying to find more carbon energy sources, and that's one of the easy ones we have nearby, a sustainable renewable resource of cold, particularly because the lake at the bottom is very cold.	D-Sustainability ambitions
8:34	I'm very certain.	C-Very certain
8:35	<p>We see the same in Amsterdam. Is there any energy produced from the water system, for example, by using osmotic processes? For example, in some places they use the salinity gradient?</p> <p>SP1: We wouldn't have any salinity. It's freshwater.</p>	U1-Energy production by using the salinity gradient in water
8:37	<p>the use of kinetic energy, do you think this is taking place now, so using wave energy, tidal energy or hydropower dams and rivers?</p> <p>SP1: Not currently, but you can see what Toronto Water thinks about that. Lake Ontario is relatively calm for a large body of water. To be able to harness kinetic energy would be difficult but we certainly do use that in other parts of the province. We have hydro-electric power and stuff like that.</p> <p>SP2: But not in Toronto?</p> <p>SP1: Mhm.</p> <p>SP2: Do you think demand for this may change in Toronto?</p> <p>SP1: I don't think so.</p> <p>SP2: Why do you think it will not change?</p> <p>SP1: Yeah, I don't think it will.</p> <p>SP2: Is there any specific reason you think it will not change?</p> <p>SP1: Because there's very low kinetic energy there.</p> <p>SP2: So it's just not a good option.</p> <p>SP1: Mhm.</p> <p>SP2: How certain are you?</p> <p>SP1: I'm somewhat certain.</p>	U1-Energy production by using kinetic energy of water
8:38	I don't think so.	T-No change
8:40	I'm somewhat certain.	C-Somewhat certain



ID	Quotation Content	Codes
8:41	<p>Firstly, the surface water system may be used to manage water quality, and it's a little bit a difficult one. I mean, in the water system there are processes going on anyway that may improve water quality like dilution or degradation of pollutants, but what I'm interested in here is: Is the surface water system intentionally, actively being used by people to improve water quality? For example, storm water management ponds that are designed to improve water quality, or by flushing water bodies with water from another water body?</p> <p>SP1: I'm not sure if I'm answering this properly, so our system does heavily rely on dilution, as you said, so a lot of our storm water outfall goes into our rivers and then indirectly into Lake Ontario. So you have that to begin with. I do think there will be an increase in overland storm water management systems like ponds, bio swales that clean up the structure kind of stuff. I think that makes sense for our changing climate. There are things we can do with the kind of landscape we have in the urban context: green streets.</p> <p>SP2: And are they intended to manage water quantity or are they also meant to manage water quality?</p> <p>SP1: Both. A storm water pond is typically designed with the plants included that help to mitigate toxins and pollutants, things like that.</p> <p>SP2: Yes, so this is...</p> <p>SP1: Wetland species, for example, can take up a lot of that kind of nutrient, as well as retain the water.</p> <p>SP2: You say there will be an increase in systems like that. Why is it increasing?</p> <p>SP1: Yes, in terms of what we call green infrastructure.</p> <p>SP2: What's behind this? What is the driver for this increase?</p> <p>SP1: Climate change.</p> <p>SP2: How certain are you of this increase?</p> <p>SP1: I'm somewhat certain.</p> <p>SP2: So that accounts both for managing water quality and water quantity?</p> <p>SP1: Mhm.</p>	<p>U2-Managing water quality U2-Managing water quantity</p>
8:42	<p>Climate change.</p>	<p>D-Rain storms more intense due to climate change</p>
8:43	<p>I'm somewhat certain.</p>	<p>C-Somewhat certain</p>
8:44	<p>You say there will be an increase in systems like that. Why is it increasing?</p> <p>SP1: Yes, in terms of what we call green infrastructure.</p>	<p>T-Increase</p>
8:45	<p>Do you know if the surface water system is being used intentionally to influence climate?</p> <p>SP1: No, I don't think so.</p> <p>SP2: Do you think this will change towards 2040?</p> <p>SP1: Can you give me an example?</p> <p>SP2: I know, for example, some spatial planners in The Netherlands told me they consider expanding the presence of surface water in the urban area to fight urban heat island effects. They want to provide more cool areas.</p> <p>SP1: It's a good point. I think the impact of that tends to be very local. From what we know on urban heat island, I can see experiencing it only near the water course so not much farther away, but that's a good point about another benefit of the green infrastructure idea in terms of urban heat island reduction. So that would be another reason that it probably will increase. But right now, we wouldn't really deal in watercourses that way, but it's true they provide a certain amount of mitigation of the heat island effect.</p> <p>SP2: Might that also lead to an increase in the demand to use the water in this way?</p> <p>SP1: I don't see that as a use of water, personally. I just see it as a function of temperature. It's also as much about the greenery around the watercourse, or even more so than it is about the water itself.</p> <p>SP2: So you don't think the intentional application of surface water bodies will change in the future?</p> <p>SP1: For urban heat island? You could say it might increase somewhat like in the tie-into green infrastructure-,</p> <p>SP2: As part of the green infrastructure.</p> <p>SP1: - which can also be called blue infrastructure. You're right, whether it's green or blue infrastructure. I don't think, to date, it's been thought of with urban heat island focus as much, but that could increase, yes.</p> <p>SP2: How certain are you that this may increase a little?</p> <p>SP1: I'm somewhat certain</p>	<p>U2-Local climate regulation</p>
8:46	<p>You could say it might increase somewhat like in the tie-into green infrastructure-</p>	<p>T-Increase</p>
8:47	<p>I'm somewhat certain.</p>	<p>C-Somewhat certain</p>
8:48	<p>At another level is that surface water may impact the global climate by impacting the emission of greenhouse gas concentrations. Is that something that's in the picture?</p> <p>SP1: No. I think we talk about carbon sequestration from trees and landscapes; they need to increase that</p>	<p>U2-Global climate regulation by reduction of greenhouse gas concentrations</p>



ID	Quotation Content	Codes
8:49	<p>I think with climate change and what we worry about more I see globally is then a decrease in available potable water in terms of quality and quantity due to drought.</p> <p>SP2: So there's not a focus on the role of the surface water system in this respect?</p> <p>SP1: Yes, the first priority is to make sure people have drinking water.</p> <p>SP2: Do you think that it will stay like that towards-,</p> <p>SP1: I think we're going to see decreasing, surface potable water sources globally in all parts of the world, so a greater pressure on cities like Toronto that have an abundance of freshwater at this time, to both serve our population here but being demanded upon elsewhere-,</p> <p>SP2: Yes, so it's why it's a priority.</p> <p>SP1: For example, the US who wants to have our potable water because they're in drought conditions, even as far down as Florida.</p> <p>SP2: So the focus is more on potable water. That's the priority.</p> <p>SP1: Yes, but I think that's a good point about use and demand on use. Demand for our freshwater here or elsewhere, like in the US, for example, will likely increase, the pressures and demands for it - to pipe it there. That's been a controversy that's gone on for a while now.</p>	U1-Water extraction for drinking water production
8:50	<p>The first one is: Primary contact recreation. This means there's full body contact with the water so swimming or diving. I know there are beaches along Lake Ontario with Blue Flag beaches as well. I'm not sure if there's swimming in other water bodies in Toronto?</p> <p>SP1: Let me think. Yes, I think there is swimming in different pockets along certain water courses and things. I'd say it's low use and it's not really publicised as something to do.</p> <p>SP2: Is that in rivers or ponds?</p> <p>SP1: In the rivers. Definitely, in Lake Ontario people swim, for sure. There's lots of beaches along Lake Ontario throughout the main swimmable area.</p> <p>SP2: But outside the beaches?</p> <p>SP1: As I say, some people might swim in parts of the river systems but it's not widely publicised as something to do. I'm not sure there are any public beaches there.</p> <p>SP2: Do you think the demand for swimming or diving will change towards 2040?</p> <p>SP1: Yes, I think it will because of heat increases.</p> <p>SP2: So it's warmer, and then it will increase?</p> <p>SP1: Mhm.</p> <p>SP2: How certain are you of this increase?</p> <p>SP1: Somewhat certain.</p> <p>SP2: Is it mainly because of the heat or are there other reasons?</p> <p>SP1: Good question. I'll just say mainly because I think the temperature is changing in the city, and the extremes that we're getting so people need to have access to different types of cooling, such as swimming. Otherwise, if they can afford it, they have swimming pools or access to swimming pools.</p> <p>SP2: Does this mainly apply to Lake Ontario or also to other locations?</p> <p>SP1: It could be across the board.</p> <p>SP2: What types of water are you thinking about then?</p> <p>SP1: Just the ones we talked about.</p> <p>SP2: Okay, the same places.</p> <p>SP1: Mhm</p>	U3-Primary contact recreation
8:51	Yes, I think it will because of heat increases.	T-Increase
8:53	Somewhat certain.	C-Somewhat certain
8:54	I think the temperature is changing in the city, and the extremes that we're getting so people need to have access to different types of cooling, such as swimming	D-Temperature increase due to climate change



ID	Quotation Content	Codes
8:55	<p>And secondary contact recreation, so things like canoeing, supping, kayaking when there's some contact with the legs and the arms but not more. I found this is popular in Rouge beach, for example. Do you think demand for this will change?</p> <p>SP1: I think it will continue to increase. Eh, let me think. About 10 years ago or so, the city of Toronto got our beaches designated as Blue Flag beaches, that's a system of recognising what the level of water quality is, and then communicating that to the public so they know it's safe to swim in and use. I think that changed Toronto's use of the waterfront quite a bit, so it's very busy now in the summers with all those kinds of things that you said. And with the increase in population that we have, and growth in our city and closer to the waterfront as well, that will increase so people wanting to kayak, swim, all the different recreational things they do. I think that's all good.</p> <p>SP2: This is not only impacting this type of recreation but also swimming.</p> <p>SP1: Yes.</p> <p>SP2: How certain are you this population growth and developments closer to the water will increase this demand?</p> <p>SP1: 100 percent certain. We have all the growth projections.</p> <p>SP2: Does this also apply to boating?</p> <p>SP1: Yes. It is a high boating area and there are a couple of sailing clubs here. People do try to use the rivers for a certain amount of boating, too. It just depends on the time of year and whether the water levels are high enough, so spring and fall especially, but more for light boats. They would not use motorised boats on the river.</p> <p>SP2: So you think this also increases for the same reasons?</p> <p>SP1: Yes.</p> <p>SP2: And you're also certain about that?</p> <p>SP1: Mhm.</p>	<p>U3-Recreational boating</p> <p>U3-Secondary contact recreation</p>
8:56	it will continue to increase	T-Increase
8:57	with the increase in population that we have	D-Population growth
8:58	100 percent certain. We have all the growth projections.	C-Very certain
8:59	<p>Eh, let me think. About 10 years ago or so, the city of Toronto got our beaches designated as Blue Flag beaches, that's a system of recognising what the level of water quality is, and then communicating that to the public so they know it's safe to swim in and use. I think that changed Toronto's use of the waterfront quite a bit, so it's very busy now in the summers with all those kinds of things that you said. And with the increase in population that we have, and growth in our city and closer to the waterfront as well, that will increase so people wanting to kayak, swim, all the different recreational things they do. I think that's all good.</p> <p>SP2: This is not only impacting this type of recreation but also swimming.</p> <p>SP1: Yes.</p> <p>SP2: How certain are you this population growth and developments closer to the water will increase this demand?</p> <p>SP1: 100 percent certain. We have all the growth projections.</p>	<p>U3-Primary contact recreation</p>
8:60	SP1: Mhm	C-Very certain
8:61	<p>What about recreational fishing? You already mentioned it's not very big. Do you think the demand for recreational fishing will change?</p> <p>SP1: It's hard to say. I'm not sure about that one. I'd be interested what other people think. I don't really know. Hopefully we can maintain the level of water quality that we have, so there are some good fisheries here, and if we can improve it then, of course, the demand would increase. But there are just so many pressures on the water courses and the health of the water courses here that it's hard to say.</p> <p>SP2: So you'd say: I don't know about the trend?</p> <p>SP1: Mhm.</p>	<p>U3-Recreational fishing</p>
8:62	<p>So you'd say: I don't know about the trend?</p> <p>SP1: Mhm.</p>	No information



ID	Quotation Content	Codes
8:63	<p>We've already talked about hunting of aquatic animals for consumption. I didn't find any hunting of aquatic animals and I also think it's not allowed, if I understand correctly?</p> <p>SP1: Yes, I think you're right about that but you can see what the TRCA says.</p> <p>SP2: Do you think the demand for this will change?</p> <p>SP1: Not really. In the urban context, people don't tend to-, Hunting isn't part of their first priority. They can just go to the nearest store, haha, plus with the issue of guns and weapons being used in the city.</p> <p>SP2: Could you say anything about the trend?</p> <p>SP1: I'd say if there is any of that now, it would decline.</p> <p>SP2: Why do you think it will even decline then?</p> <p>SP1: Because in cities it's not something people do. Also what are they using for hunting? You don't want people walking around with rifles for hunting animals in the city, really.</p> <p>SP2: That's why I think it's not allowed because I found you're not allowed to have a firearm in the city.</p> <p>SP1: Yes. I mean fishing is different, but you can see what the others say about that.</p> <p>SP2: So you say if there is any there will be a decline. How certain are you of that?</p> <p>SP1: Certain.</p> <p>SP2: Very or somewhat?</p> <p>SP1: Somewhat.</p>	U3-Hunting aquatic animals
8:64	I'd say if there is any of that now, it would decline.	T-Decrease
8:65	SP1: Somewhat.	C-Somewhat certain
8:66	<p>Besides the recreation where people are in contact with the water like swimming and boating, people can also just enjoy the landscape characterised by water; just sitting on the bench looking at the water or bird watching, or cycling or hiking along the water. This is something that's not really documented a lot. Do you know more about that?</p> <p>SP1: Oh yeah. We have a lot of that. That's our biggest use along water courses is that type of activity. All of our ravine systems have hiking trails, etc. along them so the use is high for that. We actually have to come up with increasing management plans around those ravine systems for that reason, because we have a lot of people using them and that damages the systems and brings in invasive species.</p> <p>SP2: Okay, so this is really used. Do you know if this is documented anywhere because I've seen that this is taking place but I cannot find information about how many people are doing this and where?</p> <p>SP1: I don't know, I could ask my colleagues if they know where it would be documented but we do have a ravine strategy here. There might be something about in that document.</p> <p>SP2: Okay, the ravine strategy.</p> <p>SP1: And then our parks people would know. Parks, forestry and recreation people would know more about what the levels of use are. TRCA might know also.</p> <p>SP2: If you think of any sources that I could have a look at, please let me know because it was hard to find.</p> <p>SP1: Okay.</p> <p>SP2: What do you think about the future? Will the demand for this decline, stay the same or increase?</p> <p>SP1: I think it can only increase.</p> <p>SP2: And what would drive this increase?</p> <p>SP1: Pardon me?</p> <p>SP2: What would be the cause of this increase?</p> <p>SP1: Again, it's just the number of people, I think.</p> <p>SP2: Population growth.</p> <p>SP1: Primarily yes, and new settlements and developments.</p> <p>SP2: How certain are you of this increase?</p> <p>SP1: Very certain.</p>	U3-Enjoying a landscape characterized by surface water
8:67	I think it can only increase	T-Increase
8:68	it's just the number of people, I think.	D-Population growth
8:69	Very certain.	C-Very certain



ID	Quotation Content	Codes
8:71	<p>Another recreational use of the water may be ice-skating. I think we both live in countries where this is possible. Is that happening in Toronto on surface water?</p> <p>SP1: It does, but most of our systems you're looking at, with the exception of if there were offline ponds, there's too much movement of water for them to ice over and be safe. We certainly have the temperatures for it. It's not that. Skating in the safe environment tends to happen in ice-rinks created for that purpose, for the public to use, so near the waterfront for example, or anywhere else in the city. There's lots of ice-skating but there are recreational ice-rinks created for that not on the water systems.</p> <p>SP2: Only on ice-rinks and not on ponds, for example?</p> <p>SP1: Well, there might be a little bit of it but not in an average [...] when the city manages it or anything like that.</p> <p>SP2: Or maybe people just go there and go skating?</p> <p>SP1: Yes, but as I say, if you have a river course that's moving through a system all the time then the water isn't settled enough to have a constant ice feature.</p> <p>SP2: So rivers and lakes are not suitable, only lakes and ponds. Do you think this will change in the future, that maybe more people or less people are using ponds to skate?</p> <p>SP1: I don't know.</p> <p>SP2: This movement is an issue in Amsterdam as well. There's a special policy that they reduce the water flow when it's cold and then people are not allowed to use boats anymore on the canals, things like that, because like you say the movement is a problem.</p> <p>SP1: Mhm.</p>	U3-Ice-skating
8:72	I don't know.	No information
8:73	<p>SP2: Is there any religious use of the water for religious ceremonies, for example?</p> <p>SP1: I don't know, but the TRCA will know.</p> <p>SP2: Do you have information about the future demand for this?</p> <p>SP1: No, I don't personally, no.</p> <p>SP2: I didn't find any examples in the documents either so maybe it's not there. I don't know.</p>	U3-Religious use
8:74	<p>SP2: There are also maybe some spiritual or symbolic interactions. I know, for example, that Humber River is designated as a Canadian heritage river so a formal recognition of the importance of the river to the people. I don't know if there are any other examples of that in Toronto, that there's such formal designation of the cultural value of the water system?</p> <p>SP1: I'm not the best person to answer that but TRCA will have a really good handle on it. There will be, definitely, because of the history of the lands and settlements by indigenous people here, so there will some other locations probably that have some formal, spiritual value either to the indigenous community or that's been recognised by something like what you just said, a designation, and there will be lots of informal locations, too. The river system will have spiritual value to all people but to indigenous people as well.</p> <p>SP2: Do you think this will change in the future?</p> <p>SP1: I don't think so. I think it would be constant. I'd say it's already probably high.</p> <p>SP2: And that's why it will not change, it's already high?</p> <p>SP1: Mhm.</p> <p>SP2: How certain are you of that?</p> <p>SP1: Somewhat certain.</p>	U3-Designation of cultural heritage value
8:75	I don't think so. I think it would be constant.	T-No change
8:76	I'd say it's already probably high.	D0-Potential capacity already fully used
8:77	Somewhat certain.	C-Somewhat certain
8:78	No, I don't personally, no.	No information
8:79	I think it will increase.	T-Increase
8:80	also as a sustainable way, or even just another way to transport goods as opposed to by truck or rail, just to have that diversity	D-Sustainability ambitions
8:81	<p>the main reason is to revitalise the old ports that are underutilised, if I understand you correctly?</p> <p>SP1: Yes. Historically, they were utilised more and then through history they became less used, and there's a notion now of kind of bringing them back into the urban service more so</p>	D-Revitalisation of traditional systems
8:82	I'm somewhat certain	C-Somewhat certain
8:83	<p>Are there any buildings on water like floating houses, something like that?</p> <p>SP1: No.</p> <p>SP2: Do you have information about the future demands?</p> <p>SP1: No.</p>	U4-Building on water
8:84	<p>Do you have information about the future demands?</p> <p>SP1: No.</p>	No information

ID	Quotation Content	Codes
8:87	<p>We have lots of ports so we have lots of transporting of goods, and we have ferries. Those would be the main ones.</p> <p>SP2: Yes, I found ferries to Toronto island park and, like you say, transport of goods, maybe bulk materials. Do you think the demand for transport will change over water?</p> <p>SP1: Yes, I think it will increase.</p> <p>SP2: Is that both for goods and for people?</p> <p>SP1: Yes.</p> <p>SP2: Why do you think it will increase?</p> <p>SP1: Just because it's become a little bit under-utilised and it's something that we do talk about in planning wanting to increase it.</p> <p>SP2: Why do you want to increase it?</p> <p>SP1: I think there's an interest in wanting to get all of the old ports that we have along the waterfront being fully utilised again; also as a sustainable way, or even just another way to transport goods as opposed to by truck or rail, just to have that diversity. It's just because we have the water system there. It's the same with moving people - at one time, we had the idea of a ferry across Lake Ontario and then it was kind of cancelled. It's not really a well-used system yet, or a well-developed ferry system. It could be developed further.</p> <p>SP2: So the main reason is to revitalise the old ports that are underutilised, if I understand you correctly?</p> <p>SP1: Yes. Historically, they were utilised more and then through history they became less used, and there's a notion now of kind of bringing them back into the urban service more so.</p> <p>SP2: You say it's also more sustainable.</p> <p>SP1: Then we have a lot of development, too. We have a lot of development on our waterfront right now under revitalisation, so even for direct distribution of whatever it is, construction materials, etc. it could be useful for that.</p> <p>SP2: Is that then mainly related to construction materials and other goods or also to increase the transport of persons by boat?</p> <p>SP1: In general, yes, that too.</p> <p>SP2: How certain are you of this increase?</p> <p>SP1: I'm somewhat certain.</p>	<p>U4-Transporting goods U4-Transporting persons</p>
8:88	<p>There's nothing to eat, it's not the kind of species we have</p>	<p>D0-Local water system not suitable</p>
8:89	<p>So, I'm pretty certain.</p>	<p>C-Somewhat certain</p>
8:90	<p>So, for things that are not essential, like we might need to be focusing on the use of water for priorities like drinking water as opposed to irrigation</p>	<p>Db-Other functions prevail/conflict between users/lack of space</p>
8:91	<p>we're trying to protect our river and water system to keep algae levels low. Algae means you have a eutrophic water system and that's not healthy</p>	<p>D-Water quality improvement</p>
8:92	<p>And it's very damaging to habitats; it disturbs the floras of the river systems like that. We have a very strong habitat protection framework here. I think you'll find when you talk to the TRCA, those kinds of things would, again, be frowned upon at provincial levels, municipal levels and conservation authorities.</p>	<p>D0-Ecological protection ambitions</p>
8:93	<p>From what we know on urban heat island, I can see experiencing it only near the water course so not much farther away, but that's a good point about another benefit of the green infrastructure idea in terms of urban heat island reduction. So that would be another reason that it probably will increase</p>	<p>D-Temperature increase due to climate change</p>
8:94	<p>I think with climate change and what we worry about more I see globally is then a decrease in available potable water in terms of quality and quantity due to drought.</p> <p>SP2: So there's not a focus on the role of the surface water system in this respect?</p> <p>SP1: Yes, the first priority is to make sure people have drinking water.</p> <p>SP2: Do you think that it will stay like that towards-,</p> <p>SP1: I think we're going to see decreasing, surface potable water sources globally in all parts of the world, so a greater pressure on cities like Toronto that have an abundance of freshwater at this time, to both serve our population here but being demanded upon elsewhere-,</p> <p>SP2: Yes, so it's why it's a priority.</p> <p>SP1: For example, the US who wants to have our potable water because they're in drought conditions, even as far down as Florida.</p>	<p>D-Dry periods longer and/or more frequent due to climate change</p>
8:96	<p>We don't want to extract those because that's interfering with the natural system and it would be degrading the system</p>	<p>D0-Ecological protection ambitions</p>
8:97	<p>No</p>	<p>No information</p>



ID	Quotation Content	Codes
8:98	growth in our city and closer to the waterfront as well	D- Redevelopment close to water
8:100	Then we have a lot of development, too. We have a lot of development on our waterfront right now under revitalisation, so even for direct distribution of whatever it is, construction materials, etc. it could be useful for that	D- Redevelopment close to water
8:101	SP1: We wouldn't have any salinity. It's freshwater	C-Very certain
8:102	Because in cities it's not something people do. Also what are they using for hunting? You don't want people walking around with rifles for hunting animals in the city, really.	D0-This is not a habit/lack of knowledge
8:103	We wouldn't have any salinity	T-No change
8:104	We wouldn't have any salinity. It's freshwater	D0-Potential capacity is too small to be relevant
8:106	No, because the policy's already strict about it. The federal fisheries act as well	Db-Regulations don't allow the use
8:107	new settlements and developments.	D- Urbanization/lan d use change
8:108	SP2: For storage underwater, so using the volume? SP1: No, we don't do that, no. SP2: Do you have information about the future? SP1: No.	U4-Under water storage/infrastruc ture
8:109	No, we don't do that, no. SP2: Do you have information about the future? SP1: No.	No information
8:110	Finally, is water used as a physical barrier? SP1: Not that I know of. SP2: Do you have information about the future? SP1: No.	U4-Using water as a barrier
8:111	Not that I know of. SP2: Do you have information about the future? SP1: No.	No information
8:112	Because there's very low kinetic energy there.	D0-Potential capacity is too small to be relevant



Interview coding for FW-2

FUNqyWATER code name: respondent W8 (SP1)

interview date 20 September 2019

interviewer Suzanne van der Meulen (SP2)

transcript by Uitgetypt and Suzanne van der Meulen

Information that has been removed to prevent identification of the respondent is indicated with [...].

Table 3: Current Use FW-2

ID	Quotation Content	Codes
9:147	it's just basically been used to get water out as fast as possible to reduce flooding.	CU2-Managing water quantity
9:149	So, the thinking is to revitalise Toronto's waterfront area so that it becomes a beautiful place to live and people want to go there and walk	CU2-Managing water quality
9:150	a source of recreation	CU3-Primary contact recreation CU3-Recreational boating CU3-Recreational fishing CU3-Secondary contact recreation
9:151	they've been taking water out of the lake and then running it through the building to cool the building down	CU1-Thermal energy extraction

Table 4: Future Demand FW-2

ID	Quotation Content	Codes
9:1	<p>If we start with the first section of the list, those are all use functions that are related to products that we can get out of the water system, things like nutrition, water extractions, and other materials that can be extracted from the system, or energy. If we start with nutrition, one option is to consume fish from the water system. I know there is sport fishing going on in Toronto's rivers, ponds and Lake Ontario; also this fish is being consumed. There are several studies that reveal that the Great Lakes' sport fishermen use the fish for consumption, and there are also commercial and aboriginal fisheries but that's in parts of Lake Ontario pretty far outside the city, if I'm right?</p> <p>SP1: Ja, and that's where it should be. I was just going to say, nearshore is quite polluted, I think. My viewpoint it's pretty clean water out in the lake but when you get nearshore, that's where the bulk of most lakes are being polluted is along the near shoreline.</p> <p>SP2: Ja, I still read in documents that some people do eat the fish.</p> <p>SP1: Yeah.</p> <p>SP2: Do you have any information - and like I said, I interviewe a lot of people and everybody knows some part of the puzzle so if you don't have information just say so, that's okay. But do you have any information, any idea about if the demand for this function, the consumption of fish from Toronto's waters, will change towards 2040? Will the demand for this increase or decrease, or you think it will stay the same?</p> <p>SP1: I have no idea. Hopefully, you have someone from MNRF, the Ministry of Natural Resources and Forestry who are responsible for fisheries and stuff like that. TRCA works with them. Don't forget, you're probably aware we have islands, like the Toronto Islands are just off the bridge...</p> <p>SP2: Ja, I know.</p> <p>SP1: - so there are people who will fish around there. But I don't know the answer to your question.</p>	U1-Fishing for consumption purposes
9:2	I have no idea.	No information



ID	Quotation Content	Codes
9:3	<p>SP2: Do you know if there any other types of aquatic animals that are being caught for consumption? SP1: I've heard some people are eating carp. Some of the Asian community are eating the carp in there. That's it. SP2: Do you know where they catch it? SP1: Well, yeah, I've seen them. They're fishing off the shores of Lake Ontario. SP2: That's something you've observed yourself. SP1: That's right. I would also say there's lake trout in Lake Ontario so many people will go out and recreational fishing, like sports fishing, and come back with lake trout. I've actually had lake trout from Lake Ontario and heat them at barbecues, so quite nice. SP2: Do you know if the harvest of carp is documented somewhere or is it just someone you know because you've seen it? SP1: Just because I've seen it. Again, MNRF, the Ministry of Natural Resources and Forestry, would be the people to liaise with. SP2: They would know? SP1: They would know, and TRCA should be able to direct you who to talk to there. SP2: If you think about the future towards 2040, do you think this catch of carp for consumption the demand for this will change? SP1: It could, just again because I think as we continue to start cleaning things up and we start improving by putting a wetland in at the bottom end of the Don we'll just continue to improve water quality. Over time, the contaminated sediments will get cleaner. That's my biggest concern with a fish like carp because they're bottom feeders. I get concerned when I see people would even consider eating the carp, a) it's an ugly fish, but b) I can't imagine what it tastes like, probably not very good. But it's a bottom feeder and I think that's where the bulk of the pollutants are. My greatest concerns would be a bottom feeder. SP2: But you say the demands may change because water quality is increasing. So what do you expect, do you expect the demand to grow? SP1: I would expect it to grow because the city of Toronto brings in about 60,000 people a year. It continues to grow every single year. So on a per-capita basis, I expect it to either remain the same of modestly increase but on an overall basis I expect it to increase because there's just going to be a lot more people. SP2: So population growth is also a factor. How certain are you of these trends, that it will increase? I will ask you this every time. I have four categories. I would like to know if you are: very uncertain; somewhat uncertain; somewhat certain or very certain. SP1: I would say somewhat uncertain just because I'm using my logic to think it through. I should say somewhat certain because it's a fact that the city gets just 60,000 new people every year in Toronto.</p>	U1-Catch of other aquatic animals for consumption
9:5	So on a per-capita basis, I expect it to either remain the same of modestly increase but on an overall basis I expect it to increase	T-Increase
9:6	because the city of Toronto brings in about 60,000 people a year. It continues to grow every single year. So on a per-capita basis, I expect it to either remain the same of modestly increase but on an overall basis I expect it to increase because there's just going to be a lot more people.	D-Population growth
9:8	as we continue to start cleaning things up and we start improving by putting a wetland in at the bottom end of the Don we'll just continue to improve water quality. Over time, the contaminated sediments will get cleaner	D-Water quality improvement
9:9	<p>SP2: Is there any harvest of aquatic plants or algae for consumption? SP1: I do not know the answer to that. SP2: That's okay. Do you have information about the future trends? SP1: No.</p>	U1-Harvest of aquatic plants or algae for consumption
9:10	<p>Do you have information about the future trends? SP1: No.</p>	No information



ID	Quotation Content	Codes
9:11	<p>SP2: Drinking water is also extracted from Lake Ontario-, SP1: Correct. SP2: - with intake points close to the waterfront. I also found the Humber River is also a source for drinking water. SP1: Oh, okay. I wasn't aware of that one. SP2: Ja, it's a little one. Do you have any information of the trend in demand for drinking water from the surface water in Toronto? SP1: Trends? SP2: Yes, do you think that the demand will change? SP1: That brings in a very interesting question, so it's a complicated answer. Basically, the situation is that we consume a lot of water but the cost of water is very expensive. So we had the Walkerton enquiry which I told you about, which we put in place some of the toughest drinking laws in the world, Safe Drinking Water Act and all of these things. What happened is, compared to Quebec, the province next to us, people there pay nearly 100 bucks a year for their drinking water. We pay a lot, I think, for our drinking water. I think the demand for drinking water is very expensive and that will help conservation, and a lot of people started putting in water efficiency like for the showers special showerheads, things like that, and people will also do their laundry at off-peak hours, those types of things. I think as we start building smarter homes and we start putting in these efficiencies, our per capita consumption, per person consumption, will drop. I definitely believe our consumption will drop. The question will come in is - it's the same thing I said before that you've got 60,000 people a year coming into the city constantly, there's constantly an expansion to Toronto, so overall I expect there to be an increase in water consumption, but that will be offset by improved efficiencies. SP2: How sure are you of this increase? How certain? SP1: I will say somewhat certain, because I haven't seen the studies that we saw with this or that. I just know that it's somewhere between 200 and 400 litres per person is used today. That's the design criteria. I know that some cities like Mississauga, in the greater Toronto area, there have been some cities that have really tried to target that in their development plans to drop that number to 100 or 150 litres per day per person. SP2: So it's the question: To what extent the population growth will lead to higher demand for drinking water but it may be diminished by increasing efforts in being efficient with water. SP1: Absolutely. And I will say the ministry at the provincial level, we are promoting, like we want people also get into the habit of water re-use, so capturing water for the purpose of re-use, so toilet flushing and irrigation systems for gardens, that type of thing, we are encouraging that. Actually included in our Ontario Building Code now, there is something for that, so it's covered in each home to put in a water tank and you can actually do that. So there have been steps in that direction but how many people are doing it, and all of this, I don't know the answers; that you'd need to talk to the ministry of municipal affairs and housing. SP2: Okay, good suggestion. SP1: They may have it on their website that's why I'm saying you may find it under MNRF, the fish questions, and you may find answers to MMAH on their website, too. I'm just pointing that out as a resource for you if you want to know more in terms of numbers. SP2: Very good, nice.</p>	U1-Water extraction for drinking water production
9:12	so overall I expect there to be an increase in water consumption, but that will be offset by improved efficiencies.	T-Increase
9:13	The question will come in is - it's the same thing I said before that you've got 60,000 people a year coming into the city constantly, there's constantly an expansion to Toronto	D-Population growth
9:14	I will say somewhat certain, because I haven't seen the studies that we saw with this or that	C-Somewhat certain
9:15	<p>There can be extractions for other purposes: non-drinking purposes. The first one I want to look at is the irrigation, actually, the agricultural use that may be irrigation or livestock watering. I found a report - the state of the watersheds of the Humber River from 2008 - that was the most recent I could find, and it tells that Humber River water is mainly used for, and is the main source, for agricultural water use; that more than 50 percent of the extracted volume is for agricultural purposes. SP1: Makes sense. SP2: I don't know if you have other information about the use of surface water for agricultural purposes? SP1: No, I don't have any other.</p>	U1-Water extraction for irrigation of food crops or livestock watering
9:16	I'd say somewhat certain. I should say very certain but I'll say somewhat certain. I'm not an expert. I'm not in the planning side. I grew up in the city and I see it happening	C-Somewhat certain
9:17	Agriculture, I personally think, will absolutely reduce	T-Decrease
9:18	I should say somewhat certain because it's a fact that the city gets just 60,000 new people every year in Toronto.	C-Somewhat certain



ID	Quotation Content	Codes
9:19	<p>Well, I can tell you of a golf club. The two lawsuits I mentioned were both golf clubs. The golf clubs actually would extract water from the Humber or from the Rouge and they would pump them out for irrigation purposes on their lands.</p> <p>SP2: I found that too. That's a big one actually, yeah?</p> <p>SP1: Yeah, I think it's pretty big but, again, as the city expands, the golf clubs are going to disappear and the farmlands are going to disappear so the number of extractions will likely reduce.</p> <p>SP2: You think agriculture and golf clubs will be reduced because of the development of the city?</p> <p>SP1: That's right.</p> <p>SP2: What does this mean for the demand for water extractions for golf courses and for agriculture? Do you mean they will decrease as well or are there reasons to expect that will go the other way?</p> <p>SP1: No, that's what I'm saying.</p>	U1-Water extraction for irrigation of other vegetation
9:20	<p>as the urban frontier expands and as urban areas continue to swallow up prime real estate for agriculture, agricultural land is disappearing in the greater Toronto area. I mean, as the urban development continues outward, you'll see less and less need for irrigation for farmlands because they won't exist anymore. The farmers are getting older and their children don't want to farm the land and</p>	D-Urbanization/land use change
9:21	<p>Do you think their demand for surface water for irrigation will change?</p> <p>SP1: I suspect it will as they start developing more and more,</p>	T-Decrease
9:22	<p>let's say, grasses that are hardier and can survive on less water. I just think that development in terms of plants and their ability to live longer with less water and live through harsher winters, and that type of thing, I just think science is just going to continue to improve, so I think there will be a reduction</p>	D-Technological developments
9:23	<p>I'm somewhat certain.</p>	C-Somewhat certain
9:24	<p>What about industrial process water? I cannot find any information about that in the water documents. Do you know more about it?</p> <p>SP1: Where it might exist, and it would be a lot of work on your part, you might find it in the environmental compliance approvals. They're all available, they're accessible to the public, and the only way you could find out is to actually look at an individual, environment compliance approval. They would have it in there. If they were using water, it would state: will require 'X' volume, it would say how many cubic metres they're consuming and using, and what they're doing with it. You'd be able to find that on a site-specific basis in an environmental compliance approval, so if company 'X' is using water for their facility, it will say: they're using this. But that's a lot of work on your part.</p> <p>SP2: So, generally, you don't have information about that?</p> <p>SP1: I don't, but I know it exists. It's just a matter of who wants to go and dig it up.</p> <p>SP2: I see. Do you have any idea of the demand towards 2040? Will this change?</p> <p>SP1: I have no idea.</p>	U1-Water extraction for industrial processes
9:25	<p>So, generally, you don't have information about that?</p> <p>SP1: I don't, but I know it exists. It's just a matter of who wants to go and dig it up.</p> <p>SP2: I see. Do you have any idea of the demand towards 2040? Will this change?</p> <p>SP1: I have no idea</p>	No information
9:26	<p>SP2: Do you know if the surface water is being used for firefighting?</p> <p>SP1: No.</p> <p>SP2: No idea.</p> <p>SP1: No, no! We have fire hydrants for the entire city, so my understanding is you attach-, I used to do water mains approvals so every home has to be within, I think, 90 metres or 90 feet, I can't remember which, but you have to be within a certain distance of a fire hydrant so fire hydrants are placed throughout the entire city. There are municipal drinking water systems for fire.</p> <p>SP2: Ja, municipal drinking water. What can you say about the future demand to use surface water instead of drinking water?</p> <p>SP1: For our fire demand?</p> <p>SP2: Yeah.</p> <p>SP1: It's a great question. I have never thought about it so I don't know the answer. But it's a very interesting question you raise, especially right now because we're looking at foundation drains and approving foundation drains and I'm thinking: That would be a really good use of foundation drains.</p> <p>SP2: Foundation drains, are they drains to manage the water level under buildings? What is it?</p> <p>SP1: Basically, every building has a foundation drain, so all around the foundation of a home or a building you have foundation drains and then the foundation drains are hooked up typically to a storm or sanitary sewer, usually a sanitary sewer, and they discharge to the sanitary sewer. But we are now getting applications for new residential subdivisions where every home's foundation drain is hooked up to what we call a third pipe or a purple pipe, and then that is going somewhere. We're having a large debate over what one should do with that foundation drain.</p> <p>SP2: How you can use that water. I see.</p> <p>SP1: Well, we're discharging it to the environment. They don't want it at the sanitary sewer because they have to treat it, and people are saying, well, what are the water quality objectives we should have in mind for putting it into a surface water body or putting it into the ground or for water re-use? So we are talking about it for maybe toilet flushing or irrigation or whatever. I don't know.</p> <p>SP2: Well, maybe this is a nice suggestion, too?</p> <p>SP1: It's a good idea. I hadn't thought about fire. That's a good point.</p>	U1-Water extraction for fire fighting



ID	Quotation Content	Codes
9:27	I have never thought about it so I don't know the answer.	No information
9:29	Do you have any idea if the demand for this will change towards 2040? SP1: I have no idea. No, no idea.	No information
9:30	<p>SP2: And what about filling ponds? I found that in the Don watershed that surface water is used for filling aesthetic ponds or fish ponds. It's also happening in Humber, I found, and in Rouge River watershed. So there are some examples. Again, it's more than 10 years old this information but, at least, at that time, people were filling ponds with surface water from the rivers.</p> <p>SP1: Oh!</p> <p>SP2: I don't know if you have other information about that.</p> <p>SP1: No, I have no information about that but I find that very interesting.</p> <p>SP2: I found it in the watershed plans. Actually, I found in Don watershed 62 percent of the total extracted volume is used for filling aesthetic ponds and fish ponds.</p> <p>SP1: Wow! That's amazing. That's in the Rouge, right?</p> <p>SP2: No, that's in Don. In Rouge, I don't know how much water is used but I found that surface water is the predominant source for filling aesthetic ponds.</p> <p>SP1: Wow, that's impressive. I was wondering how they're doing it. Are they sticking a little pump in the water and pumping it up to their property? I don't know.</p> <p>SP2: I guess so.</p> <p>SP1: That's impressive. It never would've occurred to me. Okay, that goes right to the cost of the municipal water, right?</p> <p>SP2: Do you have any idea if the demand for this will change towards 2040?</p> <p>SP1: I have no idea. No, no idea. I didn't know this was happening so it's interesting. I've learned something new.</p> <p>SP2: Well, that's nice. Then we're both learning something from this.</p> <p>SP1: So you know more than me so far, so I'm impressed.</p> <p>SP2: Well, I did a lot of work to find this information.</p> <p>SP1: I can tell, and you don't even live here. I'm impressed!</p>	U1-Water extraction for filling ponds
9:31	<p>SP2: I also looked into other extractions for other non-drinking purposes. What I found is there are some extractions labelled as 'other uses' but I don't have more details about what these other uses are, but maybe can you think of other purposes for which people extract surface water?</p> <p>SP1: I know outside of Toronto in Cottage Country, which is north of Toronto, a lot of the cottagers would stick a pump in the lake and water their lawns. They'd actually water their lawns with lake water. In Toronto, would people do that? You know what, it wouldn't surprise me if they were going to the point of extracting water for aesthetic ponds, it wouldn't surprise me if they're watering their gardens or watering their lawns with this water. It wouldn't surprise me at all because there's nutrients in that water, right?</p> <p>SP2: But you think it might happen but do you know if it happens?</p> <p>SP1: No, I don't know.</p> <p>SP2: Do you have an idea of the trends? Do you think the demand for this use will change?</p> <p>SP1: I don't know. The answer is: I don't know.</p>	U1-Water extraction for other non-drinking purposes



ID	Quotation Content	Codes
9:32	<p>SP2: If we move from the water extractions and we look into the extraction of other materials from the surface water system, this might be the extraction of biomass, so you could think of aquatic plants or algae for non-food purposes. Do you know if that is taking place?</p> <p>SP1: If it is being removed, it's being removed because it's impairing something, so whether it's impairing the flow, that would be the only reason I can see that it's being extracted. As far as I'm aware, it's not being extracted for re-use purposes, it's being extracted because it's a nuisance and it's blocking flow of something.</p> <p>SP2: Do you think that towards 2040, you say at this moment it's not being used, it's just being removed because it's a nuisance, but do you think the demand for this type of biomass might change to use it?</p> <p>SP1: Yes, I would say yes. Maybe it could be used in composting.</p> <p>SP2: So you think the demand may increase because now there's no demand, and in the future-,</p> <p>SP1: That's right.</p> <p>SP2: Okay, for compost?</p> <p>SP1: Yes, I do see that. The challenge comes in, as we continue to improve the watercourses and we continue to have efforts to improve the Don River and improve the various rivers in Toronto, as we continue to improve the water quality, we should see a drop in algae blooms. The problem comes in that with climate change we could get warmer weather, and the warmer weather could trigger algae blooms more frequently. So the question really comes down to which way that's going to go? The algae blooms happen because of a mix of nitrogen and phosphorous, so depending on what the nitrogen and the phosphorous and the temperature, those three factors play a big role in terms of algae blooms. So climate change could result in more algae blooms in the future, but I don't know. It's a complicated system so I don't know the answer to that one. I don't know whether we'll see increased algae blooms. If we get increased algae blooms, I can see someone harvesting and then actually re-using it somewhere for something.</p> <p>SP2: Like compost?</p> <p>SP1: Compost, exactly. Or even something else that one hasn't considered yet. I was trying to think where it was, but in Venice, they actually collect the seaweed and they dry it and burn it and create electricity.</p> <p>SP2: So if I understand you correctly, you think the demand may increase and a major driver for this would be climate change that possibly leads to more algae blooms which have to be removed and then maybe someone will think of a way to re-use it. Is that correct?</p> <p>SP1: Exactly. That's correct. I can see an economic model for the re-use to try and offset the cost of removing it.</p> <p>SP2: How certain are you of the increase?</p> <p>SP1: I'd say somewhat certain. There's a lot of phosphorous, a lot of nutrients in the algae bloom so removing them is a good thing.</p>	U1-Harvest of biomass for non-food purposes
9:33	SP1: Yes, I would say yes. Maybe it could be used in composting.	T-Increase
9:34	I'd say somewhat certain.	C-Somewhat certain
9:35	<p>The problem comes in that with climate change we could get warmer weather, and the warmer weather could trigger algae blooms more frequently. So the question really comes down to which way that's going to go? The algae blooms happen because of a mix of nitrogen and phosphorous, so depending on what the nitrogen and the phosphorous and the temperature, those three factors play a big role in terms of algae blooms. So climate change could result in more algae blooms in the future, but I don't know</p>	D-Temperature increase due to climate change
9:38	<p>SP2: And what about the extraction of other abiotic materials. For example, you could think of sand, clay or gravel, or maybe other materials. Is that happening?</p> <p>SP1: I haven't seen that but I was really impressed with one of your countrymen. A company came here and showed us what they're doing with contaminated sediments that they'd been using to build bird estuaries in Holland and in other parts of the world, and they gave us a presentation on how they're taking these sediments and pouring them in cement blocks and creating bird estuaries. I could see that type of thing maybe where the mouth of the Don is going to be cleaned up and all this contaminated soil, I know there was a potential opportunity there for that type of situation: How could we take that contaminated sediment and re-use it as opposed to land-filling it? How could it be re-used? So I could see that as a potential.</p> <p>SP2: Do you mean you think the demand may increase then?</p> <p>SP1: Yes, I think the demand could increase.</p> <p>SP2: And that's due to the fact there will be remediation works in the Don River, and you say there are opportunities to re-use the contaminated sediments?</p> <p>SP1: Absolutely and there's a need to reduce costs for clean-up.</p> <p>SP2: How certain are you of this increase?</p> <p>SP1: I'd say somewhat certain. I'm just being cautious because a part of me says I'm certain, but I want to say somewhat certain because I'm not directly involved in that clean-up project, but I've seen presentations, I've been on the edge of it, but the guys in the city of Toronto, waterfront Toronto folks should be able to tell you better.</p> <p>SP2: That's good to know.</p>	U1-Extraction of abiotic materials
9:39	Yes, I think the demand could increase.	T-Increase
9:40	I'd say somewhat certain. I'm just being cautious because a part of me says I'm certain, but I want to say somewhat certain because I'm not directly involved in that clean-up project, but I've seen presentations, I've been on the edge of it, but the guys in the city of Toronto, waterfront Toronto folks should be able to tell you better.	C-Somewhat certain



ID	Quotation Content	Codes
9:45	<p>If we look at energy, there are different ways to extract energy from the surface water system. The first I'd like to discuss is extraction of thermal energy. You already mentioned there are buildings being cooled with lake water from Lake Ontario. I also found really interesting information about this that this deep lake water system is cooling over 150 buildings in downtown Toronto. I also read this water is first being purified towards drinking water quality and then it goes to the heat exchanger and afterwards it goes to the municipal drinking water system.</p> <p>SP1: Really? SP2: Ja. SP1: Wow! I'm impressed. Okay. SP2: I was impressed, too. I don't know if it happens in other places in Toronto with other water? The only example I could find was with Lake Ontario water, but maybe you know more? SP1: No, on that front I don't. I do approvals across the province, I've seen them in the city of Ottawa. I know in Ottawa where they have the veterans' museum, they also did something similar but their system drew the water up, cooled the building and discharged it back into the lake area of the Ottawa River, but I hadn't heard of the one where they actually treat it and send it to the municipal treatment plant. That's a new one to me. I hadn't heard of that one. SP2: There's quite a nice explanation of this system on the Enwave website. SP1: Which website? SP2: On Enwave. That's the company that operates this system. SP1: Is it E-N Waste or E-N-B Waste? SP2: No, wave. It's E-N-W-A-V-E. Like energy and wave. SP1: Okay, Enwave. Okay- SP2: Wave.. SP1: - I'll take a look at that. SP2: What do you think about the future demand for thermal energy from surface water in Toronto? Do you think it will change? SP1: Surface water demand? The demand for what purposes like re-use for cooling? SP2: To use the water for using the thermal energy, so to cool or to heat buildings. SP1: I can see that actually increasing. One of the things I have seen is a conceptual design for the Don River where they're planning at the mouth of the Don, they're going to put in a huge wetland in there, but I have seen they're going to start building storm water reservoir systems. I wouldn't be at all surprised to see between storm water reservoir systems and the water in the Don River, it wouldn't surprise me that they would attempt to do something here for the discharge like take this water and re-use it. It wouldn't surprise me. SP2: Why do you think the demand to do this will increase? SP1: Just because of the cost of the municipal drinking water system and the cost of energy; I think they're going to be looking at ways of reducing it. The Ontario building code over the next 10 years - and this is in the federal government's plans which is to get to net zero energy homes, I can see all of the residential buildings are all going to move towards a net zero energy consumption, and this would be in alignment with that kind of thinking. SP2: So it's also driven by basis and policy for sustainability? SP1: That's right. SP2: How certain are you that this demand will increase? SP1: I'd say I'm certain. SP2: Very certain or somewhat? SP1: I'll say I'm somewhat certain because, again, I'm not directly involved with it but I've seen enough things to know personally it's very certain. I'm cautious around certain because it's like making a promise; I don't make a promise unless I know I can keep it. I don't like to say I'm certain when I'm not in control of the certainty</p>	U1-Thermal energy extraction
9:46	I can see that actually increasing.	T-Increase
9:47	The Ontario building code over the next 10 years - and this is in the federal government's plans which is to get to net zero energy homes, I can see all of the residential buildings are all going to move towards a net zero energy consumption, and this would be in alignment with that kind of thinking.	D-Sustainability ambitions
9:48	I'll say I'm somewhat certain because, again, I'm not directly involved with it but I've seen enough things to know personally it's very certain. I'm cautious around certain because it's like making a promise; I don't make a promise unless I know I can keep it. I don't like to say I'm certain when I'm not in control of the certainty.	C-Somewhat certain
9:50	<p>No, I don't think I'm going to see an increase in that. Me, personally, I don't see that. I can see the wastewater side growing but not from surface water.</p> <p>SP2: Why do you think this will not change? SP1: I think it will not change</p>	T-No change
9:53	SP1: Somewhat certain.	C-Somewhat certain



ID	Quotation Content	Codes
9:54	<p>You could think of other ways to really produce energy from water, for example, using the salinity gradient or using kinetic energy, from wave energy or tidal energy, well, of course, the hydropower plants in rivers. Do you know if any of these things are happening in Toronto waters?</p> <p>SP1: I know they're happening in Ontario. I can't say I know they're happening specifically in Toronto. There may be something on the Humber. That would be the most likely place; there might be a little micro-hydro plant or something, but I can't say for certainty. I would have to go and look to find out. But that's a great question to ask the TRCA or ask those folks.</p> <p>SP2: Yes, I will. I couldn't find it in the documents but I will ask them. Do you have any idea about the future trend? Do you think the demand for the production of energy using a salinity gradient or other osmotic devices for energy production?</p> <p>SP1: It's a tough call. Other than for reduction like we've already talked about, other than for thermal cooling, I can't see any other, actual energy production through hydro-electric or that type of thing. Personally, other than if you were to look at waste-water, so unless you're capturing wastewater that's been used in the building in recycling, but that's not extraction of the surface water, so I don't see as it relates to your study. I don't see it with respect to surface water, no.</p> <p>SP2: So it remains like it is, it doesn't happen or not substantially?</p> <p>SP1: No, I don't think I'm going to see an increase in that. Me, personally, I don't see that. I can see the wastewater side growing but not from surface water.</p> <p>SP2: Why do you think this will not change?</p> <p>SP1: I think it will not change because I don't think that there's enough, I think there's a better economic plan for the wastewater re-use for creating electricity or reducing your electrical cost than I do see for the surface water. I just don't see how pumping surface water to your building would be worth your while; you're going to need to use electricity to pump it to the top whereas the wastewater would be coming directly from your building right there. So I actually just see the energy demand being much higher from pumping surface water.</p> <p>SP2: So the alternatives are better?</p> <p>SP1: Yes.</p> <p>SP2: How certain are you this will not change, the demand will not increase?</p> <p>SP1: Somewhat certain.</p>	U1-Energy production by using kinetic energy of water
9:55	<p>To go back to the production of energy by using osmotic systems, for example using the salinity grades, do you have any idea if the demand for this will change?</p> <p>SP1: I have no idea.</p>	U1-Energy production by using the salinity gradient in water
9:56	<p>SP1: I have no idea.</p>	No information
9:57	<p>SP2: Okay, so then I'd like to move to Section 2. It's just a short one. This is more about processes that we can benefit from. The first one is managing water quality. I should explain this a little bit. Of course, in a water system, there are all kinds of processes that regulate the water quality like dilution or, I can't find the words, or the breakdown of pollutants, that's not the right word, so there are all kinds of processes going on anyway, it just happens. What I'm targeting now is the intentional use of people of the surface water system to improve water quality. I will give you some examples I've found. For example, there are quite a lot of storm water management ponds in the different watersheds in Rouge, Don river shed, and they are really intended to improve water quality; or you might also think about flushing a specific water body with other surface water which is cleaner to improve the water quality.</p> <p>SP1: We have an expression for that.</p> <p>SP2: And it is?</p> <p>SP1: The solution to pollution is dilution.</p> <p>SP2: Can you explain a little bit if the surface water system is intentionally being used for this?</p> <p>SP1: Okay, just so I understand. I know a fair bit about storm water management ponds, so you're talking about using storm water management facilities, for instance, to improve surface water?</p> <p>SP2: To improve surface water quality.</p> <p>SP1: Yes, so what you are seeing is low impact development techniques. So storm water runoff that hits the ground will be directed to, let's say, the road right away and then it will go through infiltration systems or filtration systems. Basically, the storm water management treatment train approach - and what you're trying to do is actually remove sediments and cool the water - the whole thinking is that as it goes through the treatment train approach, it will go through, let's say, an infiltrated, a perforated pipe that's inside crushed gravel that's being used predominantly for storm sewers. We have what's called the Etobicoke ex-filtration system. You can actually put two 100mm pipes underneath, that are at the same height, that are directly below the standard storm sewer, when the water rises in the catch basin, it goes through these two systems, it goes through the perforated pipe, they're plugged at the bottom at the down-stream end at the other catch basin so all the sediment is captured and all the water is forced into the gravel trench area of the storm sewer and then, therefore, is getting infiltrated into the ground.</p> <p>SP2: So it's more like infiltration purification system using the sub-surface than using the surface water surface system?</p> <p>SP1: That's right. That's one example but we have different types; you have bioretention systems, you have bioswales - there's all sorts of different ones, and somewhere the water gets somewhat treated and then discharges from there and continues; it goes on, it discharges to a pipe and it continues further down and then it ends up in a pond. So you have this treatment train approach. You have the minor and major systems: the minor system is what goes through the ground, basically through the storm sewers and through the low impact development techniques; the major system goes overland and ends up in the ponds. The minor system will also be discharged to the pond but the major system, which is overland and over the roads, will also go to the ponds.</p>	U2-Managing water quality



ID	Quotation Content	Codes
	<p>SP2: And from the ponds it goes to the rivers?</p> <p>SP1: It can go to the river. Before you even get to the pond, you may put in a all grain separator, so you actually have a pre-treatment to remove coarse material or garbage or whatever. You could have filters in there as well which is helping you to remove some of the finer particulate matter, and then it goes into the pond. Then the pond is used primarily for quantity control for the 100-year storm event or a regional storm which is larger than a 100-year.</p> <p>It's got its drawbacks because, for instance, the nutrients like phosphorous, are only partially held by the pond. Ponds can actually become a source of pollutant. You could actually have nutrients go right through the pond. You also warm the water up and you don't put it into a pipe system at the end of the pond and then put it underground to cool the water down before it discharges to a receiving water body. So there's pros and cons to the storm water management pond. In terms of water quality, yes, it does a lot in terms of suspended solids; it will remove the suspended solids. The problem is our target is 80 percent suspended solids. That's the target of a pond, typically.</p> <p>SP2: 80 percent removal, you mean?</p> <p>SP1: Yes. But the problem is that's based on weight, the weight of the suspended solids and, unfortunately, the bulk of the pollutant loading is in the very fine, suspended solids, which is your silts and clays which are less than 60 microns, so anything that's less than 60 microns – that's your fine particulate matter – that carries the bulk of your pollutant loading. You could achieve your 80 percent suspended solids removal but you've just released the majority of the pollutants into the water body because you didn't actually treat the fine particulates. These are all the things you need to be aware of when we talk like particle size distribution. So one of the things we're pushing for here, which I've been pushing for in the province of Ontario which would impact Toronto, is that one needs to start characterising what the receiving water body, like the Don, or the Rouge or the Humber, what do they need in terms of particle size distributions in the water body?</p> <p>SP2: Yes, you want to specify the targets. Just for me to check if I understand it correctly, and when we think about the role of the storm water management ponds in terms of water quality improvement, you say their role is mainly the removal of suspended solids-</p> <p>SP1: Correct. That's for a wet pond. There are dry ponds and wet ponds. You know the difference?</p> <p>SP2: Yes, and I mean the wet ponds because they are surface water. Do you think demand for using the wet ponds for water quality improvement, do you think demand for this will change? That it will decrease, increase or stay the same?</p> <p>SP1: Decrease.</p> <p>SP2: Why do you think it will decrease?</p> <p>SP1: Because the province is pushing for a new way of thinking and actually targeting 90 percent of the total annual volume of rainwater which is the minor storm event, and that that 90 percent total volume will be done by low impact development, where possible, and therefore we're looking at reducing, getting away from wet ponds and going to more of a dry pond so you will get, at least, the quantity control from the dry pond but the quality control will come from the treatment train system that will include low impact development and others like separators and other types of systems.</p> <p>SP2: Do you mean, because there's this aim to increase the low impact development that there will be less runoff going to the ponds?</p> <p>SP1: Yes, absolutely. The idea is to infiltrate, the idea is to meet the hydrologic cycle pre-development to post-development. It's trying to mimic the hydrologic cycle so that you're infiltrating at the source wherever possible, so level controls, so you're infiltrating that water wherever possible, and as close to where the water lands on the ground as possible.</p> <p>SP2: Yes, I understand. I want to make sure. How certain are you of the decrease?</p> <p>SP1: I'd say certain.</p> <p>SP2: Very certain or somewhat certain?</p> <p>SP1: Certain.</p> <p>SP2: It means something between somewhat and very certain?</p> <p>SP1: I'd say very certain.</p> <p>SP2: I'm sorry to bother you but I want the same system for everyone that's why I keep repeating the same question.</p> <p>SP1: That's what I have: I have somewhat that I don't have control of but I play a direct role as well in that.</p> <p>SP2: I understand. I think it's a good way to distinguish between somewhat and very certain. Yes, it makes sense.</p>	
9:58	<p>do you think demand for this will change? That it will decrease, increase or stay the same?</p> <p>SP1: Decrease</p>	T-Decrease
9:59	I'd say very certain.	C-Very certain
9:61	<p>Because the province is pushing for a new way of thinking and actually targeting 90 percent of the total annual volume of rainwater which is the minor storm event, and that that 90 percent total volume will be done by low impact development, where possible, and therefore we're looking at reducing, getting away from wet ponds and going to more of a dry pond so you will get, at least, the quantity control from the dry pond but the quality control will come from the treatment train system that will include low impact development and others like separators and other types of systems.</p>	D-Ambition to increase the low impact development



ID	Quotation Content	Codes
9:62	<p>If we look at the role of the surface water system in managing water quantity, again, I found the example of the storm water ponds. We were talking about this already and you already said the wet ponds' major role is to regulate the water quantity. Do I understand that correct?</p> <p>SP1: They do both; they do water quality and water quantity whereas the dry pond is predominantly for water quantity only.</p> <p>SP2: So if we look at the dry ponds and their role for managing water quantity, do you think the demand for this will change?</p> <p>SP1: I don't think the demand for it will change; I think it will continue on its trend.</p> <p>SP2: So it stays the same.</p> <p>SP1: It will actually likely increase because we're getting away from wet ponds and we will probably see more dry ponds.</p> <p>SP2: The reason that you think there's no change is that there will be more dry ponds?</p> <p>SP1: Yes, I do think there will be a change. I think there will actually be an increase in dry ponds.</p> <p>SP2: And that's the main reason?</p> <p>SP1: The only caveat to this is we are seeing in some places, instead of putting in a dry pond they're actually putting in underground holding tanks so that they can re-use the water, let's say, in a soccer field, or someplace where they can actually use it for irrigation purposes. I have seen that, but I don't know if that's going to become mainstream or if that's just a great idea but most people won't do it. I don't know.</p> <p>SP2: You say there will be a tendency to have more dry ponds so, at least, it will not lead to an increase. Do you think it will stay the same or will it decrease?</p> <p>SP1: It will increase. Dry ponds will increase.</p> <p>SP2: But you said: I think the demand for using storm water ponds for managing water quantity will not change.</p> <p>SP1: No, no, I do think it will change. I think it will increase for dry ponds specifically. I think dry ponds will increase.</p> <p>SP2: And for wet ponds?</p> <p>SP1: For wet ponds will decrease.</p> <p>SP2: How certain are you this will decrease?</p> <p>SP1: I'd say somewhat certain because I don't know what the holding-tank future holds.</p> <p>SP2: And the reason there's this shift from wet ponds to dry ponds, it's driven by?</p> <p>SP1: It's actually driven by provincial policy that says you should be doing a treatment train approach as opposed to just conventional storm sewer and pipe facilities. We actually had an interpretation bulletin that was put out by our ministry that actually said: The ministry is actively seeking to move towards a treatment train approach and not just strictly end of pipe treatment.</p> <p>SP2: And why do they prefer that?</p> <p>SP1: Because we think we will be mimicking the hydrologic cycle better. We will actually be infiltrating more water into the ground and we will be able to actually end up with a cleaner water quality overall by going through a treatment train approach as opposed to an end of pipe facility.</p>	U2-Managing water quantity
9:64	<p>SP2: And for wet ponds?</p> <p>SP1: For wet ponds will decrease.</p>	T-Decrease
9:65	I'd say somewhat certain because I don't know what the holding-tank future holds.	C-Somewhat certain
9:68	<p>The surface water system may play a role in the climate. In the global climate regulation because of the influence of emission of greenhouse gases, or also on the local climate. I did not find any examples of the intentional use of this, but do you know more about that? Does that happen in Toronto? Is the surface water intentionally being used for influencing the climate?</p> <p>SP1: I have not seen any such intentions. I think predominantly the thinking is we just live next to the Great Lakes, we sit on 10 percent of the world's fresh water supply so I don't think anyone's really thought about how we could use this in terms of climate change adaptation. When you say climate change, are you talking adaptation or mitigation, or both?</p> <p>SP2: Principally, mitigation so influencing the climate itself.</p> <p>SP1: I cannot think that anyone has. I'm not aware of anyone looking specifically at the surface water for implementing that because mitigation is primarily greenhouse gas and I don't know the relationship between greenhouse gases and lakes. I don't know.</p> <p>SP2: In this respect, it's about mitigation. You could say it's also part of adaptation and, let's say, global climate is changing but you can also influence the local climate given the</p>	U2-Global climate regulation by reduction of greenhouse gas concentrations
9:69	I cannot think that anyone has. I'm not aware of anyone looking specifically at the surface water for implementing that because mitigation is primarily greenhouse gas and I don't know the relationship between greenhouse gases and lakes. I don't know.	No information



ID	Quotation Content	Codes
9:70	<p>Do you think that water is used for that, to influence local temperature, for example? SP1: The problem that comes in is I don't see it as a surface water issue. It's more complex. It's more of a natural environment system. For instance, my father is a forester, a research scientist in forestry. He believes very strongly we should be planting one heck of a lot of trees around the entire Great Lakes to bring up the water table and improving the overall environment and carbon sequestering. He's saying that would all be possible because it's in the watershed of the Great Lakes, there's a lot of water there. So it's not specifically surface water-related, it's more to do with how we can improve the surface water. SP2: It's more indirectly having a good hydrological system to support the trees in this case. SP1: Absolutely. I mean the United Nations has their ambitious trillion tree planting program and Australia is targeting that. I see that as being more of a significant climate change impacting local climate change, but that again is a mix of adaptation and mitigation. So it could have a huge impact. If you plant a lot of trees in an area, you could have a big impact on the local climate. But that's not surface water directly but it has implications for surface water- SP2: Yes, I see your point. That's more indirect. SP2: - because the water in the ground partially gets into the Great Lakes, so the lakes are fed by the surface water aquifers. SP2: At the moment, you say there are no examples of explicitly using the surface water system for climate regulation. Do you have any idea if the demand for this will change in the future? SP1: No, I have no idea. I did want to go back</p>	U2-Local climate regulation
9:71	No, I have no idea	No information
9:72	<p>We will move onto the third section. This is a section with cultural use functions. Many of them are recreational functions but there may also be more spiritual or symbolic interaction with the water system. If we start with the more physical interactions, the first one I want to look at is primary contact recreation which means when there is full body contact with the water, so swimming or diving. I found this is happening at Rouge Beach, for example, where Rouge River joins Lake Ontario, and there are 14 public beaches at Lake Ontario. Do you think demand for swimming or diving in surface water will change towards 2040? SP1: I think yes, it will as we continue to separate the combined sewer, so we get less combined sewage going directly into Lake Ontario. Right now, we get warnings, so right after a major rain storm event, the warnings go up on the beach, which is controlled by the public health units, the pumps- SP2: So the water quality improves? SP1: No, it gets worse. SP2: It gets worse? SP1: Ja, because when you get a heavy-duty rainstorm, you get combined sewage that takes place and discharges directly, untreated into Lake Ontario. SP2: And you think this will happen more frequently in the future? SP1: No, I think it will be less frequent. I think as the city of Toronto continues to separate its combined sewers and continue to build capacity for improving on their ability to treat that combined sewage; they put in a big tunnel, they built a really big tunnel to capture some of this. SP2: I read about that. SP1: Actually, Dr James Lee, Darko's colleague, he knows a lot about that. But there were some major problems with it which were not put in the paper but there were some really bad design considerations in there. But there was a second tunnel built which I think went much better. So the city of Toronto continues to find ways to improve the water quality I think that will contribute by 2040. I actually think you will see improved water quality near shore and there will be an increase in people using the water. I think also the fact you're just getting more people, so there's always more and more people coming in. SP2: The population is increasing, you mean? SP1: Yes, 60,000 people come into Toronto every year. You're always getting an increase to Toronto. It's the fourth largest city in north America. It's a big city. SP2: So you think the demand for swimming will increase as a result of water quality improvements and population growth. Is that correct? SP1: Absolutely. And as the climate warms and Toronto gets warmer in the summer, I actually can see that more people will be swimming because the water will likely get warmer. SP2: Does this account for the shores of Lake Ontario only or also for other waters? SP1: Probably other waters, too. I would say less and more predominantly for Lake Ontario than the other lakes. Lake Erie has the largest number, variety of fish but the shallowest lake and it has a lot of dead zones. They have major, major nutrient problems. There's a lot of farm waste getting into the waters there largely from the US- SP2: And if you think about waters in Toronto, do you think that swimming also occurs or will increase in other types of waters, other than Lake Ontario? SP1: I'd say I don't know the answer. My guess is no. I would say no. I'm somewhat uncertain. SP2: You're somewhat uncertain about the increase at Lake Ontario? SP1: That's right. Well, not Lake Ontario, you said outside of Lake Ontario. Outside of Lake Ontario, I'd say probably no. I wouldn't see an increase. SP2: For Lake Ontario, how certain are you that it will increase? SP1: I'd say somewhat certain. SP2: Why do you think it will not happen outside Lake Ontario? SP1: You know there are five Great Lakes, four Great Lakes, five. Yes, there's five Great Lakes, it's just one is completely in the US. SP2: Yes, I mean the water in Toronto. I only focus on the water in Toronto so the rivers, the ponds, the creeks.</p>	U3-Primary contact recreation



ID	Quotation Content	Codes
	<p>SP1: I realise that but you're asking me, you said outside of Lake Ontario why not? I said the reason why not outside Lake Ontario, Lake Superior is the eighth largest lake in the world and it's very deep and it's very cold water, and in winter time they get to 40°C below. So Lake Superior will not get increased swimming because nobody should be swimming in there even in July. Lake Huron is similar. There are some places in Georgian Bay that I could see increased swimming maybe in Georgian Bay which is a big bay that's part of Lake Huron. There's a lot of cottages there and that bay is fairly shallow. I have swam in there myself so it's actually quite nice. That area might see some increases. But Lake Eerie is like I said, there's a lot of problems with Lake Eerie. I don't know if that one's going to get increased swimming. There's a lot of problems there. It's nutrifying. It's a lake that starting to nutrify.</p> <p>SP2: If you think about rivers and creeks in Toronto or ponds, are they being used for swimming or do you think the demand for swimming will change over there?</p> <p>SP1: I don't know the answer. Isn't that strange? I live in Toronto and I don't know the answer. My guess is they are being used for swimming but I have never seen anyone swim - definitely not in the Don. The Don River is rated as, I think, the poorest water quality in the province, so that's my understanding. I don't think people would swim in the Don. I don't know about the other ones. Maybe the Rouge, the Rouge is probably pretty clean. I could see maybe some people swimming in the Rouge.</p> <p>SP2: But you did not observe it yourself?</p> <p>SP1: No.</p>	
9:73	<p>Just to make a note, I just remembered something that's happening in Lake Ontario, and I don't know if it's in Toronto or not, but if it's not Toronto it's very close to Toronto. There's one guy, one gentleman – he's done this in different places – what he's doing, he's taking the water from, I think, Lake Ontario, he's dug a very deep well and he is running lake water through a turbine to generate electricity which he feeds into the electrical grid during the day and at night time he pumps the water out of that well back into the lake when the cost of electricity is not at peak hours, when it's a lot cheaper. So the difference in the cost is where he makes his money.</p> <p>SP2: Okay, so he's pumping up water from Lake Ontario, he transports that to a well, so that's a sub-surface well, right?</p> <p>SP1: Yes, basically what he's done is dug a very deep underground chamber and he runs the water from Lake Ontario into that chamber. It goes through a vertical turbine and the turbine turns and creates electricity which is fed into the grid.</p> <p>SP2: Aha! So that's interesting.</p> <p>SP1: He's done that in four or five different locations in the Great Lakes, so he's done some in the US but I'm pretty sure he did one in Toronto. It's very interesting. But the reason he makes his money is because he's getting the peak hour electrical half-price and then he's offsetting. The profit comes from he pumps that water back at night through pumps but at a lower price. For instance, he's making 7.5 cents a kilowatt hour during the day and then he pumps the water out at 4.5 cents kilowatt hour at night.</p> <p>SP2: It's costs him electricity but it's cheaper electricity. Do you know if I can find any information somewhere about this?</p> <p>SP1: I found it in the Toronto Star. It was in the newspaper clipping.</p> <p>SP2: Toronto Star, okay.</p> <p>SP1: I found that article in the newspaper. It was a very large article probably about five or six years ago. I cut it out but I don't know where it is now but it just came to me now that, oh yeah, there is somebody that's actually generating electricity from pumping that water into the ground. So, I just thought I'd share it with you</p>	U1-Energy production by using kinetic energy of water
9:74	So the city of Toronto continues to find ways to improve the water quality I think that will contribute by 2040. I actually think you will see improved water quality near shore	D-Water quality improvement
9:75	<p>I think also the fact you're just getting more people, so there's always more and more people coming in.</p> <p>SP2: The population is increasing, you mean?</p> <p>SP1: Yes, 60,000 people come into Toronto every year. You're always getting an increase to Toronto. It's the fourth largest city in north America. It's a big city.</p>	D-Population growth
9:77	I'd say somewhat certain.	C-Somewhat certain
9:78	there will be an increase in people using the water	T-Increase
9:79	<p>Then let's move on to secondary contact recreation, so that's things like canoeing, kayaking, supping, activities where there is contact with the legs and the arms. I found examples at Rouge beach and the marshes that there are people canoeing, kayaking and rowing, and that people paddle on Don River. Is that still the case?</p> <p>SP1: I think so, yes, and I think that will increase.</p> <p>SP2: Why do you think it will increase?</p> <p>SP1: Again, as the waterways get cleaner, as the water quality improves and as more people come in and they're doing rehabilitation, for instance, of the Don, I can see that because you're not in direct contact with the water, so I can see people definitely increase recreational use by boat definitely.</p> <p>SP2: You say there's no contact with the water but with canoeing or rowing there is some contact with the water, but do you think that will increase as well?</p> <p>SP1: Definitely, I think that will increase. I'm very certain that will increase for non-motorised vehicles, like non-motorised modes of transportation: kayaking, canoeing, that type of thing.</p>	U3-Secondary contact recreation



ID	Quotation Content	Codes
9:80	d I think that will increase.	T-Increase
9:81	as the waterways get cleaner, as the water quality improves and as more people come in and they're doing rehabilitation, for instance, of the Don, I can see that because you're not in direct contact with the water, so I can see people definitely increase recreational use by boat definitely.	D-Water quality improvement
9:82	they're doing rehabilitation, for instance, of the Don,	D-Remediation Plans
9:83	I'm very certain that will increase	C-Very certain
9:84	<p>If we look at other types of boating like motor boats or sailing, do you think that will change?</p> <p>SP1: In the rivers, I don't see that's going to change. I haven't seen much evidence of much sailing going on in there myself. There is some maybe at the Rouge, the mouth of the Rouge there might be some sailing in there somewhat, but for the most part it's Lake Ontario. Most of that type of activity is in the lake itself not in the water bodies.</p> <p>SP2: You think that will increase as well, you said?</p> <p>SP1: No, I don't think that will increase. That, in particular, I don't see motorised vehicle or sailing increasing in the rivers.</p> <p>SP2: Why don't you think it will not decrease of increase?</p> <p>SP1: The amount of water, quite frankly. I just don't think the rivers are big enough to support that type of activity. I don't think people will want motorboats in there. Sailing? Maybe, but even sailing, most people sailing on a river is not really-, most people sail on the lake. They might sail at the mouth of the river or a little bit up the river from the mouth but that would be about it.</p> <p>SP2: How certain are you this will not change?</p> <p>SP1: Somewhat certain.</p> <p>SP2: If you look at Lake Ontario, do you think that's the same situation there that there will be no change?</p> <p>SP1: No, I think it will increase.</p> <p>SP2: For which reason do you think this type of boating will increase?</p> <p>SP1: Waterfront development.</p> <p>SP2: Can you explain that a little bit more?</p> <p>SP1: Yes, the whole what we call the Bad lands or the Don lands where there's currently like all industrial, contaminated sites, it's all going to get transformed, cleaned up and they're going to put a whack load of condominiums in there. There's going to be a lot of condominiums and building going on in there, and I think when they do that and they put in the wetlands on the Don River and they completely clean that area up, we're going to see a very large influx of people in that area.</p> <p>SP2: So there will be population growth in that area and that will increase the demand.</p> <p>SP1: Yes.</p> <p>SP2: How certain are you of this increase?</p> <p>SP1: I'd say very certain.</p>	U3-Recreational boating
9:85	No, I don't think that will increase. That, in particular, I don't see motorised vehicle or sailing increasing in the rivers.	T-No change
9:86	SP1: Somewhat certain.	C-Somewhat certain
9:87	The amount of water, quite frankly. I just don't think the rivers are big enough to support that type of activity. I don't think people will want motorboats in there. Sailing? Maybe, but even sailing, most people sailing on a river is not really-, most people sail on the lake. They might sail at the mouth of the river or a little bit up the river from the mouth but that would be about it.	D0-Local water system not suitable
9:88	I think it will increase.	T-Increase
9:89	<p>SP1: Waterfront development.</p> <p>SP2: Can you explain that a little bit more?</p> <p>SP1: Yes, the whole what we call the Bad lands or the Don lands where there's currently like all industrial, contaminated sites, it's all going to get transformed, cleaned up and they're going to put a whack load of condominiums in there. There's going to be a lot of condominiums and building going on in there, and I think when they do that and they put in the wetlands on the Don River and they completely clean that area up</p>	D-Redevelopment close to water
9:91	I'd say very certain.	C-Very certain
9:92	<p>If we look at recreational fishing, we already talked about it when we were discussing the consumption of fish, but if we look at it from a recreation perspective, do you think the recreational fishing that now takes place at Lake Ontario but also in the rivers, do you think the demand for this will change?</p> <p>SP1: Yes, I think the demand will change. I think it will increase.</p> <p>SP2: Why do you think it will increase?</p> <p>SP1: Population growth and cleaner water, and improved water quality.</p> <p>SP2: How certain are you of this trend?</p> <p>SP1: Somewhat certain.</p>	U3-Recreational fishing
9:93	Yes, I think the demand will change. I think it will increase.	T-Increase
9:94	Population growth	D-Population growth
9:95	cleaner water, and improved water quality.	D-Water quality improvement



ID	Quotation Content	Codes
9:96	Somewhat certain.	C-Somewhat certain
9:97	<p>SP2: And hunting for other aquatic animals? As far as I can find, it's not allowed at the moment. I don't know if it happens, but do you know more about this or about a trend towards 2040?</p> <p>SP1: Other aquatic animals?</p> <p>SP2: Like water birds or maybe other animals?</p> <p>SP1: We have Canada Geese which are everywhere but you need a license to hunt them and you wouldn't be able to hunt them down in the Toronto area.</p> <p>SP2: So it's not happening now?</p> <p>SP1: No, and I don't see that changing in the future. I just don't think that would be something people would be allowing.</p> <p>SP2: So you think it will not change because it won't be allowed in the future as well?</p> <p>SP1: Yes.</p> <p>SP2: How certain are you of this?</p> <p>SP1: Somewhat certain.</p>	U3-Hunting aquatic animals
9:100	I don't see that changing in the future.	T-No change
9:102	<p>SP2: What about people just enjoying the landscape that is characterised by water? I found there's a trail along the shoreline of Lake Ontario and bird watching is very popular along Lake Ontario. Maybe there's cycling or hiking along the waterways. I cannot find a lot of information about that in the documents.</p> <p>SP1: Yes, there's the Toronto boardwalk. I walk it almost every single day. I drive down to the boardwalk and my wife and I walk probably three or four kilometres every single day on the boardwalk, so it's highly used. There is a lot going on down there so it's quite full; there's a lot of people on the beach, there's a lot of people cycling. There's lots of activities. There's people doing jogging and cycling, walking, there's a lot of dogs. There's a dog park down there too, so there's all sorts of activity down there, and it's all ages, too; all ages and ethnic backgrounds and cultures. It's a real cosmopolitan of people.</p> <p>SP2: And it's all along Lake Ontario waterfront?</p> <p>SP1: Yes, it's in the beaches. It's what's called the beaches area. If you look at Ashbridge's Bay which is where the wastewater treatment plant is, you go from there across to basically the water treatment plant which is on the far side, on the east side of the beaches, there's a walkway there that's about maybe four kilometres, and a lot of people walk along that stretch. That's where I walk.</p> <p>SP2: Do you think that the demand for recreation along the water shores, either Lake Ontario or the other waters in Toronto, do you think the demand for this will change?</p> <p>SP1: Yes, I think it will increase.</p> <p>SP2: Why do you think that?</p> <p>SP1: Increased population, improved restoration of existing habitat. I think as the waterfront gets revitalised with a mix of building and natural settings, you'll see more pathways being put in and TRCA will be overseeing a lot of that.</p> <p>SP2: So population growth and more revitalisation of the natural habitats and more pathways? How certain are you of the increase in demand?</p> <p>SP1: Very certain.</p>	U3-Enjoying a landscape characterized by surface water
9:103	Yes, I think it will increase	T-Increase
9:105	Increased population	D-Population growth
9:106	improved restoration of existing habitat.	D-Revitalisation of traditional habitats

ID	Quotation Content	Codes
9:107	<p>SP2: Is there any ice-skating on surface water?</p> <p>SP1: There is a place actually designed at the waterfront in Toronto right down at the harbour front. There's a place to skate. There are places actually just in front of city hall, there's a huge area that's used for skating. There's a lot of skating, a lot of people skate outdoors.</p> <p>SP2: What type of water is this?</p> <p>SP1: In winter.</p> <p>SP2: Sorry, what type of water?</p> <p>SP1: What type of water? I thought you said weather. What type of water? Good question. I think it's lake water though.</p> <p>SP2: Is it like a pond?</p> <p>SP1: It's a man-made structure. It's a very large, circular area that's right next to the lake.</p> <p>SP2: So it's really a special facility for skating. It's not like a pond that sometimes freezes.</p> <p>SP1: No, in the summertime, it's used for paddle boating. In the summertime, it's a place where you can rent paddle boats, go out and paddle boat in that area. It's quite a very large area of water.</p> <p>SP2: It is like a pond?</p> <p>SP1: It is like a pond, yes, it's a manmade pond though. It's a man-made pond, all concrete all the way around.</p> <p>SP2: And do you think the demand for skating on these ponds will change?</p> <p>SP1: I think it will increase.</p> <p>SP2: Why?</p> <p>SP1: I actually did approval for another system that's going to be built downtown as part of the revitalisation, so I know there's another pond that's going to be built down there. I think they're looking to increase the recreational use for waterfront residents.</p> <p>SP2: And this pond will be also be part-time skating, part-time summer recreation?</p> <p>SP1: Yes, in the summer, my understanding is there will be a fountain.</p> <p>SP2: So you think it will increase because you know there will be, at least, one other pond and there's a desire to increase the recreational use for the waterfront residents.</p> <p>SP1: Absolutely. As you're putting more and more people, the concentration of people increases per square metre, the city is also planning to put more and more spaces like parks and recreational areas for people to go to. That's just smart planning.</p> <p>SP2: And how certain are you of the increase in demand?</p> <p>SP1: Somewhat certain</p>	U3-Ice-skating
9:108	I think it will increase.	T-Increase
9:109	Somewhat certain.	C-Somewhat certain
9:111	<p>I actually did approval for another system that's going to be built downtown as part of the revitalisation, so I know there's another pond that's going to be built down there. I think they're looking to increase the recreational use for waterfront residents.</p> <p>SP2: And this pond will be also be part-time skating, part-time summer recreation?</p> <p>SP1: Yes, in the summer, my understanding is there will be a fountain.</p> <p>SP2: So you think it will increase because you know there will be, at least, one other pond and there's a desire to increase the recreational use for the waterfront residents.</p> <p>SP1: Absolutely. As you're putting more and more people, the concentration of people increases per square metre, the city is also planning to put more and more spaces like parks and recreational areas for people to go to. That's just smart planning.</p>	D-Redevelopment close to water



ID	Quotation Content	Codes
9:112	<p>SP2: This is all types of, how could you say, physical use of the water or just looking at the water as well. I know that in Toronto, Humber is designated as a Canadian Heritage River, so there is a formal recognition of its contribution to the development of the city, of the country. Do you think there is a change in the demand for this type of designation of cultural heritage value of the water?</p> <p>SP1: You were saying it's the Humber that has been identified as a cultural heritage feature?</p> <p>SP2: Yes, it's officially designated as a Canadian Heritage River. And you could think of other examples but do you think, to acknowledge this function it will change in the future?</p> <p>SP1: I don't know if it will change. I think the Rouge would be well-positioned for that classification.</p> <p>SP2: Why?</p> <p>SP1: Because it needs protecting. There's a lot of natural area there but already there's pressure to do development on the top end of it. It's a very large, pristine area that has remained relatively intact and untouched despite being in the city of Toronto, but Toronto Regional Conservation Authority has been overseeing some of that land. I think some of that was taken out of their hands by the province, the feds, so I don't know where that sits right now, but they were looking at basically allowing some development in the Rouge, and there were a lot of people very upset about that. My understanding is that the federal government may have stepped into that. I don't know where that's at right now, I'm not part of it but I know people that have been part of it. I think having a Canadian heritage designation would be very good for the Rouge, so I would hope that it will increase for other areas for other river systems draining to Lake Ontario in the Toronto area.</p> <p>SP2: So you think that the demand can increase?</p> <p>SP1: Yes, I think it would be wise that it increases. I don't know if it will but I hope so.</p> <p>SP2: But if I ask you the question: What do you think of the demand?</p> <p>SP1: If it will increase? Cautiously, I will say yes.</p> <p>SP2: And how certain are you?</p> <p>SP1: Somewhat uncertain.</p> <p>SP2: And the reason that you think it may increase is that in the Rouge River, there is a pressure to develop while there's also a need to protect?</p> <p>SP1: Yes, I think it would be a very good candidate for protection as a Canadian natural heritage feature.</p> <p>SP2: Why do you think people would want this? Let me put it another way: Where is the demand coming from?</p> <p>SP1: The people. People want natural areas, right? They want to protect the rivers and systems so I see it as the public at large want to protect it.</p>	U3-Designation of cultural heritage value

ID	Quotation Content	Codes
9:113	<p>SP2: Okay, clear. Is there any religious use of the surface water?</p> <p>SP1: I wouldn't say the surface water, I've seen along the shorelines quite a few-. There's a lot of Muslims that go there to pray so I've seen culture used that way. Often, I'll see groups of Muslims along either there or I've also seen them in [?] as well, but they will go down by the waterfront and actually do some praying and do their prayers down by the water.</p> <p>SP2: That's at the shores of Lake Ontario you see people praying?</p> <p>SP1: Yes. You don't see it everywhere but you do see it from time-to-time, yes.</p> <p>SP2: Any other examples you know?</p> <p>SP1: Oddly enough, we saw a red carpet that had been put out with a thing down on Lake Ontario and it looks like somebody had a wedding. Another time we were down there, actually two weeks ago, where it looked like there was a funeral procession where they had two little vessels they put on a little, small floating thing that was pushed out into Lake Ontario. I've seen it for saying goodbye to loved ones and saying hello to new, married couples.</p> <p>SP2: That's interesting. So these things you observed yourself at Lake Ontario shores?</p> <p>SP1: That's right. Yes, as a person.</p> <p>SP2: Do you think demand for this religious or symbolic use of, the spiritual use of the water will change?</p> <p>SP1: I will say yes. I think it will increase but not from a religious point of view but from a spiritual point of view. This summer, there was a First Nations-, Do you know about First Nations in Canada?</p> <p>SP2: In First Nations? I'm trying to-,</p> <p>SP1: Native people like people that were here before the white man came, we used to call them Indians, now we call them First Nations or aboriginal..</p> <p>SP2: First Nations, now I understand. I didn't hear it. Okay, First Nations. Yes, I know that.</p> <p>SP1: First Nations, okay. This summer, there was actually a boathouse that was in the harbour and it was promoting First Nations historical cultural heritage of the Toronto area and talking about how the First Nations used to use the Toronto area as part of their trade and their hunting and everything else that they used to do in their world before the lands were negotiated, before the lands were sequestered and taken by the white man and negotiated, they were bought by the white man. I do see increased spiritual use of Toronto waterfront, in Toronto rivers. This was a very popular area. Actually, the word Toronto means big meeting place in one of the languages. I think it's the Mississauga Indians. That's part of their language. Toronto means big meeting place.</p> <p>SP2: So you say the spiritual use of the water may increase. Do you know how First Nations people are using the water in a spiritual way?</p> <p>SP1: I know there's a woman that walks every year and she's been doing it for 13 years, she walks the entire north shore of all the Great Lakes. I shouldn't say every year, I think she does this once every two or three years, she walks the entire top of Lake Superior all the way. We're talking thousands and thousands of miles and she will actually walk the entire shoreline of the Great Lakes all the way to Quebec.</p> <p>SP2: Do you know if there are more people who do things like that or is it just her?</p> <p>SP1: They invite people to join them at different places so members of the community, so when they hit Toronto, a large number of people came and did that. There were people that came out in large First Nations canoes and canoed alongside them. They have a canoe group that joins them; while they're on the land there are people in the canoe and they follow them.</p> <p>SP2: And this is all related to First Nations culture?</p> <p>SP1: Absolutely.</p> <p>SP2: And how certain are you that the demand for this spiritual connection to the water will increase?</p> <p>SP1: I'd say I'm somewhat certain.</p> <p>SP2: What drives the increase? What makes people more and more want to do this kind of things?</p> <p>SP1: Yes, I think people do. Part of the walk, and I've done it myself, is to actually walk with a staff with a feather and you walk with a jug full of water and you collect a bit of water from each of the lakes as you're doing the walk. So, there's always a man and a woman walking as a pair, and I walked with the staff as a man, and the woman I was with was carrying the jug of water.</p> <p>SP2: Do you have any idea why this is becoming more and more popular?</p> <p>SP1: I think just greater awareness of First Nations' heritage. We have the First Nations reconciliation that was done by the federal government. I think just there's a greater and greater awareness of the injustices towards First Nations and the need to be more inclusive and bring them into the fold more.</p> <p>SP2: This increased awareness is driving the increase in demand for these kind of activities?</p> <p>SP1: Yes.</p>	U3-Religious use
9:114	<p>Yes, I think it would be wise that it increases. I don't know if it will but I hope so.</p> <p>SP2: But if I ask you the question: What do you think of the demand?</p> <p>SP1: If it will increase? Cautiously, I will say yes.</p>	T-Increase
9:115	Somewhat uncertain.	C-Somewhat uncertain
9:116	People want natural areas, right? They want to protect the rivers and systems so I see it as the public at large want to protect it	D0-Ecological protection ambitions
9:117	As you're putting more and more people, the concentration of people increases per square metre	D-Densification
9:118	we're going to see a very large influx of people in that area.	D-Densification
9:119	I will say yes. I think it will increase but not from a religious point of view but from a spiritual point of view	T-Increase
9:120	I'm somewhat certain.	C-Somewhat certain



ID	Quotation Content	Codes
9:121	I think just greater awareness of First Nations' heritage. We have the First Nations reconciliation that was done by the federal government. I think just there's a greater and greater awareness of the injustices towards First Nations and the need to be more inclusive and bring them into the fold more.	D-Awareness about First Nations heritage
9:122	<p>SP2: Okay, clear. So we go to the final section. Those are functions that are related to the use of the space that water provides so that may be the space on the surface, or the space in the 3D volume of the water. The first example is building on water so this might be floating buildings, floating houses, houseboats, temporary stages - maybe temporary or permanent. I did not find any examples so far in Toronto, but maybe you know more about this?</p> <p>SP1: There are definitely some boathouses more on the Etobicoke side. I know there are some and I don't know if they're next to the marina but I know there are some people that have boathouses down in Lake Ontario. Yes, they exist because I knew an engineer who had a boathouse down there so I know they definitely exist. You may want to check with the marinas to find out more. That's where you're likely to find out more information is to actually contact marinas. But there are people that live down there. The interesting thing is, I don't know whether they're taxed like if they have to pay property taxes or how that works.</p> <p>SP2: But there are some houses. Do you think the demand for using this space on the water for buildings will change?</p> <p>SP1: Do I think it will change? I will say no.</p> <p>SP2: It stays the same?</p> <p>SP1: I think it will stay the same only because that waterfront is for the public, and I don't think there will be a demand for more boathouses. Now having said that we do have Ontario Place. Do you know Ontario Place?</p> <p>SP2: No.</p> <p>SP1: Ontario Place is a really big area which is right in front of the Canadian National Exhibition, the CNE. Do you know the CNE?</p> <p>SP2: No.</p> <p>SP1: The CNE is a very large area basically on the west side of Toronto. It's just south of Old Fort York. Old Fort York is where the water used to be; south of Old Fort York is where they have the Canadian National Exhibition, the CNE grounds. That's been there for over 100 years so that site is open in the middle of two weeks in August. It has tons of buildings, tons of parking area and everything else and that area is used by the public for the Canadian National Exhibition in two or three weeks in August. In front of that area and actually in the water is the Ontario Place. It basically was constructed by backfilling with sediment.</p> <p>SP2: It's like an island of a peninsula?</p> <p>SP1: It's attached to the land but it's a man-made portion of land. It exists and it's currently going through a whole transformation. It's going to get re-built so that site is getting re-built. It used to have a huge cinesphere, it used to have a place where people go to listen to a concert, there was all sorts of different uses for it over there but it's a place where the public used to go and enjoy, the plan now is to put maybe some condos in there and mix them with some restaurants. There's a lot of different uses in there but it also had like little canal systems in there, like little areas where the water goes through. So there may be some opportunities in there for like we talked about before like putting in a floating house or whatever, but I don't know. I still don't think so. But I could see that area as maybe expanding out into the water somehow - maybe a restaurant floating out on the water.</p> <p>SP2: You started by saying: I don't think the demand for having structures on the water will not change; then you said for the waterfront because it's for public use and not for boathouses. Then you explained, well, maybe there are some opportunities in the canals, so in this peninsula. In the end, what would you say is the trend? Is it that there will be no significant change or will there be a decrease or increase in the demand?</p> <p>SP1: No significant change. That would still be my answer. But I do see..</p> <p>SP2: What is the main reason for that?</p> <p>SP1: The main reason for this is because it's a very densely populated area and it should be maximised for public use, and I just don't see that the city, the province or the federal government would want to encourage individuals living in boathouses.</p> <p>SP2: Okay, clear. How certain are you that it will not change?</p> <p>SP1: Somewhat certain</p>	U4-Building on water
9:123	<p>Do I think it will change? I will say no.</p> <p>SP2: It stays the same?</p> <p>SP1: I think it will stay the same</p>	T-No change
9:124	Somewhat certain.	C-Somewhat certain
9:126	The main reason for this is because it's a very densely populated area and it should be maximised for public use, and I just don't see that the city, the province or the federal government would want to encourage individuals living in boathouses.	Db-Other functions prevail/conflict between users/lack of space



ID	Quotation Content	Codes
9:127	<p>SP2: Do you know if the space under the water surface is being used to store things for buildings for constructions?</p> <p>SP1: Not that I'm aware of. The only thing I do know is that I approved a very large underground tank just behind the wall that keeps Lake Ontario back from the city of Toronto. There's a huge wall that's part of a harbour front. In behind that wall, they've dug a deep, deep hole and they've put in a huge water tank there basically to capture the rainwater-,</p> <p>SP2: - on the land side.</p> <p>SP1: Yes.</p> <p>SP2: But do you think in the future there will be a change in the demand to use the space within the water? The water volume?</p> <p>SP1: It's a great question. I have no idea. The answer is: I don't know.</p>	U4-Under water storage/infrastructure
9:128	. I have no idea. The answer is: I don't know	No information
9:129	<p>Then there are three other functions: we can use the surface water for transporting goods. I found information about the International Port of Toronto on the shores of Lake Ontario that there's a lot of bulk transport for sugar and road salts and aggregates. Do you have other examples of transports over water in Toronto?</p> <p>SP1: There had been a company – and I don't think they exist anymore, but there had been a company that had hydroplane boats that were transporting people from Toronto to Rochester, New York, across Lake Ontario.</p> <p>SP2: So it was like a ferry between Toronto...?</p> <p>SP1: Yes, except it was the hydroplane. It wasn't your traditional ferry, it was an actual high-speed type of hydroplane.</p> <p>SP2: Why do you think it doesn't exist anymore?</p> <p>SP1: I don't know if demand was there. It obviously collapsed because the economic model didn't work. You had to go through customs so I think that was part of the challenge because you were crossing into another country.</p> <p>SP2: Are there other examples? What I found is there are ferries from...., to Toronto Island Park?</p> <p>SP1: Yes, there's a whole ferry system that takes you to three different parts of Toronto Island. There's Ward Island, Centre Island and Hamlyn Point so those are three separate ferries, or four ferries, that go across, and there's some people that live on the island.</p> <p>SP2: I also found that there is a cruise ship terminal at Lake Ontario. Are there other forms of transport of people, public transport?</p> <p>SP1: There's the tour boats that go around the island and come back. They're not the ferries, they're actually tour boats and you can go on and you can have a dinner party, those types of things, gambling nights-,</p> <p>SP2: - excursion boats.</p> <p>SP1: Yes, the Mariposa. I think that's what they're called, Mariposa.</p> <p>SP2: Do you think the demand for transporting people over water will change?</p> <p>SP1: I don't know. You would have to increase-, I personally think yes, because Toronto is such a grid-locked city. I can see definitely trying to get from the east to the Westside of the city, it would be really beneficial to be able to get on a boat and bypass Toronto and go from the Westside to the east, or east to the Westside. I could see a definite advantage doing that but I, so far, haven't seen it.</p> <p>SP2: What do you think of the demand?</p> <p>SP1: I don't know. I'm just speculating. I think the demand will increase. I would say, yes, I do think the demand would increase, but how certain? I would say somewhat uncertain.</p> <p>SP2: Why do you think the demand will increase?</p> <p>SP1: More people and gridlock in the city.</p> <p>SP2: So the roads are full, is that what you mean?</p> <p>SP1: Yes, Toronto is really bad.</p>	U4-Transporting persons
9:130	I think the demand will increase. I would say, yes, I do think the demand would increase	T-Increase
9:131	I would say somewhat uncertain.	C-Somewhat uncertain
9:132	More people	D-Population growth
9:133	because Toronto is such a grid-locked city. I can see definitely trying to get from the east to the Westside of the city, it would be really beneficial to be able to get on a boat and bypass Toronto and go from the Westside to the east, or east to the Westside. I could see a definite advantage doing that but I, so far, haven't seen it.	D-Limits to transportation on land (rail, road)

ID	Quotation Content	Codes
9:134	<p>SP2: What about transporting goods? Do you think the demand for that will change? SP1: I would say yes. SP2: Do you think it will decrease or increase? SP1: Increase. SP2: And what drives this increase? SP1: Population demand for goods. SP2: You think the demand for goods will increase and that leads to an increase in transport of goods on water? SP1: Yes, I think just the fact the city's going to continue to grow and the demand is going to continue to increase, I just think there's going to be increased need for transporting goods. SP2: Does it mean more intense use of the existing lines or will there be new routes? What do you expect? SP1: Increase of the existing lines. SP2: And that is mainly the international transport going through the International Port of Toronto or is there also a local transport of goods? SP1: I think both. SP2: Do you have any examples of local transport? SP1: No, I don't have any personal examples of that. I just think there will be an increase overall, just whatever is currently being transported, like you've talked about it before, I know there's demand whether it's aggregate, I know you said sugar, too, that's Redpath sugar, but I continue to see that demand continue. SP2: Is it because the population needs more goods or because of the population growth? SP1: Because of population growth. SP2: How certain are you of this increase? SP1: Somewhat certain</p>	U4-Transporting goods
9:136	I just think there will be an increase overall	T-Increase
9:137	Because of population growth.	D-Population growth
9:138	Somewhat certain.	C-Somewhat certain
9:139	<p>SP2: The final one. Do you know if water is being used as a barrier? SP1: As a barrier. Do you mean like a physical barrier? SP2: Yes, like keeping people in or out, for example, or animals or anything else? SP1: Used as a physical barrier? Interesting. No, actually I don't know but it's a great question. I like that question. I've never thought of that. That's a very good question. Who came up with that question? Was it you? SP2: Yes, well, I made this list mainly based on water management and ecosystem services literature and, of course, also what I find in-, SP1: Have you seen any? What have you come across? I'm just curious. What did you come across? Did you see any examples of barriers? SP2: Not in Amsterdam and Toronto at the moment, but many people point to the historic use of water as a barrier in Amsterdam. We have, I don't know the word for that, but there used to be this infrastructure for wartime to keep people out of the Amsterdam region. SP1: Oh ja? SP2: And you could think of-, I mean, like the old idea of a castle with a canal around? SP1: The moat and you put the drawbridge down over the moat so you could cross over. It's interesting. SP2: So, that kind of thing you could think of around a prison maybe? SP1: Interesting. No, not aware of the use of water as a barrier. But that's a great question. I like that question. SP2: Do you have any ideas about the future? SP1: Yeah, I need to ask a lot more questions moving forward! For the future, again, I don't know. That one just kind of caught me off-guard. I haven't really thought about water as a barrier. No, that's a good one. The only thing I can see is we get a lot of people, like, Toronto is the largest city of its kind; we have the most multi-cultural in the world. I think something like 40 percent of all people living in Toronto have been in the country less than four years. SP2: So? SP1: So there's a lot of problems with people not knowing how to swim, and it's a big problem in Ontario but a lot of people come here and they don't know how to swim and they don't learn how to swim. So I can see that as a barrier. A problem is people not knowing how to swim is a big, big issue. But that's sort of the opposite side of it. The water is the</p>	U4-Using water as a barrier
9:140	<p>No, not aware of the use of water as a barrier. But that's a great question. I like that question. SP2: Do you have any ideas about the future? SP1: Yeah, I need to ask a lot more questions moving forward! For the future, again, I don't know. That one just kind of caught me off-guard. I haven't really thought about water as a barrier. No, that's a good one</p>	No information
9:141	putting a wetland in at the bottom end of the Don	D-Remediation Plans
9:142	I don't know. The answer is: I don't know.	No information
9:143	Just because of the cost of the municipal drinking water system and the cost of energy; I think they're going to be looking at ways of reducing it.	D-Cost saving ambitions

ID	Quotation Content	Codes
9:144	And as the climate warms and Toronto gets warmer in the summer, I actually can see that more people will be swimming because the water will likely get warmer.	D-Temperature increase due to climate change
9:145	I think as the waterfront gets revitalised with a mix of building and natural settings, you'll see more pathways being put in and TRCA will be overseeing a lot of that.	D-Redevelopment close to water
9:146	as the city expands, the golf clubs are going to disappear	D-Urbanization/land use change
9:147	<p>and the farmlands are going to disappear so the number of extractions will likely reduce. SP2: You think agriculture and golf clubs will be reduced because of the development of the city? SP1: That's right. SP2: What does this mean for the demand for water extractions for golf courses and for agriculture? Do you mean they will decrease as well or are there reasons to expect that will go the other way? SP1: No, that's what I'm saying. Agriculture, I personally think, will absolutely reduce as the urban frontier expands and as urban areas continue to swallow up prime real estate for agriculture, agricultural land is disappearing in the greater Toronto area. I mean, as the urban development continues outward, you'll see less and less need for irrigation for farmlands because they won't exist anymore. The farmers are getting older and their children don't want to farm the land and that land is now worth a fortune for development, so a farmer who probably doesn't have children that want to take it over, and he's not going to sell it to another farmer to take it over, he'll likely sell it and take that money and live on it quite comfortably for him/her and their family. I definitely see a reduction in the irrigation consumption just because of that. SP2: How certain are you of that? SP1: I'd say reasonably certain. SP2: Somewhat certain or very certain? SP1: I'd say somewhat certain. I should say very certain but I'll say somewhat certain. I'm not an expert. I'm not in the planning side. I grew up in the city and I see it happening.</p>	U1-Water extraction for irrigation of food crops or livestock watering
9:148	that land is now worth a fortune for development, so a farmer who probably doesn't have children that want to take it over, and he's not going to sell it to another farmer to take it over, he'll likely sell it and take that money and live on it quite comfortably for him/her and their family.	D-Land Value Increase
9:149	<p>On the other side, the golf club, what the lawsuits were about was the erosion of water quality and the lack of water quantity. These were two factors that the lawsuits were about. I know one of the settlements was they would be allowed to supplement with municipal water - but the challenge there is you can pump the water out of the Humber River or out of the Rouge River and you don't have to pay for that, but if you use municipal water, you've got to pay for that. So that was part of the challenge: if the golf club was going to start using municipal water, sure, it's nice, clean water but then you're paying an arm and a leg for it if you're using it for irrigation purposes for 18 holes, right? That's a big chunk of land, probably 10 acres or more. SP2: Sorry, sometimes I don't completely understand. So the golf clubs were forced to use municipal water or did they decide by themselves to do that? SP1: They negotiated. I was part of the lawsuit and it looked like they were going to shift over to using some of the water from the municipal drinking-water system, so they would supplement. Some of the water would be re-used from the Humber and the Rouge – I was dealing with the one on the Humber so that particular one, they had looked at negotiating a price for the municipal water. SP2: Ja, because the water quality wasn't good enough and that's why they didn't- SP1: And the quantity. SP2: And the quantity as well. SP1: Don't forget, as you urbanise, the water runs off faster. SP2: So because there were constraints to the water quantity and quality then they were kind of forced or motivated to look at the municipal water system as an additional source? SP1: That's right. SP2: What do you expect for the future? Do you think their demand for surface water for irrigation will change? SP1: I suspect it will as they start developing more and more, let's say, grasses that are hardier and can survive on less water. I just think that development in terms of plants and their ability to live longer with less water and live through harsher winters, and that type of thing, I just think science is just going to continue to improve, so I think there will be a reduction. I'm somewhat certain. SP2: Is there any other non-agricultural irrigation? For example, irrigation of gardens or public green or parks? Do you know about that? SP1: No, I don't know. It wouldn't surprise me, but I don't know. Just so you know, in the province of Ontario, if you extract more than 50,000 litres a day, you have to get a permit to take water. That would be the only way you would know, if they're taking more than 50,000 litres a day. That information would be available but anything less than 50,000ℓ a day, you probably wouldn't know. SP2: Ja, the permit use is documented in the TRCA reports, in the watershed, state of the watershed reports but like you say, if it's smaller than that I don't think it's documented anywhere. I have the same problem in The Netherlands, of course</p>	U1-Water extraction for irrigation of other vegetation



ID	Quotation Content	Codes
9:150	And I will say the ministry at the provincial level, we are promoting, like we want people also get into the habit of water re-use, so capturing water for the purpose of re-use, so toilet flushing and irrigation systems for gardens, that type of thing, we are encouraging that. Actually included in our Ontario Building Code now, there is something for that, so it's covered in each home to put in a water tank and you can actually do that. So there have been steps in that direction but how many people are doing it, and all of this,	D-Water use efficiency
9:151	and the warmer weather could trigger algae blooms more frequently. So the question really comes down to which way that's going to go? The algae blooms happen because of a mix of nitrogen and phosphorous, so depending on what the nitrogen and the phosphorous and the temperature, those three factors play a big role in terms of algae blooms. So climate change could result in more algae blooms in the future	Db-Water quality deterioration/salinization
9:152	If we get increased algae blooms, I can see someone harvesting and then actually re-using it somewhere for something. SP2: Like compost? SP1: Compost, exactly. Or even something else that one hasn't considered yet. I was trying to think where it was, but in Venice, they actually collect the seaweed and they dry it and burn it and create electricity. SP2: So if I understand you correctly, you think the demand may increase and a major driver for this would be climate change that possibly leads to more algae blooms which have to be removed and then maybe someone will think of a way to re-use it. Is that correct? SP1: Exactly. That's correct. I can see an economic model for the re-use to try and offset the cost of removing it.	D-Circular economy/re-use of waste streams ambitions
9:153	I could see that type of thing maybe where the mouth of the Don is going to be cleaned up and all this contaminated soil, I know there was a potential opportunity there for that type of situation: How could we take that contaminated sediment and re-use it as opposed to land-filling it? How could it be re-used? So I could see that as a potential.	D-Circular economy/re-use of waste streams ambitions
9:154	because I don't think that there's enough, I think there's a better economic plan for the wastewater re-use for creating electricity or reducing your electrical cost than I do see for the surface water. I just don't see how pumping surface water to your building would be worth your while; you're going to need to use electricity to pump it to the top whereas the wastewater would be coming directly from your building right there. So I actually just see the energy demand being much higher from pumping surface water.	D0-Potential capacity is too small to be relevant
9:155	It's actually driven by provincial policy that says you should be doing a treatment train approach as opposed to just conventional storm sewer and pipe facilities. We actually had an interpretation bulletin that was put out by our ministry that actually said: The ministry is actively seeking to move towards a treatment train approach and not just strictly end of pipe treatment. SP2: And why do they prefer that? SP1: Because we think we will be mimicking the hydrologic cycle better. We will actually be infiltrating more water into the ground and we will be able to actually end up with a cleaner water quality overall by going through a treatment train approach as opposed to an end of pipe facility	D-Ambition to increase the low impact development
9:156	I just don't think that would be something people would be allowing.	Db-Regulations don't allow the use
9:157	Somewhat certain.	C-Somewhat certain
9:159	I think as the city of Toronto continues to separate its combined sewers and continue to build capacity for improving on their ability to treat that combined sewage; they put in a big tunnel, they built a really big tunnel to capture some of this. SP2: I read about that. SP1: Actually, Dr James Lee, Darko's colleague, he knows a lot about that. But there were some major problems with it which were not put in the paper but there were some really bad design considerations in there. But there was a second tunnel built which I think went much better.	D-Stormwater management
9:160	The amount of water, quite frankly. I just don't think the rivers are big enough to support that type of activity. I don't think people will want motorboats in there. Sailing? Maybe, but even sailing, most people sailing on a river is not really-, most people sail on the lake. They might sail at the mouth of the river or a little bit up the river from the mouth but that would be about it.	Db-Water quantity not sufficient
9:161	Very certain	C-Very certain

Interview coding for FW-3

FUNqyWATER code name: respondent W9 (SP2)

interview date 1 October 2019

interviewer Suzanne van der Meulen (SP1)

transcript by Uitgetypt and Suzanne van der Meulen

Information that has been removed to prevent identification of the respondent is indicated with [...].

Table 5: Current Use FW-3

ID	Quotation Content	Codes
10:148	a way of conveying our storm sewers	CU2-Managing water quantity
10:149	there's some fisheries	CU3-Recreational fishing
10:150	It's recreational in some areas	CU3-Primary contact recreation CU3-Recreational boating CU3-Secondary contact recreation

Table 6: Future Demand FW-3

ID	Quotation Content	Codes
10:1	<p>If we start with the first section: Production use functions: this relates to goods we can retrieve from the water system. If we start with nutrition, I think the obvious form for this is the consumption of fish from the surface water system. I found there's some sport fishing going on in Toronto's rivers, ponds and in Lake Ontario. I don't have specific numbers for the consumption of this local fish but I know other studies in the Great Lakes area reveal there's consumption of lake fish. I also found there are commercial and regional fisheries but that's mostly concentrated for outside Toronto in the north-east part of Lake Ontario. Do you recognise this or do you have other information?</p> <p>SP2: It's true, it's sports fishing. I'm not aware of that other commercial fishing, but, yes, sports fishing in the lake especially during the spawning season for salmon, so there is some fishing at that time.</p> <p>SP1: What do you expect for the future? Do you think the demand for catching fish and consume it will change? Will it decrease or increase, or do you think it will stay the same?</p> <p>SP2: It will say it either stay the same or increase. If we do clean up the lake as the goals of the city and other people around the province and around the lake, I think people will want and be willing to eat the fish more because a lot of people-, some people don't even want to drink tap water.</p> <p>SP1: It's about cleaning up the water? Is that what you mean?</p> <p>SP2: It's cleaning up the water, it's also having the residents being confident the water's clean. It's not so much just cleaning it, they have to be confident that it is clean.</p> <p>SP1: So you think it will stay the same or increase, and the reason is if we clean up then people may be more willing to eat it.</p> <p>SP2: Yes, because you know local sourcing, seeing the whole idea of not buying goods from far away, I think that's going to happen more.</p> <p>SP1: You think that's another reason why it may increase?</p> <p>SP2: Yes, that may increase.</p> <p>SP1: How certain are you of this trend that it stays or it increases? I will ask this every time and every time I would like to know four categories: Are you very uncertain; somewhat uncertain; somewhat certain; or very certain?</p> <p>SP2: Somewhat certain.</p>	U1-Fishing for consumption purposes
10:3	Somewhat certain.	C-Somewhat certain
10:6	<p>P1: Is there any catch of other animals from the surface water system other than fish?</p> <p>SP2: For consumption? Not that I'm aware of.</p> <p>SP1: Do you have any idea whether the demand for this will change in the future?</p> <p>SP2: That I do not know.</p>	U1-Catch of other aquatic animals for consumption
10:7	<p>Not that I'm aware of.</p> <p>SP1: Do you have any idea whether the demand for this will change in the future?</p> <p>SP2: That I do not know</p>	No information



ID	Quotation Content	Codes
10:8	<p>SP1: Is there harvest of aquatic plants or algae for consumption?</p> <p>SP2: I'm not an expert on this one. I doubt algae. Aquatic plants? There used to be water cress people would pick but I'm not sure whether they still do that anymore.</p> <p>SP1: They used to harvest water cress?</p> <p>SP2: Yes, going on 30 years maybe. I don't know about today.</p> <p>SP1: Do you know where they harvested it?</p> <p>SP2: It was usually at the end of a storm source but these days I don't know. I doubt they do that anymore.</p> <p>SP1: What do you expect for the future towards 2040? Do you think the demand for this will change?</p> <p>SP2: I don't think so.</p> <p>SP1: Do you think it will stay the same?</p> <p>SP2: I think it will stay the same. I think it's just that people are not aware of it or how to do it.</p> <p>SP1: How certain are you it will stay the same?</p> <p>SP2: I am not very certain. Somewhat uncertain.</p>	U1-Harvest of aquatic plants or algae for consumption
10:9	I am not very certain. Somewhat uncertain.	C-Somewhat uncertain
10:10	<p>I don't think so.</p> <p>SP1: Do you think it will stay the same?</p> <p>SP2: I think it will stay the same</p>	T-No change
10:11	SP2: Yes, because you know local sourcing, seeing the whole idea of not buying goods from far away, I think that's going to happen more.	D-Local food trend
10:14	<p>SP1: Also in the category of nutrition, surface water can be extracted for drinking water production. I know this is the case in Toronto that drinking water is primarily drawn from Lake Ontario but also to a smaller extent from the Humber River.</p> <p>SP2: Yes, the lake will be the main source. I didn't think there was anything from Humber. I know we have a plant near Humber but I didn't think we were drawing it directly from the Humber.</p> <p>SP1: Do you know how I could find out about it?</p> <p>SP2: I can find out. I can double-check because we have the Clark. The Clark Plant is the closest to the Humber River. The Clark, the R.C. Harris and Toronto Island are the three major water supply plants that we have.</p> <p>SP1: Yes, it would be nice to know. I must say, I have this information from a state of the watershed report of TRCA, but it's already from 2008, so maybe something changed there?</p> <p>SP2: Yes. I'm not aware of the Humber water treatment plants. I could be wrong because I generally don't deal with the plants themselves. I can confirm.</p> <p>SP1: What do you expect for the future? Do you think the demand for using surface water for drinking water production will change?</p> <p>SP2: I do not think it will change. I think it will remain the same. I've very confident on that.</p> <p>SP1: Very confident or somewhat?</p> <p>SP2: Very confident. The demand is very high. The densities we have right now, rainwater would not be sufficient and our aquifers are deep aquifers. It's just the way the urbanisation is done that it's much more economically feasible to take it from the lake.</p> <p>SP1: But the lake is also surface water.</p> <p>SP2: Yes, so it will remain the same.</p> <p>SP1: Why do think it's not changing?</p> <p>SP2: Why do I think it will not change taking water from the lake?</p> <p>SP1: No, sorry. I mean there's a certain demand now for drinking water from lake water. Do you think this demand will change?</p> <p>SP2: Oh demand. I thought you meant source. Apologies. The demand will increase over time with population.</p> <p>SP1: Because of the population growth?</p> <p>SP2: Because of population growth. Our water efficiency is getting better so we are decreasing the per capita consumption, but you can only go down so much, and we do have a big population growth in the Toronto area.</p> <p>SP1: So that will overrule that?</p> <p>SP2: It will overrule that, yes. Our plants are not in bad shape in terms of the ability to do it but the overall demand will increase mainly for population.</p>	U1-Water extraction for drinking water production
10:15	The demand will increase over time	T-Increase
10:16	<p>The demand will increase over time with population.</p> <p>SP1: Because of the population growth?</p> <p>SP2: Because of population growth. Our water efficiency is getting better so we are decreasing the per capita consumption, but you can only go down so much, and we do have a big population growth in the Toronto area.</p> <p>SP1: So that will overrule that?</p> <p>SP2: It will overrule that, yes. Our plants are not in bad shape in terms of the ability to do it but the overall demand will increase mainly for population</p>	D-Population growth
10:17	<p>I've very confident on that.</p> <p>SP1: Very confident or somewhat?</p> <p>SP2: Very confident. The demand is very high</p>	C-Very certain



ID	Quotation Content	Codes
10:18	<p>SP1: If we look at other materials that can be extracted from the water system – water extractions for other purposes than drinking - for example, agriculture, agricultural use in the form of irrigation or livestock watering, again, there's a report from 2008 that says that Humber water is used for agricultural use. That actually is what I could find. Do you have more information about the use of surface water for agriculture?</p> <p>SP2: I'm not aware of that report or I'm not sure of that part. Agriculture, the Humber is quite a long river so the agricultural requirements could be north of the city. Within the city itself, I cannot speak on the agricultural use from Humber. I do know we still have some especially in the Scarborough area there's some farmland that may still be for agricultural use. I think it depends. We do have people putting in community gardens and, therefore, locally growing vegetables so there is a demand for water from there. As we move forward, if there is an increase in urban agriculture then there will be an increase in water consumption for urban agriculture.</p> <p>One of the works I'm trying to do as new developments come in, I'm encouraging them to use storm water, but storm water still is not enough so even if we have a rooftop garden, we would still need city water to help with that for that agricultural use.</p> <p>SP1: What do you mean by city water? Is that municipal drinking water or surface water?</p> <p>SP2: It's municipal drinking water which is from surface water, hopefully.</p> <p>SP1: To go back to agriculture, you say: I'm not sure if there's a lot of agriculture within the city, maybe it's more to the north.</p> <p>SP2: To the north, possibly north-east of the city where it's not fully developed yet. We still have farmland and undeveloped land in the north-east side of the city.</p> <p>SP1: All in all, what do you think about demand for using surface water for agriculture? Do you think it will change towards 2040?</p> <p>SP2: I think it may. There's a possibility it will increase due to urban agriculture.</p> <p>SP1: May increase. How certain are you of this increase?</p> <p>SP2: I'm relatively certain on that one.</p> <p>SP1: Somewhat certain or very certain?</p> <p>SP2: Somewhat certain.</p> <p>SP1: So that's mainly related to community gardens.</p> <p>SP2: Yes. It's my work. As I said, I deal with the Toronto green standards so I work with our energy and environmental group who help to advocate urban green roofs, bees and increase in bee population and biodiversity, things like that. As I said, I work with the gardening community if they want to look at how to get water to their gardening plots where they grow more vegetables</p>	U1-Water extraction for irrigation of food crops or livestock watering
10:19	There's a possibility it will increase due to urban agriculture.	T-Increase
10:20	<p>I'm relatively certain on that one.</p> <p>SP1: Somewhat certain or very certain?</p> <p>SP2: Somewhat certain.</p>	C-Somewhat certain



ID	Quotation Content	Codes
10:22	<p>As I said, I deal with the Toronto green standards so I work with our energy and environmental group who help to advocate urban green roofs, bees and increase in bee population and biodiversity, things like that. As I said, I work with the gardening community if they want to look at how to get water to their gardening plots where they grow more vegetables.</p> <p>SP1: If we look at irrigation with other vegetation, so maybe parks, golf courses, gardens, I found that water from the Humber is being used for this and some water from Don and Rouge.</p> <p>SP2: I can see golf courses using surface water for irrigation. I'm not sure about our parks because there are some concerns about the quality of water, but I see the golf course using that.</p> <p>SP1: So that's still the case. Do you think the demand for this type of irrigation, so non-agricultural irrigation, will change?</p> <p>SP2: Do you mean for the parks?</p> <p>SP1: Parks or golf courses.</p> <p>SP2: Golf courses, I don't have data but I've been told demand is starting to decrease.</p> <p>SP1: Decrease?</p> <p>SP2: Yes, we see once all the baby boomers retire, I don't know whether that's going to be true. In terms of the parks, we're trying to build more parks. At the same time, however, one of the movements we're trying to push it to use more storm water to water the parks so there may be a slight increase for municipal water from the parks but hopefully that will not be a big increase overall.</p> <p>SP1: That's municipal drinking water but if we look at the use of surface water, do you think surface water will be extracted to irrigate the parks?</p> <p>SP2: Runoff will be harvested to irrigate the parks.</p> <p>SP1: So no extractions from ponds, lakes or rivers?</p> <p>SP2: No, I don't see that.</p> <p>SP1: So that's not used now and it stays the same, do you mean?</p> <p>SP2: Yes, I think it will stay the same.</p> <p>SP1: For golf courses, you said it may decrease. Why do you think it may decrease?</p> <p>SP2: Because apparently golfing isn't as popular as it used to be.</p> <p>SP1: So popularity is declining.</p> <p>SP2: It could be declining but there is, especially some of the industrial world, there's a lot of people retiring so who knows, maybe it will be picking up. I don't have enough, I'm not an expert in that area so I can't really say too much. That part, I'm somewhat uncertain.</p> <p>SP1: Somewhat uncertain?</p> <p>SP2: Somewhat uncertain for that part.</p> <p>SP1: For parks where you say there won't be a change in demand for surface water for that, how certain are you of that?</p> <p>SP2: I'm somewhat certain there will be some increase in that.</p> <p>SP1: Some increase? I thought you said no change. Not a change in surface water.</p> <p>SP2: There will be some. I guess the term 'surface water,' if it's directly from the lakes and rivers, no. From storm water management ponds, yes. Some ponds we may do that. The issue is going to be: How it's going to be done? That's more of technique than actually whether it's going to be extracted from our storm water ponds.</p>	U1-Water extraction for irrigation of other vegetation
10:24	I don't have data but I've been told demand is starting to decrease.	T-Decrease
10:25	<p>That part, I'm somewhat uncertain.</p> <p>SP1: Somewhat uncertain?</p> <p>SP2: Somewhat uncertain for that part.</p>	C-Somewhat uncertain
10:27	I'm somewhat certain	C-Somewhat certain
10:28	there will be some increase in that.	T-Increase
10:30	<p>SP2: Because apparently golfing isn't as popular as it used to be.</p> <p>SP1: So popularity is declining.</p>	D0-Popularity declines
10:32	<p>SP1: What about industrial water? Is surface water being extracted for industrial use?</p> <p>SP2: From the city of Toronto, I cannot speak on that. I know outside of Toronto there was extraction. In most cases, most of our industry is using municipal water.</p> <p>SP1: Do you have any idea about the future? Do you think the demand for surface water extractions for industry will change?</p> <p>SP2: I don't think it will change. I'm somewhat certain on that.</p> <p>SP1: Why do you think it will not change?</p> <p>SP2: We don't have as much industry anymore. We're still trying to keep the industry, and industry will want to decrease water use, where possible. So, we're not a growing industry. We're not having increases in industry in the city, let's say, so we're just trying to keep what we have.</p>	U1-Water extraction for industrial processes
10:33	I don't think it will change	T-No change
10:34	I'm somewhat certain on that.	C-Somewhat certain



ID	Quotation Content	Codes
10:36	<p>SP1: What about firefighting? Is the surface water used for firefighting?</p> <p>SP2: I know our exhibition place used to use lake water for some of the buildings for firefighting. In terms of the newer buildings using lake water for firefighting, at this point, no. Will that change? I am not certain on that one. I don't think it will change, I'm somewhat certain on that one.</p> <p>SP1: Why do you think it will not change?</p> <p>SP2: Because it would require an investment in infrastructure to change our system, so from an overall city standpoint I don't see a change. There could be a possibility in some of the newer developments along the waterfront because it is closer to the lake.</p> <p>SP1: Yes, but overall you think it will not change?</p> <p>SP2: Yes.</p> <p>SP1: You said it is being used in some buildings, in the exhibition place?</p> <p>SP2: Yes, I believe they have some. It's one of the older buildings that was built and I'm not sure whether it still does. This is going back about 10 years ago when they were doing that but they may not. I know they use the lake water to help with some of their toilet flushing but it's not consistent.</p> <p>SP1: Do you know if I could find any documented information about that somewhere?</p> <p>SP2: I don't think it's documented. I can check. Somebody had a tour a couple of months ago and they talked about it then.</p> <p>SP1: Yes, it will be interesting to know because I didn't find any information here.</p> <p>SP2: I can try to get you a contact.</p> <p>SP1: Yes, that will be great.</p> <p>SP2: I'm involved in a group looking at onsite use of sewage, black water, so we're not as advanced as The Netherlands on that part.</p>	U1-Water extraction for fire fighting
10:37	. I don't think it will change	T-No change
10:38	I'm somewhat certain on that one.	C-Somewhat certain
10:39	<p>Sometimes the surface water is also used to fill other surface water bodies like filling ponds. I know, for example, in Don watersheds, the water from Don River is extracted and used as a source for filling aesthetic ponds or fish ponds, and in the Humber there's some filling of aesthetic ponds with river water, also in Rouge. Again, this is information that's around 10 years old so I'm not sure if it's still taking place. Do you know more about that?</p> <p>SP2: I don't know about that but if it was taking place before it's most likely still happening.</p> <p>SP1: What do you expect about the future? Do you think demand for this will change?</p> <p>SP2: I really can't comment about knowing those, where they are and why.</p>	U1-Water extraction for filling ponds
10:40	I really can't comment about knowing those, where they are and why	No information
10:41	Because it would require an investment in infrastructure to change our system,	Db-High costs
10:42	<p>SP1: Are there any other extractions for non-drinking purposes?</p> <p>SP2: From surface water? Not that I'm aware of.</p> <p>SP1: Do you have any information about future demand for other extractions?</p> <p>SP2: No, I'm not aware of any. I don't see any future extractions for non-drinking purpose.</p>	U1-Water extraction for other non-drinking purposes
10:43	<p>Actually, I'm sorry, I should back up. For a non-drinking purpose, we do. In actual fact we do. We have our Enwave system and they're extracting lake water in producing steam and heating some of the buildings. That's for steam. Then they also extracting - well, they're not extracting, they're using part of our water supply system and using it for cooling some of our buildings.</p> <p>SP1: Yes, I found that, too. It's very interesting.</p> <p>SP2: So it's only through this one company. We wouldn't do it for individual buildings but they basically have a non-contact system that extracts, uses the cold water, taking that to a lower temperature to cool buildings with it. It's mainly downtown.</p> <p>SP1: You started with: They also use steam but then you're not sure. Are they also using steam?</p> <p>SP2: I think it's a separate system. They also extract lake water and turn it to steam to heat some of the buildings so it's a centralised heating system.</p> <p>SP1: I didn't know that. I only found out about cooling. Okay, so also heating?</p> <p>SP2: Yes. The steam, I just found out about a year ago, within this one year, too. I knew that we did have steam systems but I thought they were starting to disappear. They were using municipal water but they've switched to lake water. There was some talk about trying to use storm water, well, there's other issues with that.</p> <p>SP1: Okay, it's nice to know. So they use this thermal energy from the water. Do you think demand for this will change towards 2040?</p> <p>SP2: I believe towards 2040 it will increase. I'm confident of that because I know the parklands [or portlands?] are in discussion as we have new developments along the lake, they are in discussion on building more of this type of infrastructure.</p> <p>SP1: You say: I'm confident. Are you somewhat confident or very confident?</p> <p>SP2: Very confident that they will increase. How much increase, that I cannot say but there will be some increase.</p> <p>SP1: And the reason is you know there are new development plans in which this is included?</p> <p>SP2: There's discussion on that. Will it go 100 percent or not is another story but there will definitely be some. And that company's expanding to include more buildings as we speak for the existing buildings, too. I'm talking of existing buildings.</p>	U1-Thermal energy extraction

ID	Quotation Content	Codes
10:44	I believe towards 2040 it will increase	T-Increase
10:45	Very confident that they will increase. How much increase, that I cannot say but there will be some increase.	C-Very certain
10:46	I'm confident of that because I know the parklands [or portlands?] are in discussion as we have new developments along the lake, they are in discussion on building more of this type of infrastructure.	D-Redevelopment close to water
10:47	<p>SP1: We talked about water extractions, are there any other materials extracted from the surface water system? This can be biomass for non-food purposes like water plants or algae for non-food products. Do you know if that's taking place?</p> <p>SP2: No. I could imagine. I was out in the west coast of Canada and they were talking about kelp, things like that. I don't think we have that at this time. Is it possible in the future? I won't rule it out but this time I cannot say. I'm not an expert in that area.</p> <p>SP1: So no info on that.</p> <p>SP2: No info. If you wanted a guess, I'd say yes but that's a guess.</p> <p>SP1: The guess would be yes, it increases?</p> <p>SP2: Yes, my guess I'd say there's a possibility of increase.</p> <p>SP1: Why do you think it could increase?</p> <p>SP2: It's just people are more aware of environmental issues, trying to grow local sources of goods.</p> <p>SP1: How certain are you of this guess?</p> <p>SP2: I'm not certain on that one. It's a guess.</p> <p>SP1: Is it very uncertain or somewhat uncertain?</p> <p>SP2: Somewhat uncertain.</p>	U1-Harvest of biomass for non-food purposes
10:48	Yes, my guess I'd say there's a possibility of increase.	T-Increase
10:50	Somewhat uncertain.	C-Somewhat uncertain
10:51	<p>SP1: Is there any extraction of abiotic materials like sands, clay or maybe other material?</p> <p>SP2: No, we don't extract sand or clay, not from the bodies of water.</p> <p>SP1: Do you think the demand for this will change in the future?</p> <p>SP2: That I cannot say. I know we are doing a lot of siltation removal as part of our Don River works.</p> <p>SP1: What removal? Sorry.</p> <p>SP2: De-silt the silt in the rivers. That's more maintenance and that is something I don't believe will be as regular. It's part of operations requirement.</p> <p>SP1: Do you have any information about the future demand for abiotic materials from the water system?</p> <p>SP2: No, I don't.</p>	U1-Extraction of abiotic materials
10:52	<p>SP1: Do you have any information about the future demand for abiotic materials from the water system?</p> <p>SP2: No, I don't.</p>	No information
10:53	<p>SP1: We've already discussed the thermal energy. I didn't find any examples but do you know if there's energy production going on by using osmotic processes like using the salinity gradient to produce energy?</p> <p>SP2: No, I don't. Not that I'm aware of.</p> <p>SP1: No, me neither. Do you think the demand for this will change?</p> <p>SP2: I don't think it will change. I'm somewhat confident on that. We don't have that much of a change in salinity unless somebody figures a way to take the salty road water to do it, runoff, and that would not be consistent, too, so I don't think it would work.</p>	U1-Energy production by using the salinity gradient in water
10:54	I don't think it will change	T-No change
10:55	I'm somewhat confident on that	C-Somewhat certain
10:57	<p>SP1: What about using kinetic energy like wave energy, tidal energy, hydropower, dams in rivers? I didn't find any information about that but do you know if this is taking place in Toronto?</p> <p>SP2: We used to have mills in a lot of rivers but those are very old, several hundred years ago, maybe even 100 years ago, but I'm not aware of that type of work along the rivers. Wave energy from the lake, I don't have enough information. Is it out of the question? I don't think it's out of the question depending on the technology. I'd be somewhat uncertain about that use. The technology itself is relatively new, wave energy. There are not that many installations around the world yet, so 40 years from now? Possibly.</p> <p>SP1: But if we look at 2040, what do you think about demand for this in Toronto?</p> <p>SP2: I'd say there could be an increase in that but I'm somewhat uncertain about that because I'm not an expert on the wave action that goes in or the amount of flows that go through the system. Both rivers Humber and Don have a steady flow going through that's the base flow, so there's that energy coming through, but I'm not aware of the technologies to say whether that would be sufficient to have an alternative, sustainable system.</p> <p>SP1: You say it may increase. What do you think what would be the driver of this increase?</p> <p>SP2: Energy costs. We do have the nuclear plants but I'm not aware of the age of them and the renewal systems. There's an increase in demand of electricity for the city as the city grows, that's why I think there will be a demand for this type of energy.</p> <p>SP1: If you say the city grows, do you mean the population growth or do you mean something else?</p> <p>SP2: Population growth.</p>	U1-Energy production by using kinetic energy of water



ID	Quotation Content	Codes
10:59	I'd say there could be an increase in that	T-Increase
10:60	but I'm somewhat uncertain about that because I'm not an expert on the wave action that goes in or the amount of flows that go through the system	C-Somewhat uncertain
10:61	SP2: Population growth.	D-Population growth
10:62	There's an increase in demand of electricity for the city as the city grows, that's why I think there will be a demand for this type of energy.	D-Electricity demand increases
10:63	<p>SP1: Let's move onto the next category which is a short one. This is a category of regulation and maintenance use functions. These are more processes we can use. The first one is managing water quality and I need to explain it a little bit. In a surface water system, there are processes taking place that can improve water quality like dilution or degradation of pollutants, they're just taking place, but what I mean here: Is there an intentional use of the surface water system to improve water quality? This may be, for example, by using surface water to flush other water to make it cleaner but also the use of the storm water ponds. I found there</p> <p>are many storm water management ponds in the different watersheds and, of course, intended for water quantity management but I read that some of them are also being used for water quality management. Again, a lot of the information is pretty old. What do you know about how surface water bodies are used to regulate water quality?</p> <p>SP2: Water quality requirements for new development came in the early 1990s so that's for the province not just Toronto. The ability to do that has been increasing over time as we learn more how to do it. I remember when it came out, nobody knew what to do so we're actually in discussion with the Ministry of Environment, Conservation and Parks, and they are interested in controlling the water quality in the province. It's something that would not happen overnight and they want more increase in the water quality of storm runoff into the rivers and lakes, even also into the aquifers. I'm very confident we are going to see an increase in managing water quality by 2040.</p> <p>SP1: You say we want to improve water quality but is there also an increase in demand to use surface water like storm water ponds or other parts of the surface water system to help improve water quality?</p> <p>SP2: Yes, there is. As I mentioned earlier, the pilot project I worked on, called The Queensway, is one where we are using surface water to improve quality and helping to grow trees. Our forestry and transportation departments after ten years are finally getting very, I wouldn't say excited, but they're very interested in expanding that concept in a city to help clean water and grow trees at the same time, so I see that has one of the demands are parks is, as I said, again working on storm water. One of the concepts is if we can use that water, which is a vector for conveyance of pollutants into rivers, if we do not convey that pollutant to the rivers then we're not increasing pollutants into the river and lakes. This de-systems they just don't simply trap those pollutants, in most cases they will break down some of the greases, and our theory is that some of the heavy metals will be sequestered by the materials themselves, especially the trees.</p> <p>SP1: So is this mainly about water quality improvements in the soil system or also in the storm water ponds?</p> <p>SP2: First of all, we're building very few storm water ponds if any, and this would be increasing the water quality. If there are ponds, it could increase the water quality to the ponds and to other surface water bodies or surface water. At the same time, we're also doing roofs. We're encouraging green roofs, so once again, although we consider roof water relatively clean, we're trying to increase the amount of green roofs we have in new developments.</p> <p>SP1: Yes, so they try to store the rainwater.</p> <p>SP2: Yes, store.</p> <p>SP1: You say we are not building a lot of storm water ponds?</p> <p>SP2: Yes, because land is so expensive.</p> <p>SP1: Because it's expensive?</p> <p>SP2: That's right.</p>	U2-Managing water quality
10:64	we're building very few storm water ponds if any, and this would be increasing the water quality	T-Decrease



ID	Quotation Content	Codes
10:66	<p>SP1: Maybe that's a good link to the next function and that is managing water quantity. In reports from TRCA from 2007 and 2009, I found there were hundreds of storm water management ponds in Rouge and Don that were constructed, or that were proposed. I don't know if they've all be constructed in the last ten years?</p> <p>SP2: That I don't know. There will be proposals from developments not necessarily always the city. The city has done some work, as I said, in the Earl Bales Park areas so we are building some ponds and they're both for quantity and quality. We have operational – I guess that's the next one we'll get into – but I'm also exploring other ways to manage storm water, a new development through the green roofs for the roof systems and through the soil cell systems; we're looking at other technology within the road itself. Our basement funding program is also managing quantity to stop basin flooding so we're putting a lot of big pipes in the ground, too. So it's a combination of many of these things.</p> <p>SP1: I have an idea if I hear this but I want to know it from you, so what do you expect for the future? Do you think the demand for using the surface water system for water quantity management will change?</p> <p>SP2: I think it will increase.</p> <p>SP1: What is the drive for this increase?</p> <p>SP2: Urban flooding.</p> <p>SP1: More than now?</p> <p>SP2: Maybe rephrase. Just go over the question again to make sure we're-, I think water quantity management will increase to address our urban flooding and we're doing water quantity, or erosion control, within the river systems.</p> <p>SP1: What will be the main measures for this water quantity control? Does the surface water system play a role in that or will it mainly be targeted at measures on the land?</p> <p>SP2: It would be mainly in the land with some exceptions such as the change in the mouth of the Don River where we're expanding that, providing a new outlet.</p> <p>SP1: So when you look at the role of the surface water systems, or the measures you take in this system, will that also increase?</p> <p>SP2: I think so. We will look at quantity more. One of the plans is to re-urbanise some of our channels, rivers that have been channelized. That's a longer term goal we'll reach in 2040 hopefully. If we do that that will help with the flooding. As you know, channel water is always faster, it can cause more flooding much easier so we'd naturalise the quantity.</p> <p>SP1: How certain are you of this increase?</p> <p>SP2: Somewhat certain. And the reason I say that is our concentration has been on basement flooding right now and that's where a lot of money's going. We went from a \$1-billion program for wet weather flow to, I think it's about \$13 or \$16-billion for wet weather flow and that was mainly because of basement flooding works.</p>	U2-Managing water quantity
10:67	I think it will increase.	T-Increase
10:68	Somewhat certain. And the reason I say that is our concentration has been on basement flooding right now and that's where a lot of money's going.	C-Somewhat certain
10:69	One of the plans is to re-urbanise some of our channels, rivers that have been channelized. That's a longer term goal we'll reach in 2040 hopefully. If we do that that will help with the flooding. As you know, channel water is always faster, it can cause more flooding much easier so we'd naturalise the quantity.	D-Redevelopment close to water
10:70	<p>SP1: Is the surface water system being intentionally used for climate regulation, either influencing the global climate or influencing local climate?</p> <p>SP2: Global, no.</p>	U2-Global climate regulation by reduction of greenhouse gas concentrations

ID	Quotation Content	Codes
10:71	<p>Local adaptation, yes. SP1: How is the surface water system being used in this perspective? SP2: I'd say if we were changing the Don River, just building more capacity in the system or the way that we do it, to allow for continuation of flows. SP1: That's already happening? SP2: That's already happening. In terms of ponds, we're not there. Hopefully we'll get there The Netherlands idea of waterplazas. In Amsterdam, Rotterdam have them. I'd like to see more of that type of configuration being put into the city. We're still learning and there are very few people in the whole city that knows about it. SP1: This is mainly about water storage capacity right? SP2: That's correct. SP1: What about the influence on local temperature? Is water used for that? SP2: That's a very good question. One of our jobs, the pilot project I was involved in - and we've been unable to construct for other reasons - is to actually look at the temperature mitigation by use of porous materials and also the water stored underneath these porous materials to help decrease the ambient temperature to help cool the temperature of the water that goes into our rivers because we have a cold water fishery; also by encouraging the use of water for green infrastructure, especially for trees to grow, to increase the canopy of the trees which will, of course, help with overall ambient temperature in our city. SP1: Yes, that's mainly the idea of water infiltration and then it can contribute to the water cycle and cooling. SP2: Right. SP1: Are there also examples where surface water is being used to influence local climate or is it mainly through this infiltration? SP2: It's more evapotranspiration than infiltration, through vegetation so that would be in the trees and green roofs. Once again green roofs. In terms of cooling, in terms of taking that surface water and sprinkling, things like that, no, we don't have any plans for that. SP1: So you don't think there will be a change in the use of surface water directly to influence climate? SP2: No, not directly. SP1: Why do you think that will not happen? SP2: I think our public health would be very concerned about the quality of surface water and the bacteria, bacteria in terms of airborne, having disease and bacteria getting airborne. SP1: How certain are you that it's going to - , SP2: I'm somewhat confident that this would not happen unless we do something, and there's a lot of cost involved to do that. I've been sitting with the public health on exactly those topics for rainwater so they're already concerned about rainwater.</p>	U2-Local climate regulation
10:73	In terms of cooling, in terms of taking that surface water and sprinkling, things like that, no, we don't have any plans for that.	T-No change
10:74	I'm somewhat confident	C-Somewhat certain
10:75	<p>SP1: You said: We don't use the surface water system to influence global climate. Do you think that would change? SP2: I cannot speak on that one. It's beyond our scope at this point.</p>	U2-Global climate regulation by reduction of greenhouse gas concentrations
10:76	SP2: I cannot speak on that one. It's beyond our scope at this point.	No information
10:78	there's a lot of cost involved to do that.	Db-High costs
10:79	<p>SP1: I understand. Moving onto the third section, these are cultural use functions. They can either be physical or intellectual interactions with the water system or more symbolic or spiritual interactions. Most of these examples are recreation. If we look at the first one: Primary contact recreation, that includes swimming or diving, you already mentioned there are some Blue Flag beaches. I also found that there are 14 beaches along Lake Ontario and there's also swimming taking place at Rouge beach where the river joins Lake Ontario. Do you have any idea how the demand for this will change towards 2040? SP2: As I said earlier, if our water quality does increase I can see a higher demand. SP1: Do you expect this water quality increase to happen? SP2: I think in the long run in 2040 there would be some increase. How much of an increase, I'm not certain. All new development that comes into the city are supposed to provide water quality controls. The city is being re-developed as we speak, it's a slow rate but it is getting re-developed. Even our road works; when we put in new roads we're looking at quality control, some type of improvements in water. SP1: So you expect some improvement there? SP2: Yes. That's why I'm somewhat confident there will be an increase in quality of the overall system in 20 years. SP1: How certain are you this leads to an increase in the demand for swimming or diving? SP2: There's a demand for waterfront usage, it's increasing all the time. People just want that place to go and as long as that water quality's there that population-, And just generally population growth. Even if you had the same percentage of people going to the beaches there will be an increase because we have a population growth. SP1: How certain are you this trend in demand will increase? SP2: I'm very certain that demand will increase from pure population growth.</p>	U3-Primary contact recreation
10:80	I think in the long run in 2040 there would be some increase	T-Increase
10:82	I'm very certain	C-Very certain



ID	Quotation Content	Codes
10:84	And just generally population growth. Even if you had the same percentage of people going to the beaches there will be an increase because we have a population growth.	D-Population growth
10:85	All new development that comes into the city are supposed to provide water quality controls. The city is being re-developed as we speak, it's a slow rate but it is getting re-developed. Even our road works; when we put in new roads we're looking at quality control, some type of improvements in water	D-Water quality improvement
10:86	SP1: For secondary contact recreations, so things like kayaking or supping, activities where there is contact with the legs and the arms with the water. I've found some information about there is canoeing and kayaking at Rouge beach and also on Don River. Do you know more about this? SP2: Yes, in Rouge I'm not as familiar but I could imagine the Rouge would be a bigger demand. Once again, I would be very confident that would increase just as I said from an overall population standpoint, even if the percentage stays the same because of the growth in population we would have an increase in that demand. SP1: So just more people	U3-Secondary contact recreation
10:87	Once again, I would be very confident that would increase just as I said from an overall population standpoint, even if the percentage stays the same because of the growth in population we would have an increase in that demand.	D-Population growth
10:88	I'm somewhat confident it will stay the same.	C-Somewhat certain
10:89	There's a lot of sail boats out in the lake during the summer and I'm somewhat certain that will remain the same.	T-No change
10:90	we would have an increase in that demand.	T-Increase
10:91	The reason I say 'somewhat' is boating is not cheap. SP1: Why do you think it will stay the same? Why not a decrease or an increase? SP2: I think, as I said, there is a population growth so there could be an increase in population but with the cost I'm not sure whether that percentage will keep pace.	Db-High costs
10:92	SP1: What about fishing? We already talked about fishing in the context of nutrition, to consume the fish. I found there is recreational fishing at Lake Ontario and in the tributaries. SP2: I think that would either remain the same or increase. As I said, the population growth percentage, and people actually want to do more fishing that's something I can't speak of so I'm somewhat confident that would either remain the same or increase. SP1: Yes, due to population change. SP2: Yes.	U3-Recreational fishing
10:93	I think that would either remain the same or increase	T-Increase
10:94	I said, the population growth percentage, and people actually want to do more fishing that's something I can't speak of so I'm somewhat confident that would either remain the same or increase	D-Population growth
10:95	I'm somewhat confident	C-Somewhat certain
10:96	SP1: The hunting of other aquatic animals I didn't find any examples. It seems to be not allowed. Do you know more about it? SP2: No, I haven't heard about hunting other aquatic animals but I cannot speak on that one, I can only guess. SP1: And about the trend for the future? SP2: I can't speak on that one. If I was to guess I'd say it would probably decrease. SP1: It's up to you if you want to guess or you say I don't have information. I cannot decide. SP2: I don't have information.	U3-Hunting aquatic animals
10:97	SP2: I can't speak on that one. If I was to guess I'd say it would probably decrease. SP1: It's up to you if you want to guess or you say I don't have information. I cannot decide. SP2: I don't have information.	No information
10:98	SP1: Okay. Recreation can also be related to the water but not within the water, so people can just enjoy the landscape that's characterized by the water; sitting on the bench looking at the water, or cycling or walking, bird watching. SP2: I see that as an increase and I'm somewhat confident because people are requesting more access to the lake and if we build up the systems along the stream up the rivers, more pathways and that, then there will be more demand. That's one of the plans for the new developments in the mouth of the Don to have more access to that greenery. Also, as I said earlier, the ponds that are besides the city parks, we're trying to make it as part integrated so they can enjoy the landscaping around the ponds more. SP1: So the opportunities are better? SP2: Yes, and the opportunities are increased and there will be some increase in that access. SP1: Is this the main reason that demand is increasing or is there a reason behind these developments? SP2: I think people are more aware of their natural surroundings today. I think it's a change in attitude and once again in population itself. Even if you had the same percentage, the population will drive that.	U3-Enjoying a landscape characterized by surface water
10:99	I see that as an increase	T-Increase
10:100	I'm somewhat confident	C-Somewhat certain



ID	Quotation Content	Codes
10:101	I think people are more aware of their natural surroundings today. I think it's a change in attitude	D-Popularity of the activity
10:102	the population will drive that	D-Population growth
10:103	<p>SP1: In the beginning of our talk you already mentioned ice-skating. I didn't find any examples of that but maybe you know if there's ice-skating going on?</p> <p>SP2: Our temperature's not consistently cold enough to have ice-skating on those ponds. In actual fact, we discourage that because we don't know how thick the ice is so I don't see an increase in ice-skating in these bodies of water just because of temperature. We don't have that consistent, cold temperature. I'm going 50 years ago, the harbour of Toronto used to freeze over and people would drive cars on into the harbour. That has not happened for many, many years, or decades. We just don't have the consistent temperature that will produce the ice that's safe enough for ice-skating or any of that type of recreation.</p> <p>SP1: You say it will not increase, does it mean it stays the same or will it decrease? What do you think?</p> <p>SP2: Well, it's almost non-existent now so I'd say it would stay the same.</p> <p>SP1: Because of this.</p> <p>SP2: I'm somewhat certain on that one.</p>	U3-Ice-skating
10:104	Well, it's almost non-existent now so I'd say it would stay the same.	T-No change
10:105	I'm somewhat certain on that one	C-Somewhat certain
10:106	Our temperature's not consistently cold enough to have ice-skating on those ponds. In actual fact, we discourage that because we don't know how thick the ice is so I don't see an increase in ice-skating in these bodies of water just because of temperature. We don't have that consistent, cold temperature. I'm going 50 years ago, the harbour of Toronto used to freeze over and people would drive cars on into the harbour. That has not happened for many, many years, or decades. We just don't have the consistent temperature that will produce the ice that's safe enough for ice-skating or any of that type of recreation.	D0-Local water system not suitable
10:107	<p>SP1: I also read that Humber River is designated as a Canadian heritage river so there is also a formal designation of the cultural heritage value of the surface water in Toronto.</p> <p>SP2: Yes, and I think the Rouge has some heritage, some designation, too. There's a reason the Rouge, if I remember correctly.</p> <p>SP1: Is it also designated as a Canadian heritage river or is it another designation?</p> <p>SP2: Actually, I think it's becoming a park. Some of the areas are becoming parks.</p> <p>SP1: And that includes the water?</p> <p>SP2: I'm not sure but it's a watershed along certain areas of the Rouge.</p> <p>SP1: Do you think the demand for such a formal designation to recognise the importance of the surface water to the people will change?</p> <p>SP2: Given the current landscape of recognising indigenous rights more, it's more prominent now. I think that will increase. I'm somewhat confident on that</p>	U3-Designation of cultural heritage value
10:108	I think that will increase	T-Increase
10:109	I'm somewhat confident on that.	C-Somewhat certain
10:110	Given the current landscape of recognising indigenous rights more, it's more prominent now	D-Awareness about First Nations heritage
10:111	<p>SP1: Is there any religious use of the water?</p> <p>SP2: I can't comment on that. I know there's some things that indigenous people are looking at but I don't understand enough to comment.</p> <p>SP1: Do you have any information about the future demand for religious use of the water?</p> <p>SP2: No, I don't.</p> <p>SP1: Do you know if I could find some information somewhere else?</p> <p>SP2: I don't know directly myself. I would have to ask around.</p> <p>SP1: No, don't worry. I'm just asking. I'm asking a lot, so. Don't worry, you don't need to provide information on everything</p>	U3-Religious use
10:112	<p>SP1: Do you have any information about the future demand for religious use of the water?</p> <p>SP2: No, I don't.</p> <p>SP1: Do you know if I could find some information somewhere else?</p> <p>SP2: I don't know directly myself. I would have to ask around</p>	No information
10:113	<p>So that brings us to the final category, it's a small one. It's about using the space that's provided by the surface water and that may either be the space on the surface or the space in the volume of the water. The first example is building on water. This may either be floating buildings or buildings on top of the water. It can be houses or temporal stages, any kind of temporal or permanent buildings. Do you have any examples of this in Toronto?</p> <p>SP2: I'm vaguely aware of possibly houseboats but that is very rare. There may be the odd person but it's not something like a big area. I in some of the states in [?] have lots of that but I'm not aware of anything that we have. I'd say at this point I'm not aware of any plans. I'm somewhat confident on that.</p> <p>SP1: You're not aware of plans.</p> <p>SP2: That's on the water. Building around the water, against the water, yes, but not building on the water.</p> <p>SP1: So you think it's very rare and there are no plans. Do you think the demand will stay the same or what do you expect for the demand?</p> <p>SP2: I don't have enough information to comment properly on that one. I'd be totally guessing.</p> <p>SP1: Well, then we'll just say no info. That's fine</p>	U4-Building on water



ID	Quotation Content	Codes
10:114	I don't have enough information to comment properly on that one. I'd be totally guessing.	No information
10:115	Is there any underwater storage. Is the volume below the water surface being used for constructions or buildings or storage of any materials? SP2: I'm not aware of it. I would say I don't have enough information on it. SP1: And for the future demand? SP2: I don't have enough information. SP1: I didn't find any examples about this. SP2: No. But I can imagine even computer systems that do that, nobody wants underwater. I don't know, what would you store underwater? SP1: I don't know, maybe some buildings, or somebody in Amsterdam said cables, or maybe store sediments you need to get rid of? I don't know. SP2: I guess, something that's hot or something you need to keep cool for whatever reason. That's only nuclear waste that I can think of where you want that. SP1: That's not happening in Toronto? SP2: No, I don't think it's happening in Toronto.	U4-Under water storage/infrastructure
10:116	SP2: I'm not aware of it. I would say I don't have enough information on it. SP1: And for the future demand? SP2: I don't have enough information.	No information
10:118	I'd say that would remain the same for the next forty years	T-No change
10:119	I'm somewhat confident on that.	C-Somewhat certain
10:121	It's just the depth and the facilities are not there.	D0-Local water system not suitable
10:123	I guess that's the next one we'll get into – but I'm also exploring other ways to manage storm water, a new development through the green roofs for the roof systems and through the soil cell systems; we're looking at other technology within the road itself.	D-Green Infrastructure Development
10:124	SP1: Transport of persons. I know that there are some ferries from the city of Toronto to the islands in Lake Ontario. SP2: Yes, that's very short. I think there could be more demand from the US. There was a lake transport at one point to go from Toronto, I think, to either Buffalo or Rochester, another area across the lake. It's hard to say because shipping is changing. There are new hybrid ships coming in. I'd pass on that. I can't speak enough. That's not my area of expertise.	U4-Transporting persons
10:125	SP1: Fine. The last one I'd like to discuss: Is water used as a physical barrier? SP2: No. SP1: I didn't find any examples but maybe you know one? SP2: No. SP1: Do you think the demand for this will change? SP2: I don't think it will change. I'm somewhat confident on that. SP1: Why do you think it will not change? SP2: I can't see why. First of all, as a barrier to movement or-? SP1: Yes, to keep people in or out or animals in or out, or anything else. SP2: No, we haven't used that. I mean other than if you had a moat around for a zoo, that's about it. No, we haven't used that. SP1: And you don't see it- SP2: I don't see, no.	U4-Using water as a barrier
10:126	I can't speak enough. That's not my area of expertise.	No information
10:127	SP1: And you don't see it- SP2: I don't see, no.	No information
10:130	No, I'm not aware of any	No information
10:131	SP2: Yes, because land is so expensive. SP1: Because it's expensive? SP2: That's right	D-Land Value Increase
10:132	I would be very confident	C-Very certain
10:133	What about recreational boating so not in a kayak but in a boat? I know there are some public boat launches. That's all information I have about boating. SP2: Yes, there's still a demand for boating. There's a lot of sail boats out in the lake during the summer and I'm somewhat certain that will remain the same. The reason I say 'somewhat' is boating is not cheap. SP1: Why do you think it will stay the same? Why not a decrease or an increase? SP2: I think, as I said, there is a population growth so there could be an increase in population but with the cost I'm not sure whether that percentage will keep pace. SP1: So that's why you think it may stay the same? SP2: Yes, that's why I'm somewhat confident it will stay the same.	U3-Recreational boating



ID	Quotation Content	Codes
10:134	<p>SP1: What about transporting goods? I've read, of course, there's this international port of Toronto on the shores of Lake Ontario.</p> <p>SP2: I think it will continue. There's still a lot of goods that go through the lake system, raw materials. I'd say that would remain the same for the next forty years. I'm somewhat confident on that.</p> <p>SP1: Why do you think it will stay the same?</p> <p>SP2: Canada still does export a lot of raw material so I think there's still some raw material coming up to through the lakes. Goods are still coming through. There's still shipping coming through and moving goods even into Canada.</p> <p>SP1: But you don't think it will decrease or increase?</p> <p>SP2: I think it will just remain the same. After forty years, that I can't say.</p> <p>SP1: That's on the lake systems. Is there any transportation of goods through the rivers?</p> <p>SP2: Not at this time I'm aware of, and I don't think it would change. It's just the depth and the facilities are not there.</p>	U4-Transporting goods
10:135	Our water efficiency is getting better so we are decreasing the per capita consumption, but you can only go down so much,	D-Water use efficiency
10:136	I'm not sure about our parks because there are some concerns about the quality of water	Db-Water quality not sufficient
10:137	<p>So that's mainly related to community gardens.</p> <p>SP2: Yes. It's my work. As I said, I deal with the Toronto green standards so I work with our energy and environmental group who help to advocate urban green roofs, bees and increase in bee population and biodiversity, things like that.</p>	D-Urban agriculture increase
10:138	Runoff will be harvested to irrigate the parks.	D-Stormwater management
10:139	It's just people are more aware of environmental issues, trying to grow local sources of goods.	D-Sustainability ambitions
10:140	Energy costs	D-Cost saving ambitions
10:141	We don't have that much of a change in salinity unless somebody figures a way to take the salty road water to do it, runoff, and that would not be consistent, too, so I don't think it would work	D0-Potential capacity is too small to be relevant
10:142	We don't have as much industry anymore. We're still trying to keep the industry, and industry will want to decrease water use, where possible. So, we're not a growing industry. We're not having increases in industry in the city, let's say, so we're just trying to keep what we have	D0-No reason for change/don't know
10:143	I think water quantity management will increase to address our urban flooding and we're doing water quantity, or erosion control, within the river systems.	D-Stormwater management
10:145	Canada still does export a lot of raw material so I think there's still some raw material coming up to through the lakes. Goods are still coming through. There's still shipping coming through and moving goods even into Canada.	D0-No reason for change/don't know
10:148	If we do clean up the lake as the goals of the city and other people around the province and around the lake, I think people will want and be willing to eat the fish more	D-Water quality improvement
10:149	I think our public health would be very concerned about the quality of surface water and the bacteria, bacteria in terms of airborne, having disease and bacteria getting airborne.	Db-Water quality not sufficient
10:150	I think it's just that people are not aware of it or how to do it.	D0-This is not a habit/lack of knowledge
10:151	There's a demand for waterfront usage, it's increasing all the time. People just want that place to go and as long as that water quality's there that population	D-Popularity of the activity
10:152	because people are requesting more access to the lake and if we build up the systems along the stream up the rivers, more pathways and that, then there will be more demand. That's one of the plans for the new developments in the mouth of the Don to have more access to that greenery. Also, as I said earlier, the ponds that are besides the city parks, we're trying to make it as part integrated so they can enjoy the landscaping around the ponds more.	D-Redevelopment close to water
10:153	It will say it either stay the same or increase.	T-Increase
10:154	it's also having the residents being confident the water's clean. It's not so much just cleaning it, they have to be confident that it is clean	Db-Concerns about water quality

Interview coding for FW-4

FUNqyWATER code name: respondent W11 (SP2)

interview date 8 October 2019

interviewer Suzanne van der Meulen (SP1)

transcript by Uitgetypt and Suzanne van der Meulen

Information that has been removed to prevent identification of the respondent is indicated with [...].

Table 7: Current Use FW-4

ID	Quotation Content	Codes
11:161	We rely on clean water for drinking water	CU1-Water extraction for drinking water production
11:162	transportation uses as well	CU4-Transporting goods CU4-Transporting persons
11:163	there's even recreation	CU3-Recreational boating CU3-Secondary contact recreation CU4-Transporting persons
11:164	they're used for recreation	CU3-Recreational fishing
11:165	And fishing,	CU1-Fishing for consumption purposes
11:166	we've started to introduce storm water management policies	CU2-Managing water quantity
11:167	water has to be cleaned in ponds	CU2-Managing water quality

Table 8: Future Demand FW-4

ID	Quotation Content	Codes
11:1	<p>If we start with this first section of production use, you've already mentioned that maybe the water system can play a role in food provision. I found that there's already some consumption of fish, that is called sport fishermen, but there's also some commercial and aboriginal fisheries but it seems to be quite far away from Toronto and more in the north-east part of Lake Ontario.</p> <p>SP2: Yes.</p> <p>SP1: Do you have any idea if the demand for this, for the consumption of fish from Toronto's water system, will change? Do you think it will increase, or decrease or maybe it stays the same?</p> <p>SP2: I don't think it's going to change. Given the quality of the water in the urban systems, I think a lot has to happen before we could utilise it for consumption of fish in our area.</p> <p>SP1: You think the limitations are within the water quality?</p> <p>SP2: Yes.</p> <p>SP1: How certain are you? I will ask you this every time. How certain are you that this will not change? I would like to use four categories: Are you very uncertain; somewhat uncertain; somewhat certain or very certain?</p> <p>SP2: I'm somewhat certain. My background, I didn't explain it to you, but my background is actually natural hazards and flooding. I'm not an expert on water ecology.</p>	U1-Fishing for consumption purposes
11:2	I don't think it's going to change.	T-No change
11:3	I'm somewhat certain	C-Somewhat certain
11:4	Given the quality of the water in the urban systems, I think a lot has to happen before we could utilise it for consumption of fish in our area.	Db-Water quality not sufficient



ID	Quotation Content	Codes
11:5	<p>Is there any catch of other surface water-related animals for consumption? SP2: You're talking about surface water not using groundwater? SP1: Yes. SP2: There is some production, there is some use for the water in some of the headwater, in some of the up areas for farming, but generally our watersheds are all urban where farming is very limited. SP1: So you mean there are no extractions for irrigation in Toronto? SP2: Very little. We do use it for watering golf courses and what-not, but for growing food it's very little in our jurisdiction. There is some, there are some farms that utilise the water but it's not substantial. SP1: No. I've found a number. For example, there is some quite some extractions but that is all north of the city line? SP2: Yes, because we're mostly city, urban. SP1: What do you think for the future, do you think the demand for irrigation water coming from surface water will change? SP2: In the future for irrigation? SP1: Or livestock watering so agricultural use? SP2: I don't see that agricultural use in our watersheds is going to change much because, again, it's very urban. SP1: So you think it will stay the same? SP2: Yes, but the need for, from surface water I think it will remain the same. There may be more water needed from Lake Ontario. Again, I don't know if you're including Lake Ontario? We only have a portion so. SP1: Yes, I'm including Lake Ontario as well. I look at the city and adjacent waters. SP2: Yes, so there may be some need for potable, or water for consumption and irrigation from Lake Ontario but probably outside of TRCAs watersheds. SP1: Yes, so not close to Toronto? SP2: Yes. SP1: To go back to the agricultural use, you say there won't be a change, it's not very big and that stays the same. Did I understand correctly? SP2: Yes. SP1: How certain are you this will not change? SP2: Somewhat certain</p>	U1-Water extraction for irrigation of food crops or livestock watering
11:6	<p>I don't see that agricultural use in our watersheds is going to change much because, again, it's very urban. SP1: So you think it will stay the same? SP2: Yes, but the need for, from surface water I think it will remain the same.</p>	T-No change
11:7	Somewhat certain.	C-Somewhat certain
11:8	because, again, it's very urban.	D-Urbanization/land use change
11:9	<p>P1: We talked about catching fish for consumption but are there other animals that are harvested or hunted for consumption from the water system? SP2: Not in our watersheds. No, there are some farms but that's it. SP1: Do you think that will change in the future? Do you think there will be a change in the demand for hunting aquatic animals? SP2: No, not in our watersheds. SP1: No. Why not? SP2: Again, a lot has to be done to clean up the water before you could utilise the waterways for consumption. SP1: How certain are you this will not change? SP2: Somewhat certain.</p>	U1-Catch of other aquatic animals for consumption
11:10	Somewhat certain	C-Somewhat certain
11:11	SP2: Again, a lot has to be done to clean up the water before you could utilise the waterways for consumption.	Db-Water quality not sufficient
11:12	<p>Do you think that will change in the future? Do you think there will be a change in the demand for hunting aquatic animals? SP2: No, not in our watersheds.</p>	T-No change



ID	Quotation Content	Codes
11:13	<p>SP1: Is there any harvest of aquatic plants or algae for consumption? SP2: No, not that I'm aware of. SP1: Do you think that will change? SP2: I don't think so. SP1: No. Is that for the same reason or does it have another reason? SP2: Just historically, our area, because of the high-density city, we don't utilise our land for that. SP1: You just don't. That will stay the same, you say? SP2: I think so. There's more demand to put people than farms. SP1: Yes, but if you think about, this is not about farms on the land but about harvesting aquatic life, so aquatic vegetation or algae? SP2: No, I'm not familiar with that. I can't imagine that we would. If you look at our harbour-front where Lake Ontario is, it's all urban. There's very little opportunity to harvest for fish or anything. The nearshore of Toronto to Lake Ontario, the water quality is very poor. SP1: Yes. How certain are you that the demand will not change? SP2: I'm somewhat certain.</p>	U1-Harvest of aquatic plants or algae for consumption
11:14	<p>That will stay the same, you say? SP2: I think so</p>	T-No change
11:15	I'm somewhat certain.	C-Somewhat certain
11:16	The nearshore of Toronto to Lake Ontario, the water quality is very poor.	Db-Water quality not sufficient
11:19	There's more demand to put people than farms	D-Urbanization/land use change
11:20	<p>SP1: You already mentioned that surface water is extracted for drinking water production. I know that Lake Ontario is used for this. I thought there are also some smaller extractions from Humber River? SP2: Yes. SP1: Is that still so? SP2: The Humber not so much, but we do extract groundwater up there in the northern areas but most of our water in our watersheds is from Lake Ontario for consumption. SP1: Yes. You already mentioned that you think the demand for this will increase. SP2: Yes. SP1: Why do you think that will increase? SP2: The population is increasing so much. SP1: So it's just a matter of a growing population. How certain are you that this demand will increase? SP2: I'm very certain.</p>	U1-Water extraction for drinking water production
11:21	<p>You already mentioned that you think the demand for this will increase. SP2: Yes.</p>	T-Increase
11:22	The population is increasing so much.	D-Population growth
11:23	I'm very certain.	C-Very certain
11:24	<p>SP1: We already talked about irrigation in the context of agriculture. You already mentioned there may be other types of irrigation like irrigation of parks or golf courses. I know that there are quite some extractions for golf courses in Humber, Don also in Rouge. I'm not sure if it's still the case because the reports I've found are from 2007, '08 and '09, the watershed plans, but is this still the case? SP2: Yes, there are still extractions. The ministry of environment issue permits to take water and they regulate it. TRCA doesn't, but that is still the case, they still extract water for golf course irrigation. SP1: Do you think the demand for this will change? SP2: It might go down. SP1: Why do you think it will go down? SP2: Because the value of the land in the Toronto area has gone up so much that many golf courses are shutting down and they're developing them. SP1: So golf courses are disappearing because the land is so valuable that it's worth selling. SP2: Yes. SP1: How certain are you this may decrease? SP2: Somewhat certain</p>	U1-Water extraction for irrigation of other vegetation
11:25	It might go down.	T-Decrease
11:26	SP2: Somewhat certain.	C-Somewhat certain
11:28	many golf courses are shutting down and they're developing them.	D-Urbanization/land use change



ID	Quotation Content	Codes
11:29	<p>SP1: Is there any industrial use? Is there any industrial process water that is extracted from surface water?</p> <p>SP2: Yes, there is. I don't have the details though but I know there are a number of industries in our watershed that do extract water.</p> <p>SP1: Do you know where I could find information because I couldn't find any information about that so far.</p> <p>SP2: There is somebody in our office. His name is Eric Melton. He works for a group called Projects in Partner Green. He would be a good person to talk to.</p> <p>SP1: Could I contact him? Could you send me his contact details so I can ask him for more information?</p> <p>SP2: Yes, I'll do that.</p> <p>SP1: That would be great. Do you have any information about the future demand for this?</p> <p>SP2: No, I don't have that information.</p>	U1-Water extraction for industrial processes
11:31	<p>SP1: I will ask your colleague Eric then. Is the surface water used for fire fighting?</p> <p>SP2: They use mostly the water distribution system, so the water is supplied from Lake Ontario.</p> <p>SP1: Is this potable water?</p> <p>SP2: Potable water, yes. That's used for fire fighting.</p> <p>SP1: So there's no surface water that's directly being used for this?</p> <p>SP2: Not that I'm aware of.</p> <p>SP1: No. Do you think that the demand for this will change in the future?</p> <p>SP2: I don't think so. I mean, if we have more population, potentially they will need to ensure the potable water is available for fire fighting.</p> <p>SP1: You don't think there's a desire to switch from surface water?</p> <p>SP2: No, I don't think they could count on it. Plus, because you have to understand in our area, so we've protected our rivers and next to our rivers we've protected the ravine and the valley, so development is very far from the river system. We've protected all that's natural so in order to get the water from there would require a whole new infrastructure. It's easier to get water from our water distribution system.</p> <p>SP1: Yes, I see. You also said: We cannot count on it. What do you mean by that?</p> <p>SP2: In a lot of the headwater areas, so areas just north of Toronto, some of our rivers, because the watersheds are not large we have small watersheds; sometimes the rivers run dry in the summer.</p> <p>SP1: So it's an issue of not having enough water. How certain are you demand will not change?</p> <p>SP2: Somewhat certain</p>	U1-Water extraction for fire fighting
11:32	Somewhat certain.	C-Somewhat certain
11:33	I don't think so.	T-No change
11:34	No, I don't think they could count on it. Plus, because you have to understand in our area, so we've protected our rivers and next to our rivers we've protected the ravine and the valley, so development is very far from the river system. We've protected all that's natural so in order to get the water from there would require a whole new infrastructure	D0-Access to surface water is unpractical
11:35	<p>SP1: I also found there are some extractions from Don, Humber and Rouge for filling ponds, for filling aesthetic ponds or fish ponds. Again, this is information from watershed reports that are 10 years old so I'm not sure if it's still the case. Do you know that?</p> <p>SP2: Maybe a little bit, but usually they capture the water before it gets into the river to fill their ponds.</p> <p>SP1: Do you think the demand for this will change towards 2040?</p> <p>SP2: No, not from the rivers.</p> <p>SP1: Why do think it's not changing?</p> <p>SP2: There's not so many. It's very minor. You have storm water plants; there are many storm water plants. The water is collected from the watershed before it goes into the river. It's not extracted from the river; it's collected before.</p> <p>SP1: So if you have aesthetic ponds or fish ponds, you don't think there will be an increase or a decrease in their demand for surface water?</p> <p>SP2: No, there's very few.</p> <p>SP1: How certain are you this demand will not change?</p> <p>SP2: Very certain</p>	U1-Water extraction for filling ponds
11:36	Very certain.	C-Very certain
11:38	<p>So if you have aesthetic ponds or fish ponds, you don't think there will be an increase or a decrease in their demand for surface water?</p> <p>SP2: No, there's very few.</p>	T-No change
11:39	There's not so many. It's very minor. You have storm water plants; there are many storm water plants. The water is collected from the watershed before it goes into the river. It's not extracted from the river; it's collected before.	D0-No reason for change/don't know
11:40	<p>SP1: Are there any other extractions for non-drinking purposes?</p> <p>SP2: No, I can't think of any. No, I can't think of any.</p> <p>SP1: Do you have any ideas, do you think there may be new demands in the future, new uses of extracted water?</p> <p>SP2: No, I can't really think of so much right now.</p>	U1-Water extraction for other non-drinking purposes



ID	Quotation Content	Codes
11:41	No, I can't really think of so much right now.	No information
11:42	So we talked about extractions of water but maybe there also extractions of other materials from the surface water system like biomass for non-food purposes. This can be aquatic plants or algae, something like that. Is that taking place in Toronto? SP2: Not so much. SP1: Not so much or not at all? Do you have any examples? SP2: I don't have that information. SP1: No. And for future demand? SP2: I have no idea.	U1-Harvest of biomass for non-food purposes
11:43	I don't have that information. SP1: No. And for future demand? SP2: I have no idea.	No information
11:44	SP1: And extraction of abiotic materials, so that can be, for example, sand or clay or gravel? SP2: For what purpose? SP1: For example, for building, as building materials or something like concrete. SP2: Yes, that happens all the time. There are many quarries that we extract materials from for building. SP1: Yes, but that's on the land, but is it also extracted from the water system, from rivers? SP2: There may be some in Lake Ontario but I'm not familiar in our area. SP1: Do you know if the demand to do this from the surface water system will change? SP2: I don't think so. SP1: Why do you think that that will not change? SP2: Because there's so much. This material's usually extracted from land; it would be more costly and expensive to try finding it from water. Plus, we have very strong regulations in our water systems. In terms of our fisheries, it would be very difficult and costly to do that. SP1: So there are better alternatives. SP2: Yes. SP1: How certain are you of this? SP2: Somewhat certain.	U1-Extraction of abiotic materials
11:45	Somewhat certain.	C-Somewhat certain
11:46	Do you know if the demand to do this from the surface water system will change? SP2: I don't think so.	T-No change
11:47	Plus, we have very strong regulations in our water systems. In terms of our fisheries, it would be very difficult and costly to do that.	D0-Ecological protection ambitions
11:49	SP1: If we look at energy, I found a very interesting example that Enwave is extracting cold water from Lake Ontario to cool office buildings and that the same water is also used for the municipal potable water system. SP2: Yes. SP1: I think it's only for cooling and not for heating, is that right? SP2: That's right, it's only cooling. And that's only in Toronto, downtown core. SP1: Do you think the demand for this will change in the future? SP2: The demand? It may increase in the downtown core but outside of downtown, outside of Lake Ontario where you have that access, it's very difficult. There may be some heating and cooling systems but the water may not come from the river systems; it might come from the potable water system or harvested from storm water. SP1: And you think it increases in downtown Toronto, why do you think the demands for cooling with lake water will increase? SP2: I think it might increase a little because they have the infrastructure there already. SP1: And why would it increase? SP2: Because of new developments joining that Enwave system. SP1: Yes, so there are more demands from more buildings. SP2: Yes. SP1: How certain are you of that? SP2: Not very. Somewhat certain. Again, my area of expertise is flood management. SP1: But you seem to know quite a lot about the other issues in the water system as well. And you think it will only increase in downtown Toronto and not in other places? SP2: No, I think other areas may have district energy systems but I don't think the extraction from surface water will be used. I think they'll find other sources. SP1: Why would they choose other sources? SP2: Because extraction in those areas, the volume of water is not available. SP1: They are too far away from Lake Ontario and there are no other good sources. SP2: Yes.	U1-Thermal energy extraction



ID	Quotation Content	Codes
11:50	<p>SP1: Is there any energy production from the water system? I didn't find any examples.</p> <p>SP2: Hydropower, not in our jurisdiction.</p> <p>SP1: No. Will the demand for this change?</p> <p>SP2: No, because our rivers are not big enough and the grades are not big enough to generate power. If the new technology comes along, maybe, but right now we have a couple of dams that we looked at the possibility of generating power and it didn't work.</p> <p>SP1: So how certain are you this demand will not change?</p> <p>SP2: Somewhat certain unless the technology changes a lot.</p>	U1-Energy production by using kinetic energy of water
11:51	<p>SP1: Are there any examples of osmotic processes to generate electricity, for example using a salinity gradient or biological processes?</p> <p>SP2: I'm not familiar with any other.</p> <p>SP1: No, I didn't find any examples either. What do you think about the future demand for this? Do you have information about that?</p> <p>SP2: I don't think in our Toronto area it's going to change much in the future because we have good access to nuclear power.</p> <p>SP1: So there's a good alternative.</p> <p>SP2: Yes.</p> <p>SP1: How certain are you that this demand will not change?</p> <p>SP2: I'm somewhat certain</p>	U1-Energy production by using the salinity gradient in water
11:52	I don't think in our Toronto area it's going to change much	T-No change
11:53	I'm somewhat certain.	C-Somewhat certain
11:54	I don't think in our Toronto area it's going to change much in the future because we have good access to nuclear power.	D0-Alternatives are better
11:55	<p>SP1: Let's go to the next section, it's a short one. These are all use functions that are related to regulation and maintenance of the environment. The first one is managing water quality. Of course, there are a lot of processes taking place in the water system that may improve water quality, like dilution or degradation of pollutants, but I'm wondering if there is intentional use of the surface water to improve water quality? So this may, for example, be in the form of storm water management ponds that are also designed to improve water quality or flushing of another water body with surface water from a cleaner water body, things like that.</p> <p>SP2: Yes, this is a big issue. A lot of the Toronto area, a lot of the old areas in our watershed don't have storm water management treatment. In the future, we're working with our municipal partners to retrofit these areas to provide storm water controls for water quality.</p> <p>SP1: You said in a form of surface water, is this like storm water management ponds?</p> <p>SP2: It's a number of things, it could be storm water ponds, it could be infiltration, bioswales, green roofs, permeable pavers, all different types of low impact development practice plus storm water ponds.</p> <p>SP1: If we focus now on the storm water ponds because we're now looking at surface water bodies, do you think the demand for ponds to improve water quality will change?</p> <p>SP2: The demands for ponds? Well, ponds also take a lot of land area so we're looking at ponds but we're also looking at other types of treatment devices that also may provide that benefit. So I think the demand for ponds is going to remain the same because all new developments do require ponds right now, so I don't think it's going to increase but it may decrease a little with other technologies.</p> <p>SP1: Decrease a little?</p> <p>SP2: Yes, with the use of other technologies. Or they may start constructing ponds underground.</p> <p>SP1: How certain are you of this?</p> <p>SP2: Somewhat certain. Actually, I'd say very certain because I think in the future the land values are so high that maybe they'll start putting the ponds underground.</p>	U2-Managing water quality
11:56	<p>So I think the demand for ponds is going to remain the same because all new developments do require ponds right now, so I don't think it's going to increase but it may decrease a little with other technologies.</p> <p>SP1: Decrease a little?</p> <p>SP2: Yes, with the use of other technologies. Or they may start constructing ponds underground.</p>	T-Decrease
11:57	Somewhat certain. Actually, I'd say very certain	C-Very certain
11:58	Because the value of the land in the Toronto area has gone up so much	D-Land Value Increase
11:59	I think in the future the land values are so high that maybe they'll start putting the ponds underground.	D-Land Value Increase
11:60	<p>I don't think it's going to increase but it may decrease a little with other technologies.</p> <p>SP1: Decrease a little?</p> <p>SP2: Yes, with the use of other technologies. Or they may start constructing ponds underground</p>	D-Technological developments

ID	Quotation Content	Codes
11:61	<p>What about managing the water quantity? What is the role of the surface water system in managing water quantity?</p> <p>SP2: Water quantity is managed before water gets into the natural system. The storm water ponds are built to hold back and attenuate the detained storm water and it's released slowly back in the system to protect against erosion and flooding. This will still be a requirement for all new developments, but in the future as we develop and there is less urban space, there will be a lot of in-fill developments but there's still going to be a requirement to detain and protect our water courses and protect communities from flooding, so it is a requirement.</p> <p>SP1: And do you think that...If I understand you correctly, you say the management of the water quality is mainly focused on managing actually rainfall. When it falls we want to keep it to prevent runoff?</p> <p>SP2: Yes.</p> <p>SP1: Yes. Is there a role in ponds there as well?</p> <p>SP2: Yes. Ponds are build. The size of the pond usually is governed by the amount of water in the urban area that it treats.</p> <p>SP1: Do you think that the demand for these ponds will change for the purpose of managing water quantity?</p> <p>SP2: No, it won't change. It will still be required. Right now, we have over a 1,000 storm water ponds in our jurisdiction and that number will go up as we continue to develop, but the amount of land that's available for development is a lot less now near our waters. So we're not going to see as many new ponds being built because there's just not that much more land available to develop.</p> <p>SP1: How certain are you of this that it will not change due to these reasons?</p> <p>SP2: Yes, I'm very certain.</p>	U2-Managing water quantity
11:62	No, it won't change. It will still be required	T-No change
11:63	Yes, I'm very certain.	C-Very certain
11:64	<p>Right now, we have over a 1,000 storm water ponds in our jurisdiction and that number will go up as we continue to develop, but the amount of land that's available for development is a lot less now near our waters. So we're not going to see as many new ponds being built because there's just not that much more land available to develop.</p>	D0-Potential capacity already fully used D-Lack of space on land
11:66	I'm not sure. I don't have that expertise	No information
11:68	<p>SP1: Is there any intentional use of surface water bodies to influence climate, either the local climate or the global climate?</p> <p>SP2: Not that I'm aware of.</p> <p>SP1: No. Do you have any information about the future?</p> <p>SP2: In the future, in terms of climate change, there is discussion that climate change will result in more floods occurring or more intensive events so the need to provide flood protection is becoming more and more important due to climate change so we are looking at water quantity ponds again, or storage tanks to provide that protection.</p> <p>SP1: Yes, so climate change is impacting the need to manage water quantity but is there an influence of the water systems itself on climate?</p> <p>SP2: The water system itself, too, with climate would have to potentially convey more water right. So we're looking at impacts of erosion of our water systems. We're looking at also the water system itself and the possibility of flooding, what the impacts to flooding would be: are floodplains going to get larger or not? That's one of the impacts.</p> <p>SP1: So this flood management is an important issue. Is there any role for the surface water system in emission of greenhouse gases or the influence on temperature in Toronto?</p> <p>SP2: Not that I'm aware of.</p> <p>SP1: No. Do you think that will change in the future?</p> <p>SP2: I'm not sure. I don't have that expertise.</p>	U2-Global climate regulation by reduction of greenhouse gas concentrations
11:69	<p>Is there any intentional use of surface water bodies to influence climate, either the local climate or the global climate?</p> <p>SP2: Not that I'm aware of.</p> <p>SP1: No. Do you have any information about the future?</p> <p>SP2: In the future, in terms of climate change, there is discussion that climate change will result in more floods occurring or more intensive events so the need to provide flood protection is becoming more and more important due to climate change so we are looking at water quantity ponds again, or storage tanks to provide that protection.</p> <p>SP1: Yes, so climate change is impacting the need to manage water quantity but is there an influence of the water systems itself on climate?</p> <p>SP2: The water system itself, too, with climate would have to potentially convey more water right. So we're looking at impacts of erosion of our water systems. We're looking at also the water system itself and the possibility of flooding, what the impacts to flooding would be: are floodplains going to get larger or not? That's one of the impacts.</p> <p>SP1: So this flood management is an important issue. Is there any role for the surface water system in emission of greenhouse gases or the influence on temperature in Toronto?</p> <p>SP2: Not that I'm aware of.</p> <p>SP1: No. Do you think that will change in the future?</p> <p>SP2: I'm not sure. I don't have that expertise.</p>	U2-Local climate regulation



ID	Quotation Content	Codes
11:70	<p>I'm sorry, I'm maybe rushing a little bit but I know that you only have an hour. I hope to get through everything. If we look at cultural functions, there's a lot of recreation here. The first one is primary contact recreation so that's swimming or diving. I found a lot of examples there. Do you think that the demand for this will change towards 2040?</p> <p>SP2: From now to 2040? I think that, for swimming, I don't think it's going to change much. As the population increases there will be a need to have more recreation, and swimming is important but I don't think swimming in our natural systems like our lakes and rivers the water quality is good. There may be some more increase in our lake fronts where we do have beaches that are open for swimming so in some areas it will increase moderately.</p> <p>SP1: Maybe a little increase in the lake fronts and further no change because the water quality is not good enough?</p> <p>SP2: Yes.</p> <p>SP1: How certain are you of this?</p> <p>SP2: Somewhat certain. I think you'll see a marginal increase in the lake front.</p>	U3-Primary contact recreation
11:72	Somewhat certain	C-Somewhat certain
11:73	<p>There may be some more increase in our lake fronts where we do have beaches that are open for swimming so in some areas it will increase moderately.</p> <p>SP1: Maybe a little increase in the lake fronts and further no change because the water quality is not good enough?</p> <p>SP2: Yes.</p> <p>SP1: How certain are you of this?</p> <p>SP2: Somewhat certain. I think you'll see a marginal increase in the lake front.</p>	T-Increase
11:74	there will be a need to have more recreation, and swimming is important but I don't think swimming in our natural systems like our lakes and rivers the water quality is good.	Db-Water quality not sufficient
11:75	<p>SP1: And secondary contact recreation, so that's when there's contact with the arms and the legs so like canoeing, kayaking, rowing, supping. Do you think the demand will change for this?</p> <p>SP2: Again, it will probably go up, but minor. [background noise] - having problem with the lakes -. So I think it again will be because of population increasing it will increase, but not substantially.</p> <p>SP1: Is that the same as what you said with swimming, so the population grows but the limitation is the water quality?</p> <p>SP2: Well, for boating it's not as bad so you will see more increase of recreational canoeing and boating on Lake Ontario.</p> <p>SP1: Only in Lake Ontario?</p> <p>SP2: Yes, because our river systems we don't have that much water in them so the volume doesn't allow for so much boats.</p> <p>SP1: How certain are you there will be some increase due to population growth for kayaking and boating?</p> <p>SP2: I'm certain.</p> <p>SP1: Somewhat or very certain?</p> <p>SP2: I don't know, somewhat certain.</p> <p>SP1: And that's for kayaking and for boating?</p> <p>SP2: Yes.</p>	U3-Secondary contact recreation
11:76	I don't know, somewhat certain	C-Somewhat certain
11:77	As the population increases there will be a need to have more recreation	D-Population growth
11:78	So I think it again will be because of population increasing it will increase, but not substantially.	D-Population growth
11:79	Only in Lake Ontario? SP2: Yes	T-No change
11:81	it will probably go up, but minor.	T-Increase
11:83	<p>SP1: Recreational fishing. We've already discussed fishing for consumption but if we just look at it as recreational, do you think that-,</p> <p>SP2: I think all of these from fishing and all that is tied to population so if you have more population the demand will increase.</p> <p>SP1: How certain are you for fishing?</p> <p>SP2: I'm somewhat certain.</p>	U3-Recreational fishing
11:85	the demand will increase.	T-Increase
11:86	I think all of these from fishing and all that is tied to population so if you have more population the demand will increase.	D-Population growth



ID	Quotation Content	Codes
11:87	<p>SP1: And hunting of aquatic animals? SP2: I, how is that different from fishing? SP1: Different animals so not fishes but maybe aquatic birds, crab. SP2: I don't think we have so many species so I don't think it's going to increase that much. SP1: I don't know if it happens now? SP2: Not so much, mostly focused on fishing. SP1: You say it will not change. Why do you think it will not change? SP2: Because a lot of these other areas are outside our area where they hunt other like birds. SP1: Outside? SP2: Yes, not in the Toronto area. SP1: How certain are you that it will not change? SP2: Somewhat certain.</p>	U3-Hunting aquatic animals
11:88	I don't think we have so many species so I don't think it's going to increase that much.	T-No change
11:89	Somewhat certain.	C-Somewhat certain
11:92	<p>SP1: There is one other recreational use of the water. It's not really being in contact with the water but just watching the water as a landscape element, enjoying it on a bench, hiking along the water. SP2: Yeah, it will increase. SP1: Why? SP2: Population. More population, more demand. SP1: How certain are you? SP2: I'm very certain because we're building more and more trails and giving more and more access for people to do that. SP1: So the possibilities are also better? SP2: Yes.</p>	U3-Enjoying a landscape characterized by surface water
11:93	Yeah, it will increase.	T-Increase
11:94	Population. More population, more demand.	D-Population growth
11:95	I'm very certain	C-Very certain
11:97	because we're building more and more trails and giving more and more access for people to do that.	D-Redevelopment close to water
11:98	<p>SP1: And what do you expect for ice-skating? SP2: Ice-skating? Again, if the population increases then people will want to do more ice-skating but here in Canada we have more skating on manmade ice rinks outside as opposed to natural water bodies. The temperature fluctuates in the winter so you can't count on these natural water bodies to maintain the ice so in some cases, even in the winter time, you could have a warm front come in and melt and make it unsafe so we prefer to have people skate on outdoor ice rinks but manmade ice rinks. SP1: So there is not much skating on ponds or lakes or..? SP2: There is some but it's not that much. And in the future, I don't think it's going to increase much on natural water bodies because we don't know with climate change if these natural water bodies will be frozen in the winter. SP1: How certain are you that it probably will not change? SP2: Somewhat certain. There's going to be a demand for more ice-skating but just not on natural water bodies so we'll need more ice rinks and more ice facilities</p>	U3-Ice-skating
11:99	And in the future, I don't think it's going to increase much on natural water bodies	T-No change
11:101	Somewhat certain.	C-Somewhat certain
11:102	The temperature fluctuates in the winter so you can't count on these natural water bodies to maintain the ice so in some cases, even in the winter time, you could have a warm front come in and melt and make it unsafe so we prefer to have people skate on outdoor ice rinks but manmade ice rinks.	D0-Local water system not suitable
11:103	<p>P1: If we look at more spiritual or symbolic interactions, I know that the Humber River is designated as a Canadian heritage river. This is a formal designation of the cultural heritage value of the water system. Do you think the demand for this type of designations, recognition of the importance of the water also other waters for the people, do you think the demand for that will change? SP2: Yes, it should increase. SP1: And what drives that increase? SP2: One example I have is again population. SP1: Population growth, do you mean? SP2: Population growth, yes.</p>	U3-Designation of cultural heritage value
11:104	Yes, it should increase.	T-Increase
11:105	<p>One example I have is again population. SP1: Population growth, do you mean? SP2: Population growth, yes.</p>	D-Population growth



ID	Quotation Content	Codes
11:106	<p>SP1: If we go back to the designation of cultural heritage, so not religious use but recognising the importance of the water system, do you think there will be a change in demand for this?</p> <p>SP2: I hope so.</p> <p>SP1: But what do you think?</p> <p>SP2: I think so. People are more connected with water, so I think so.</p> <p>SP1: How certain are you of that?</p> <p>SP2: Somewhat certain.</p>	U3-Designation of cultural heritage value
11:107	Somewhat certain.	C-Somewhat certain
11:108	I think so. People are more connected with water, so I think so.	D-Use and value of surface water increases
11:109	<p>One example I have is again population.</p> <p>SP1: Population growth, do you mean?</p> <p>SP2: Population growth, yes.</p> <p>SP1: One example is some cultures cremate and they sprinkle ashes in the river. We're seeing more and more requests to do that.</p> <p>SP2: So that's a religious use of the water?</p> <p>SP1: Yes.</p> <p>SP2: That's interesting. Is that documented somewhere?</p> <p>SP2: I'm not sure. I just know recently we've had a couple of councillors, so politicians, ask us if they could build facilities so that people could sprinkle the ashes for those purposes.</p> <p>SP1: So if I understand correctly, you think that this will increase because there's a population growth and you see that there are more applications for this?</p> <p>SP2: Yes, we're starting to see more. Interesting.</p> <p>SP1: That's interesting. How certain are you that this demand will increase?</p> <p>SP2: Somewhat certain.</p>	U3-Religious use
11:110	Yes, we're starting to see more. Interesting	T-Increase
11:111	Somewhat certain.	C-Somewhat certain
11:112	<p>SP1: That's the use of the space that is provided by the water system, so that can either be the space on the water, the surface, or the volume. Are there any examples of temporal or permanent buildings on water like floating houses, offices, stages?</p> <p>SP2: No, not in our area.</p> <p>SP1: No. Do you think that demand for that will increase in the future, decrease or stay the same?</p> <p>SP2: I'm not sure. It's a good question but we do have strong regulations against putting buildings on natural hazards, so if it's subject to flooding or anything, we would keep people away from the natural hazard. Our current policies don't allow for that.</p> <p>SP1: Also not to build on the water, to have like floating houses or buildings on piles above the water.</p> <p>SP2: Regulations don't allow for that because of the disruption to aquatic habitat and increase of natural hazards because you're putting people at risk by putting them there.</p> <p>SP1: What do you expect for the demand, apart from it's not allowed today? Do you think the demand will change?</p> <p>SP2: Demand? Of course there will be a demand but I don't know if the regulation will change, because there's less land for development so the demand will be higher. But we're asking the type of development, I think our regulations are strong to protect our water bodies and to keep them natural, so I don't think we'll see much increase.</p> <p>SP1: You said the demand will increase due to the fact that land is full?</p> <p>SP2: Yes, but even if the demand increases that doesn't mean we'll allow it. Our preference is that they should be building on land so changing the landscape, maybe more density on the land rather than building on water.</p> <p>SP1: How certain are you that the demand may increase a little bit, that it will not be allowed so it will not happen.</p> <p>SP2: I'm somewhat certain</p>	U4-Building on water
11:113	Of course there will be a demand but I don't know if the regulation will change, because there's less land for development so the demand will be higher.	T-Increase
11:114	because there's less land for development so the demand will be higher.	D-Lack of space on land
11:115	I'm somewhat certain.	C-Somewhat certain



ID	Quotation Content	Codes
11:116	<p>SP2: Regulations don't allow for that because of the disruption to aquatic habitat and increase of natural hazards because you're putting people at risk by putting them there.</p> <p>SP1: What do you expect for the demand, apart from it's not allowed today? Do you think the demand will change?</p> <p>SP2: Demand? Of course there will be a demand but I don't know if the regulation will change, because there's less land for development so the demand will be higher. But we're asking the type of development, I think our regulations are strong to protect our water bodies and to keep them natural, so I don't think we'll see much increase.</p> <p>SP1: You said the demand will increase due to the fact that land is full?</p> <p>SP2: Yes, but even if the demand increases that doesn't mean we'll allow it. Our preference is that they should be building on land so changing the landscape, maybe more density on the land rather than building on water.</p>	Db-Regulations don't allow the use
11:117	<p>SP1: Is there any use of the space underwater, in the volume of the water? Is there any storage underwater of materials or is there infrastructure or buildings in the water body?</p> <p>SP2: Not that I'm aware of. Lake Ontario might have something but I'm not aware of it. Our rivers are so small that we can't do anything.</p> <p>SP1: No, I couldn't find it either. Do you think the demand for this will change?</p> <p>SP2: No. Again, we have strong regulations against it.</p> <p>SP1: And that will prevent people from having the demand as well?</p> <p>SP2: Yes.</p> <p>SP1: How certain are you?</p> <p>SP2: Somewhat certain.</p>	U4-Under water storage/infrastructure
11:118	<p>Do you think the demand for this will change?</p> <p>SP2: No. Again, we have strong regulations against it.</p>	T-No change
11:119	Somewhat certain.	C-Somewhat certain
11:120	No. Again, we have strong regulations against it.	Db-Regulations don't allow the use
11:121	<p>SP1: We already talked about transportation of goods. You already mentioned that there is transportation on Lake Ontario. I found there's international transport of bulk materials. I didn't find any examples of transportation on other water bodies like the rivers. Is there any?</p> <p>SP2: Our rivers are too small.</p> <p>SP1: What do you expect for the future demand for transportation, waterborne transportation for goods?</p> <p>SP2: On Lake Ontario, it should increase as the population goes up.</p> <p>SP1: How certain are you?</p> <p>SP2: Somewhat certain.</p>	U4-Transporting goods
11:122	On Lake Ontario, it should increase	T-Increase
11:123	Somewhat certain.	C-Somewhat certain
11:124	it should increase as the population goes up	D-Population growth
11:125	<p>: And if we look at the transportation of persons, so I now found there are ferries to Toronto Island Park and there are some cruise ships that travel through the Great Lake system. Will that change? Do you think the demand for that will change?</p> <p>SP2: I think it will go up because of population again.</p> <p>SP1: How certain are you?</p> <p>SP2: Somewhat certain.</p>	U4-Transporting persons
11:126	Somewhat certain.	C-Somewhat certain
11:127	I think it will go up	T-Increase
11:128	because of population again.	D-Population growth
11:129	<p>SP1: Is water used as a barrier, a physical barrier?</p> <p>SP2: Water as a physical barrier? Again, could you give me an example?</p> <p>SP1: Like use it to keep people in or out, or animals in or out. It would be, the idea of a moat or like maybe around a prison?</p> <p>SP2: Not used so much.</p> <p>SP1: No, I didn't find it either. Do you think the demand for this function will change?</p> <p>SP2: I can't imagine, no.</p> <p>SP1: No. Why not?</p> <p>SP2: It's just not a practical use that we have right now.</p> <p>SP1: How certain are you that will not change?</p> <p>SP2: Somewhat, again I'm not familiar with so much of that.</p>	U4-Using water as a barrier
11:130	<p>SP2: Not used so much.</p> <p>SP1: No, I didn't find it either. Do you think the demand for this function will change?</p> <p>SP2: I can't imagine, no.</p>	T-No change
11:131	Somewhat, again I'm not familiar with so much of that	C-Somewhat certain



ID	Quotation Content	Codes
11:132	: It's just not a practical use that we have right now.	D0-No reason for change/don't know
11:133	Because there's so much. This material's usually extracted from land; it would be more costly and expensive to try finding it from water.	Db-High costs
11:134	Will the demand for this change? SP2: No	T-No change
11:135	because our rivers are not big enough and the grades are not big enough to generate power. If the new technology comes along, maybe, but right now we have a couple of dams that we looked at the possibility of generating power and it didn't work.	D0-Potential capacity is too small to be relevant
11:136	Somewhat certain	C-Somewhat certain
11:137	There's very little opportunity to harvest for fish or anything	D0-Potential capacity is too small to be relevant
11:138	No, I don't have that information.	No information
11:140	In a lot of the headwater areas, so areas just north of Toronto, some of our rivers, because the watersheds are not large we have small watersheds; sometimes the rivers run dry in the summer.	Db-Water quantity not reliable
11:141	It's easier to get water from our water distribution system.	Db-Preference for other source of water
11:142	It may increase in the downtown core	T-Increase
11:143	Somewhat certain. Again, my area of expertise is flood management	C-Somewhat certain
11:144	Because of new developments joining that Enwave system.	D-Urbanization/land use change
11:146	I'm somewhat certain	C-Somewhat certain
11:147	I don't think we have so many species so I don't think it's going to increase that much.	D0-Potential capacity is too small to be relevant
11:148	because we don't know with climate change if these natural water bodies will be frozen in the winter.	D-Temperature increase due to climate change
11:149	If the new technology comes along, maybe	D-Technological developments
11:150	maybe	T-Increase
11:151	because our river systems we don't have that much water in them so the volume doesn't allow for so much boats	Db-Water quantity not sufficient
11:152	<p>Again, it will probably go up, but minor. [background noise] - having problem with the lakes -. So I think it again will be because of population increasing it will increase, but not substantially.</p> <p>SP1: Is that the same as what you said with swimming, so the population grows but the limitation is the water quality?</p> <p>SP2: Well, for boating it's not as bad so you will see more increase of recreational canoeing and boating on Lake Ontario.</p> <p>SP1: Only in Lake Ontario?</p> <p>SP2: Yes, because our river systems we don't have that much water in them so the volume doesn't allow for so much boats.</p> <p>SP1: How certain are you there will be some increase due to population growth for kayaking and boating?</p> <p>SP2: I'm certain.</p> <p>SP1: Somewhat or very certain?</p> <p>SP2: I don't know, somewhat certain.</p> <p>SP1: And that's for kayaking and for boating?</p> <p>SP2: Yes</p>	U3-Recreational boating

Interview coding for FW-5

FUNqyWATER code name: respondent W12 (SP2)

interview date 11 October 2019

interviewer Suzanne van der Meulen (SP1)

transcript by Uitgetypt and Suzanne van der Meulen

Information that has been removed to prevent identification of the respondent is indicated with [...].

Table 9: Current Use FW-5

ID	Quotation Content	Codes
12:164	canoeing and kayaking on the river	CU3-Secondary contact recreation
12:166	the beaches are very much used for recreations	CU3-Primary contact recreation
12:168	there is sailing and boating	CU3-Recreational boating
12:170	There is irrigation uses. So, golf courses	CU1-Water extraction for irrigation of other vegetation
12:171	I guess there might be some other businesses that take water	CU1-Water extraction for other non-drinking purposes
12:173	you see often people fishing in the rivers	CU3-Recreational fishing
12:174	also used for fishing	CU1-Fishing for consumption purposes
12:175	order to manage during, for flooding	CU2-Managing water quantity

Table 10: Future Demand FW-5

ID	Quotation Content	Codes
12:1	<p>SP1: So, if we start with the first section, those are provisioning use functions, so these are goods that we can retrieve from the surface water system, and you already mentioned the fishing for consumption.</p> <p>SP2: Yeah.</p> <p>SP1: I found this is taking place, so the sport fishing in the rivers, the ponds and in Lake Ontario. I didn't find specific numbers for Toronto, but I found some literature that shows that there is consumption of fish that is caught in the Great Lakes system.</p> <p>SP2: Yeah.</p> <p>SP1: And I also found these guidelines from the province of Ontario. What do you think for the future, you said well... There are some plans to improve the situation for consumption, do you think that the demand for catching fish for consumption, that it will change?</p> <p>SP2: It will change if the quality of the fish improves, yes. It would change quite substantially, I would think.</p> <p>SP1: Yeah.</p> <p>SP2: Because people love to fish, people love to fish. Wedo fishing, we are big on fishing in Canada, because we have all of these lakes, and we go long distances to go fish. So, if they could fish right in Toronto, they would do it more often.</p> <p>SP1: Yes.</p> <p>SP2: And I think the thing preventing them from doing that, is that there is a perception – whether right or wrong – that all fish caught in those rivers is too contaminated for consumption.</p> <p>SP1: Yeah.</p> <p>SP2: And, so in many cases people who do fish, they just catch and release, they just do catch and release.</p> <p>SP1: Okay.</p> <p>SP2: Because they like the sport of fish, but they don't really want to consume the fish. So, if the fish were more consumable, and the... If this was provable by looking at fish tissues over time and trending to... being more and more consumable, then I would imagine that that would definitely increase the amount of people interested in doing fishing for consumption purposes.</p> <p>SP1: Yeah. So, because the improvement. And every time I will ask you how certain you are of the trend. So, now you think that the trend is that demand will increase, and I would like to know: are you very certain, somewhat certain, somewhat uncertain, or very certain about this trend?</p> <p>SP2: Somewhat certain.</p>	U1-Fishing for consumption purposes
12:2	It would change quite substantially, I would think.	T-Increase
12:3	Because people love to fish, people love to fish. Wedo fishing, we are big on fishing in Canada, because we have all of these lakes, and we go long distances to go fish. So, if they could fish right in Toronto, they would do it more often.	D-Popularity of the activity

ID	Quotation Content	Codes
12:4	Somewhat certain.	C-Somewhat certain
12:5	So, if the fish were more consumable, and the... If this was provable by looking at fish tissues over time and trending to... being more and more consumable, then I would imagine that that would definitely increase the amount of people interested in doing fishing for consumption purposes.	D-Water quality improvement
12:6	<p>SP1: Okay. And is there any catch of other water related animals in Toronto? I didn't find information about that, but maybe you know more?</p> <p>SP2: Uh. ... No, I mean, not for human use I would say. Of course, there is catch of beavers – ha-ha – but they are trying to catch them in order to manage them. So, they do catch them and they take them elsewhere, they don't euthanize them, they take them elsewhere.</p> <p>SP1: Yeah.</p> <p>SP2: Where they not could be of harm. So, there is...</p> <p>SP1: Yeah, but that is not for...</p> <p>SP2: ...that kind of, yeah...</p> <p>SP1: Not for consumption.</p> <p>SP2: I guess... Yeah, no, I mean, I am not gonna say, in many parts of Ontario of course waterfowl are a big, you know, source of meat, and people love to hunt waterfowl. But you're not allowed (00:36:29) hunting waterfowl in the city, and you won't be ever able to do that, so yeah, that is not really something where people would... In fact, we have like thousands and thousands of Canada geese, you know that. People don't really want any more of these guys, in our parks, they are just very dirty - ha-ha. But... And sometimes they do have programs where they catch them and take them out, they are not necessarily waterfowl though, they are kind of... They do use the water, and they do tend to congregate around water, but they certainly congregate around other areas as well. So, I don't know of any other animals that would be used. Maybe, maybe shellfish.</p> <p>SP1: M-hm.</p> <p>SP2: Maybe mussels and so on, there might be some people that eat those, but I am not really familiar with that. My fish guy would probably know, ha-ha, whether people who eat those or not. There is a lot of mussels, and those could be consumed.</p> <p>SP1: Yeah, but you said there is no hunting of waterfowls in Toronto.</p> <p>SP2: No, not allowed, no.</p> <p>SP1: No, I thought so too. And do you think that demand to catch water related animals for consumption, so not fish but other animals, do you think that the demand for this will change?</p> <p>SP2: I don't think so. I don't think that is going to change much.</p> <p>SP1: No, and why do you think it will not change?</p> <p>SP2: I think that there is just not that much interest in catching animals and cleaning them for consumption, you know. It would be... The knowledge just isn't there and the interest isn't there. And I don't meet anyone – put it that way – or I don't talk to anyone or I don't see anything in the literature that suggests that that is indeed something that would be a trend. And I don't know that cleaning up the water, would necessarily bring more of them into the watershed. I don't think they are limited like fish are limited, in terms of the quality of the water. They tend to be more resilient, so you know... Otters for instance, or you know they... if they thought it was a good habitat, you know regardless of whether it was particularly clean or not, they would probably, you know, be here. But they don't think it's good habitat, so they are not here.</p> <p>SP1: Yeah.</p> <p>SP2: So, yeah, I don't think so, I don't think so. I am not...</p> <p>SP1: And how certain are you that the demand...</p> <p>SP2: I am not certain okay, so don't, I am not an expert in that area, so I would say I am not that certain, no. You would have to talk to someone who is kind of more tight into that.</p> <p>SP1: And not that certain, is that somewhat certain of somewhat uncertain? Of very uncertain?</p> <p>SP2: Somewhat uncertain.</p>	U1-Catch of other aquatic animals for consumption
12:7	I don't think so. I don't think that is going to change much.	T-No change
12:8	<p>I am not certain okay, so don't, I am not an expert in that area, so I would say I am not that certain, no. You would have to talk to someone who is kind of more tight into that.</p> <p>SP1: And not that certain, is that somewhat certain of somewhat uncertain? Of very uncertain?</p> <p>SP2: Somewhat uncertain</p>	C-Somewhat uncertain



ID	Quotation Content	Codes
12:10	<p>And, is there any harvest of aquatic plants, or algae for consumption? SP2: Well you got it on your list, so you definitely found it in the literature, uhm... SP1: I didn't find any examples of that in Toronto. SP2: Oh okay. Uhm. SP1: I didn't find SP2: No, it... SP1: ...but maybe you know an example, I didn't find it. SP2: No, I would say that... I mean, we do have indigenous communities, indigenous communities know their aquatic plants and they know what they can eat and what they can't eat. And certainly, there is, probably some minor amount of aquatic plant harvesting by those groups, but it would be very, very minor, by a very small segment of the population. So, I would say that that is not happening very much, and it's not likely to happen much more in the future. So, unless they programme... Yeah, unless there was a programme that specifically tried to encourage it. SP1: And why do you think that it is minor and that will not change? The demand will not change? SP2: Uhm. Well, it is minor because there are not very many groups that know anything about aquatic plants, or how to harvest them for consumption purposes. SP1: Yeah. SP2: And so... I mean, your regularly person in Toronto is gonna know nothing about that. And the same with algae, uhm... SP1: Yeah, just don't know about it. SP2: ...so the indigenous people, you the very, very far and few between, and most of them probably don't harvest aquatic plants, and there is just a very limited number that would harvest the plans for consumption. SP1: Hm. SP2: And so, I just, yeah, I think that's probably not going to increase a lot. SP1: Okay, and how certain are you that it will not change? SP2: Eh, somewhat uncertain. SP1: Okay. SP2: It's not my area, so I can't sort of say for sure.</p>	U1-Harvest of aquatic plants or algae for consumption
12:11	it's not likely to happen much more in the future	T-No change
12:12	<p>SP2: Eh, somewhat uncertain. SP1: Okay. SP2: It's not my area, so I can't sort of say for sure.</p>	C-Somewhat uncertain
12:14	<p>You already mentioned before that surface water is used from drinking water, hè, most drinking water comes from Lake Ontario. I found in the State of the watershed report for Humber that there is also some extractions of Humber River water for drinking water production. But I don't know if that is still the case? SP2: Uhm. Surprising, it is surprising to me. I don't know why, no I mean, my understanding anyways is that... all of the water comes from intakes that are located a couple of kilometres offshore. And that is... in a sort of deeper part of the lake. So, it is a much cleaner source. To take it from the river itself, for drinking, eh... I don't know of any examples of that. So, maybe it is true, but I don't know of any examples of that. SP1: Okay. Well, other people I interviewed, were also surprised, so maybe I have to check that again. But if... SP2: Yeah, I would... I mean, if it is in there, it is probably true. You know what the... You probably know about the history of the water treatment plants, is that we used to have those sort of spread up the watersheds. And they used to take river water for drinking water. But there was a big push to put all of those along the waterfront, and to take them off the watersheds. Because, eh well, that was the waste water treatment plant. So, yeah, the drinking water treatment plants, were typically on the waterfront. But the waste water treatment plants were kind of spread out all over. And basically, put all those down on the waterfront. So, we discharged our waste to Toronto, that is one kilometre offshore, and we take our drinking water from Lake Ontario, and as far as I know that is the only place, we actually get it. SP1: Okay... SP2: And it would be very, very minor. SP1: ...wellir was a very small one. Yeah, but if you think about the future, do you think the demand for extracting surface water for drinking water production, that it will increase, decrease, stay the same? SP2: It will increase. SP1: Okay, and why do you think that it will increase? SP2: Because all of the populations around Toronto are using that source as their drinking water source. So, as the population expands, the urbanfringe expands, continuous to expand northward, up towards the Oak Ridges Moraine, there will be a larger population that needs to be served. And so... SP1: Yeah, so it's population. SP2: ...there will be more water being extracted to serve that population, so it is just a population growth issue. SP1: Yeah. SP2: We get all of our drinking water from there, and so as the population expands, so too will the use. SP1: Okay, and how certain are you of this increase? SP2: Very certain.</p>	U1-Water extraction for drinking water production
12:15	It will increase.	T-Increase



ID	Quotation Content	Codes
12:16	<p>Because all of the populations around Toronto are using that source as their drinking water source. So, as the population expands, the urbanfringe expands, continuous to expand northward, up towards to the Oak Ridges Moraine, there will be a larger population that needs to be served. And so...</p> <p>SP1: Yeah, so it's population.</p> <p>SP2: ...there will be more water being extracted to serve that population, so it is just a population growth issue.</p> <p>SP1: Yeah.</p> <p>SP2: We get all of our drinking water from there, and so as the population expands, so too will the use.</p>	D-Population growth
12:17	Very certain	C-Very certain
12:18	<p>And there may be extractions for non-drinking purposes. You mentioned irrigation. If we first look at irrigation for agricultural purposes. I found that there is quite some extraction of Humber water for irrigation, but this may be outside of Toronto, that's not within the figures. Do you know if there is extraction of surface water in urban Toronto or in Toronto for irrigation of agriculture, or to feed livestock?</p> <p>SP2: Uhm. Well, there is very little livestock and agriculture in Toronto.</p> <p>SP1: M-hm.</p> <p>SP2: I am not gonna say there is none, you know there are small gardens here and there, and so on. And there might be some small water takings associated with those. But wherever those community gardens are, there is typically a tap, you know, uses main supply to provide the water for irrigation.</p> <p>SP1: M-hm.</p> <p>SP2: So, if it is in any way a city run facility, it would be probably not taking the water from the river.</p> <p>SP1: Yeah, so you think that this is not or only very minor taking place?</p> <p>SP2: Minor, minor, very, very minor. And probably...</p> <p>SP1: Yeah, and do you think...</p> <p>SP2: ...won't increase, no probably won't increase, I don't think it will.</p> <p>SP1: Do you think it will stay the same, or do you think the demand will decline?</p> <p>SP2: I think it will stay the same.</p> <p>SP1: Okay.</p> <p>SP2: Possibly increase slightly, but you know, if the quality of the water would be better.</p> <p>SP1: Yeah, and why do you think that it will either stay the same or increase a little bit.</p> <p>SP2: Well I think, you know, in keeping with the sort of trend towards trying to improve the water quality, if the water quality is better, then there might be more demand for it. And I think there is a tendency to try to create better access to the rivers, to use the floodplains for various, beneficial purposes, including urban gardens. And so, I think there is... As the number of gardens and the amount of food production increases in Toronto, there might be a small increase in the amount of takings.</p> <p>SP1: Yeah.</p> <p>SP2: If it... yeah, but... I wouldn't say that is likely. I think likely what is gonna happen, is they are just going use more main supply water, going to use more lake water to irrigate.</p> <p>SP1: Lake water or drinking water? Potable water?</p> <p>SP2: Yeah, drinking water, lake water, well lake water... When I say lake water, it is drinking water. So, it goes to the treatment plant and thenup and then treat it, so then it is drinking water.</p> <p>SP1: So, in the end, what is the trend in demand?</p> <p>SP2: The trend in demand is probably, you know, constant, it is not going to change, it's not probably going up, no.</p> <p>SP1: Yeah, and how certain are you of this?</p> <p>SP2: Somewhat certain</p>	U1-Water extraction for irrigation of food crops or livestock watering
12:22	Somewhat certain	C-Somewhat certain
12:23	The trend in demand is probably, you know, constant, it is not going to change, it's not probably going up, no.	T-No change



ID	Quotation Content	Codes
12:25	<p>there may be also irrigation of other types of vegetation, you already mentioned the golf courses. And I also found figures in a TRCA-reports, that actually, yeah, a large part of the extractions of surface water are for golf course irrigation. I don't know if there are also other types of irrigations, like parks or gardens. Do you know more about that?</p> <p>SP2: Most of the gardens and parks are irrigated with drinking water, so lake water. I... I don't think... If any... Well, I guess it depends on the trends right, so if the quality of the water gets better, then there will be potentially more water taken for irrigation of parks and golf courses. But currently, there is a downward trend. There is a downward trend. Many golf courses are being forced to go off of that source. And as the urban area expands north, we get more and more salt in the rivers. It's likely to become more and more salty, even if it's cleaner from other perspectives, the salt is likely to increase or stay the same. So, I don't... it's actually more increase in surface water takings for irrigation than is currently the case. I would say it's going remain relatively similar to what it is now.</p> <p>SP1: Okay, so there... you say the water quality improves, but the golf courses are forced to move to another source. Who forces them?</p> <p>SP2: Well they are forced just by the quality of the water, because it is no longer.....making the grass green, you know, it's actually hurting the grass.</p> <p>SP1: Yeah.</p> <p>SP2: So, that's what forcing them, it's just the practicalities of it. So, and I don't expect that the salt, that the rivers will become less salty over time, because of the urban growth. So, I am saying that that is likely not going to change. We are not going to use more irrigation for vegetation because it is not becoming less salty, and salt is the main reason why we are not taking as much as maybe we used to take from the river, for irrigation and other vegetation like golf courses, park.</p> <p>SP1: Yeah, okay. And you say it is not increasing, and it is also not decreasing, it is staying the same?</p> <p>SP2: Yeah, staying the same I would say.</p> <p>SP1: Okay, and how certain are you?</p> <p>SP2: Somewhat certain.</p>	U1-Water extraction for irrigation of other vegetation
12:26	Somewhat certain	C-Somewhat certain
12:28	Yeah, staying the same I would say.	T-No change
12:29	<p>Many golf courses are being forced to go off of that source. And as the urban area expands north, we get more and more salt in the rivers. It's likely to become more and more salty, even if it's cleaner from other perspectives, the salt is likely to increase or stay the same. So, I don't... it's actually more increase in surface water takings for irrigation than is currently the case. I would say it's going remain relatively similar to what it is now.</p> <p>SP1: Okay, so there... you say the water quality improves, but the golf courses are forced to move to another source. Who forces them?</p> <p>SP2: Well they are forced just by the quality of the water, because it is no longer.....making the grass green, you know, it's actually hurting the grass.</p> <p>SP1: Yeah.</p> <p>SP2: So, that's what forcing them, it's just the practicalities of it. So, and I don't expect that the salt, that the rivers will become less salty over time, because of the urban growth. So, I am saying that that is likely not going to change. We are not going to use more irrigation for vegetation because it is not becoming less salty, and salt is the main reason why we are not taking as much as maybe we used to take from the river, for irrigation and other vegetation like golf courses, park.</p>	Db-Water quality deterioration/salinization
12:30	<p>P1: And is there any extractions of surface water for industrial process water? I didn't find any information about that. Maybe it is hidden behind the use for miscellaneous use, I don't know.</p> <p>SP2: I don't think so, no. I don't know, like I said I just don't know. I don't think so, but I don't know enough to be able to say for sure, whether it is being used for that purpose.</p> <p>SP1: Okay. And do you have any information about the future demand?</p> <p>SP2: I don't expect it is gonna increase. I don't hear any talk about that, anyways. But I am somewhat uncertain, ha-ha.</p> <p>SP1: Ja.</p> <p>SP2: I don't think it is going to increase.</p> <p>SP1: You say it will not increase, that can mean that it stays the same, or it can mean that it decreases?</p> <p>SP2: Yeah, it's gonna stay the same I think, you know, pretty much.</p> <p>SP1: Okay.</p> <p>SP2: So, I don't see it as increasing necessarily.</p> <p>SP1: Yeah. Okay.</p> <p>SP2: Yeah, because, you know, process water also has to be of a certain quality as well, sometime, often, right. And no one wants to put salty water in their – well, most of the time salty water is the problem. So, I can't see it increasing in Toronto, outside of Toronto, further north, maybe. But not so much in Toronto.</p>	U1-Water extraction for industrial processes
12:33	Yeah, it's gonna stay the same I think, you know, pretty much	T-No change
12:34	But I am somewhat uncertain, ha-ha.	C-Somewhat uncertain
12:35	Yeah, because, you know, process water also has to be of a certain quality as well, sometime, often, right. And no one wants to put salty water in their – well, most of the time salty water is the problem. So, I can't see it increasing in Toronto, outside of Toronto, further north, maybe. But not so much in Toronto	Db-Water quality deterioration/salinization



ID	Quotation Content	Codes
12:36	<p>SP1: No, okay. And for firefighting? I didn't find any examples that surface water is being used for firefighting? But maybe it happens?</p> <p>SP2: Eh, no, I don't know... You know, we have hydrants everywhere, and the hydrants are all connected to the main supply. So, whenever there is a fire, they are always connecting to a hydrant, and by law, they have to have hydrants at, you know, regular intervals everywhere in Toronto. So, the likelihood that they would not be able to find a fire hydrant, and then have to tap into the lake, or to the river is small. And declining I would say, ha-ha, because...</p> <p>SP1: Do you think that the demand is declining?</p> <p>SP2: ...if there is such a situation, if there is a development, and there is such a situation where there is not any water for fire, then they would put one in, and that would be main supply. It would be drinking water.</p> <p>SP1: So, you think that the demand will even decline?</p> <p>SP2: Yeah.</p> <p>SP1: And what would be the main reason for that?</p> <p>SP2: Because, in order to fight a fire effectively, you need to respond quickly, and if... And the quickest response is to connect to a hydrant.</p> <p>SP1: Yeah.</p> <p>SP2: That's what all their equipment is geared towards. The slowest response is to go running down to the river, and putting an intake in the river, and then connecting it to a pump and then turning the pump on, and then, that's just not gonna happen, I don't think ...</p> <p>SP1: No, I see why that would be more of an advantage then to have the hydrant, but why do you think the demand is declining compared to now?</p> <p>SP2: There is someone at the door, I have to get that, because it is a delivery, just a sec, okay, just one minute, one moment.</p> <p>SP1: Yeah.</p> <p>SP2: Okay, sorry I had to just deal with this guy, but it's only gonna take like half a minute, but he is not, he is going getting the stuff, he gave me a window of nine to three, if he is gonna com, and he has to come right now.</p> <p>SP1: It's always like that, don't worry.</p> <p>SP2: Okay, yeah, it's gonna take just two seconds, once he arrives at the door, I just have to put it down and make sure he gave it to me.</p> <p>SP1: Yeah, that's okay. So, we were talking about the firefighting, you thought that the demand will even decline, how certain how you of that?</p> <p>SP2: Which one was this one, this was your firefighting, yes...</p> <p>SP1: How certain are you that it will decline...?</p> <p>SP2: Somewhat certain.</p> <p>SP1: Okay. And I...</p> <p>SP2: It's not my area really.</p>	U1-Water extraction for fire fighting
12:37	<p>SP1: Do you think that the demand is declining?</p> <p>SP2: ...if there is such a situation, if there is a development, and there is such a situation where there is not any water for fire, then they would put one in, and that would be main supply. It would be drinking water.</p> <p>SP1: So, you think that the demand will even decline?</p> <p>SP2: Yeah.</p>	T-Decrease
12:38	Somewhat certain.	C-Somewhat certain
12:39	That's what all their equipment is geared towards. The slowest response is to go running down to the river, and putting an intake in the river, and then connecting it to a pump and then turning the pump on, and then, that's just not gonna happen, I don't think ...	D0-Access to surface water is unpractical
12:40	<p>I also found that there are surface water extractions of, for example in Don and in Humber for filling ponds, for filling aesthetic ponds or fish ponds. Again, this is from the watershed plans, so that's almost ten years old information. Do you think that this is still happening?</p> <p>SP2: I need to say I don't know.</p> <p>SP1: Okay.</p> <p>SP2: Hm, filling the ponds hey, hm. Yeah, most ponds are just filled by the sewer water, you know, water coming out of the sewer, so that one is a bit of an odd one to me. But yeah, I guess it would be...</p> <p>SP1: Most of them are filled my sewer water?</p> <p>SP2: Well, I mean the stormwater ponds right, so the stormwater ponds would be connected to sewers, to the drain the catchment and that's how they would get filled up. These are some kind of other ponds that I am not that familiar with...</p> <p>SP1: Yeah, they are mentioned to be like aesthetic ponds or fish ponds.</p> <p>SP2: Yeah, okay. Not many of those. Just a second, got to just go. Okay sorry, okay now I am back, yeah, he is done. Yeah, filling ponds, yeah, I don't know anything about that, I don't know those ponds.</p> <p>SP1: No, okay.</p> <p>SP2: Someone working on the waterfront would know more about how many of those there are, and whether they are increasing or not.</p> <p>SP1: Yeah, so you also don't have information about the future demand?</p> <p>SP2: No, not going to say anything about that.</p>	U1-Water extraction for filling ponds
12:41	No, not going to say anything about that.	No information



ID	Quotation Content	Codes
12:42	<p>And are there any other extractions for non-drinking purposes? I found that there are...</p> <p>SP2: Non-drinking...</p> <p>SP1: ...other uses, but I mean, I don't know what is behind that in the figures.</p> <p>SP2: Eh, let me think. There are other uses, what it just said other uses? Is that what it said?</p> <p>SP1: Yeah, its extractions for other uses, so that's a collection of many small extractions probably, I don't know.</p> <p>SP2: Yeah.... Yeah, sometimes water trucks...</p> <p>SP1: ... maybe not small extractions, but a few number of the extractions.</p> <p>SP2: Yeah, sometimes what happens, is these water trucks require to water and take it somewhere. So, there is not a source of water, and they need water. It tends to happen outside of Toronto, not so much in Toronto, because there are sources everywhere in Toronto. But what they will do, is they will drive down to the river and then they will fill up their tank, their truck, and then they will go take the water to where they need to take it. But they require a permit to do that – sometimes they are doing it illegally. So, I don't think there is a lot of those, not many of those.</p> <p>SP1: But I don't really understand, so there are people with a truck taking the water, but what is this water used for then?</p> <p>SP2: Well, it's wherever they don't... Let's say a place needs water, let's say a business needs water but it doesn't have a source of water. So, it needs to kind of use a truck to get it there. Yeah, it's a good question, like... There are not many things like that in the city. In the rural areas, yes there is a lot like that. Because they don't have that many sources. But in the city, there are so many sources. So, the thing is there, if... sometimes there is lot of sources, but because each of those sources, someone has to pay for the water at each of those sources, the truck isn't able to gonna just go up and take it from those sources, ha-ha, so in order to supply the water where they need to take, they need to go the river. Now what are this, the final end users of that, that's a good question, where are those water trucks using it for, good question, I mean... It happens, but I don't really have a good sense of kind what they are using it for. Like, it might be some kind of irrigation project, that they sort of... Where there are no taps nearby, and they need to irrigate, or maybe they did some tree planting or something, and they need to irrigate, but they don't have a source nearby so they just go to the river and get it.</p> <p>SP1: Yeah maybe on a project basis, yeah.</p> <p>SP2: No, it's a...</p> <p>SP1: So, you say, you say I don't think this happens a lot in Toronto, it's more in the rural areas, so if you think about Toronto, what do you think, will the demand for this change towards 2040?</p> <p>SP2: No, I don't think it's going to change.</p> <p>SP1: Okay, and why do you think it will not change.</p> <p>SP2: Uhm. Because there is... more and more other sources of water. And also... there tends to be more and more restrictions related to water takings. And so... To take water like that requires a permit, and it takes a long time to get the permit and so and so. I think they are trying to reduce the numbers of illegal water takings, and legal water takings. Not increase them. So, I think that is... I think the city would prefer if they just got the water from their sources, and pay them for it – ha-ha – rather than taking it from the river.</p> <p>SP1: Yeah, it is ...</p> <p>SP2: And the river is becoming more and more salty over time, and therefore it will become less and less suitable for many uses. So, that's why I think it's not going to become more, it's not gonna come more, it might stay the same, but it won't become more. I am somewhat certain about that.</p>	U1-Water extraction for other non-drinking purposes
12:43	No, I don't think it's going to change.	T-No change
12:44	<p>And also... there tends to be more and more restrictions related to water takings. And so... To take water like that requires a permit, and it takes a long time to get the permit and so and so. I think they are trying to reduce the numbers of illegal water takings, and legal water takings. Not increase them. So, I think that is... I think the city would prefer if they just got the water from their sources, and pay them for it – ha-ha – rather than taking it from the river.</p>	Db-Regulations don't allow the use
12:45	<p>And the river is becoming more and more salty over time, and therefore it will become less and less suitable for many uses. So, that's why I think it's not going to become more, it's not gonna come more, it might stay the same, but it won't become more</p>	Db-Water quality deterioration/salinization
12:46	I am somewhat certain about that.	C-Somewhat certain
12:47	<p>Are there any other extractions of materials from the surface water system? So, is there maybe extraction of biomass, so that's again plants or algae for non-food purposes? I didn't find...</p> <p>SP2: No that I know of, no.</p> <p>SP1: No, I didn't find it either. Do you think that the demand for this will change?</p> <p>SP2: Well, not knowing the sources very well, I am probably not in a good position to comment.</p> <p>SP1: Okay, so...</p> <p>SP2: I mean I don't know that there are... There might be, but I don't know of any.</p> <p>SP1: I didn't find any examples either, no.</p> <p>SP2: Yeah, I mean, it is a really big city, and there is lots of people and things happening, you know, so I am reluctant to say that I know, for sure, ha-ha, but I just say no comment on that, I don't know for sure. Whether in fact... yeah there are gonna be other ones.</p> <p>SP1: Okay.</p> <p>SP2: It would be small.</p>	U1-Harvest of biomass for non-food purposes



ID	Quotation Content	Codes
12:48	so I am reluctant to say that I know, for sure, ha-ha, but I just say no comment on that, I don't know for sure.	No information
12:49	<p>SP1: Yeah, and hat about extractions of abiotic materials, I didn't find any examples of that either in Toronto, but yeah, maybe you know more? Are there any extractions from the surface water system, for example like sand or clay of gravel?</p> <p>SP2: No. Uhm, not allowed. So, no.</p> <p>SP1: No. And do you think...</p> <p>SP2: No, you're not allowed. This is again something that they are trying to, from a regulatory point of view, they are trying to ensure it doesn't happen. They don't want to disturb the creeks, any work in the creek, any sort of takings from the creek, any sort of small change to the creek requires extensive permits, to do. So, I would say that is not happening very much right now, and is likely to happen less and less over time. As... as the regulations start to become more stringent.</p> <p>SP1: Yeah, so do you think it is... that because of the regulations are more stringent, that also the demand will decline?</p> <p>SP2: Yeah, uhm... possibly, but I think the demand right now is fairly small, anyways. Because there are many, many sources for a lot of those abiotic materials, gravels and sands, and those kinds of things are... There's many other sources, they can buy them.</p> <p>SP1: Yeah.</p> <p>SP2: So, these things are typically bought, they don't go down to the creek and do that.</p> <p>SP1: No, but maybe there are companies who sell these aggregates and they take it from the water system?</p> <p>SP2: Illegal. Can't do it, they are not allowed just doing that. It has to ... yeah.</p> <p>SP1: Yeah. And how certain are you that this will even decline?</p> <p>SP2: I would say, let's just say it's going to stay the same as it is now. And I am somewhat certain.</p>	U1-Extraction of abiotic materials
12:50	And I am somewhat certain	C-Somewhat certain
12:51	I would say, let's just say it's going to stay the same as it is now	T-No change
12:52	No, you're not allowed. This is again something that they are trying to, from a regulatory point of view, they are trying to ensure it doesn't happen. They don't want to disturb the creeks, any work in the creek, any sort of takings from the creek, any sort of small change to the creek requires extensive permits, to do. So, I would say that is not happening very much right now, and is likely to happen less and less over time. As... as the regulations start to become more stringent.	Db-Regulations don't allow the use
12:53	<p>Because there are many, many sources for a lot of those abiotic materials, gravels and sands, and those kinds of things are... There's many other sources, they can buy them.</p> <p>SP1: Yeah.</p> <p>SP2: So, these things are typically bought, they don't go down to the creek and do that.</p>	D0-Alternatives are better
12:54	<p>And I know, if we go to the next one, that there is the use of thermal energy from the water system, that Enwave is using this deep lake water cooling system to cool the offices in downtown Toronto. And I also read that the samewater is also used for producing potable water.</p> <p>SP2: M-hm.</p> <p>SP1: Do you think that the demand for this will change towards 2040? To use surface water for this?</p> <p>SP2: Yeah, I think that project was a very successful project. And so, there will be probably interest in expanding the project or potentially replicating the project elsewhere.</p> <p>SP1: M-hm.</p> <p>SP2: As a... because there is a, well, Toronto has a climate plan, and in order to meet that climate plan, they need to find ways of reducing greenhouse gas emissions. And this is a very successful way of doing that, so it could be a potential... something that potentially expands over time. I am somewhat certain of that.</p> <p>SP1: Yeah, and that is because of this ambition to reduce the greenhouse gasses.</p> <p>SP2: That particular project was very successful.</p> <p>SP1: Yeah okay. And are there...</p> <p>SP2: It was very cost effective and successful, so there was a very good business case associated with it, and it was very successful, so I think they might be looking for other options there.</p> <p>SP1: Yeah okay. And is the surface water also being used as cooling water for power plants?</p> <p>SP2: Yes, but not so much in Toronto, that's out in Pickering, or rather Ajax, right near Ajax there is a thermal, there is a nuclear plant, that uses it for cooling.</p> <p>SP1: Okay, yeah.</p> <p>SP2: Yeah, uses it extensively for cooling.</p> <p>SP1: Okay, so that is just outside...</p> <p>SP2: They have problems because their intakes for all of that cooling water – and it is a lot of cooling water, this is nuclear plant, so it is a lot of cooling water – there intakes get clogged with algae. And so, there is a lot of concern about, you know, they have to go and clean the intakes more often than they otherwise would if there weren't algae and so and so. Yeah, there is definitely cooling happening, but I don't believe not so much in Toronto.</p> <p>SP1: Do you know which water the nuclear plant in Ajax is using? Which water...</p> <p>SP2: It's taken right from the lake, along the waterfront.</p> <p>SP1: Lake Ontario?</p> <p>SP2: Yeah, so if you look at where that nuclear plant is located, the intake for that is gonna be right next to that, like literally right in front of it, it is right on the shoreline.</p> <p>SP1: Okay.</p> <p>SP2: And it would be just taking right from there, the water, and cool.</p>	U1-Thermal energy extraction



ID	Quotation Content	Codes
12:55	I am somewhat certain of that.	C-Somewhat certain
12:56	because there is a, well, Toronto has a climate plan, and in order to meet that climate plan, they need to find ways of reducing greenhouse gas emissions. And this is a very successful way of doing that, so it could be a potential... something that potentially expands over time	D-Sustainability ambitions
12:57	It was very cost effective and successful, so there was a very good business case associated with it, and it was very successful, so I think they might be looking for other options there.	D-Cost saving ambitions
12:58	I think that project was a very successful project. And so, there will be probably interest in expanding the project or potentially replicating the project elsewhere.	T-Increase
12:59	is there any electricity, energy, being produced from the surface water system by using, ja, osmotic processes, like using the salinity gradient, or biological, microbial processes? SP2: No. SP1: No, I didn't find it either. Do you think that the demand for this will change? SP2: Uhm, I don't hear any talk about it, you know. But again, this is not my area, so I'd have to ask someone in the energy sector. But I don't hear any talk about that. SP1: No, so what do you think then for the demand? SP2: I think not, but I am not that certain because it is not my area. SP1: Yeah. SP2: So, let's say I am uncertain, but I don't think it will increase. SP1: Yeah, are you somewhat uncertain or very uncertain? SP2: Very uncertain. SP1: Okay. SP2: Like, you know there might be a burgeoning industry there that I don't know about.	U1-Energy production by using the salinity gradient in water
12:60	but I don't think it will increase.	T-No change
12:61	Very uncertain.	C-Very uncertain
12:62	Uhm, I don't hear any talk about it, you know. But again, this is not my area, so I'd have to ask someone in the energy sector. But I don't hear any talk about that.	D0-No reason for change/don't know
12:63	SP1: Yeah, and any energy production by using the kinetic energy of water? So, like in hydropower dams or using wave energy? SP2: Well, we have dams and we've never used them for that purpose, so I don't think that they are going to be used for that purpose. Uhm, no I think not, but I am very uncertain, ha-ha, because it is not really my area, but I think not. There is definitely not any desire to put in dams specifically for energy production. That's just something that is out of fashion, it used to be in fashion, and now it is completely out of fashion because of the other by-products of that, of those dams. So, it is not something that is going to increase, whether they use existing dams for that purpose, probably not, because they are not designed for that purpose, so I doubt it, I very much doubt it, but I would say I am still very uncertain about that, because it's not my area. SP1: Yeah. So, you mean that is not going to take place or it will stay the same, it's not happening now and it will not happen? SP2: Yeah, it's going to stay the same, if it is happening now, it is probably going to continue to happen, but it's... likely stay the same, but I would say somewhat uncertain about that	U1-Energy production by using kinetic energy of water
12:64	Yeah, it's going to stay the same, if it is happening now, it is probably going to continue to happen, but it's... likely stay the same	T-No change
12:65	but I would say somewhat uncertain about that.	C-Somewhat uncertain
12:67	SP1: Yeah, okay. Shall we move on to the next category, this is a category of more like processes that we can use to manage the quality of our environment. The first one is managing water quality. Yeah, there are some processes taking place in surface water that can improve water quality, like dilution or degradation of pollutants. But what I mean here, is: is the surface water intentionally being used to improve water quality? To manage water quality? SP2: ... SP1: And this can be by the use of, yeah, I think that we can regard the storm, some of the stormwater management ponds in Toronto in this perspective, because some of them are really designed to improve water quality before the water is discharged into the river water. But you could also think of using surface water to flush another waterbody for example. SP2: Yes, I mean, eh... stormwater ponds are... are likely to become more than less over time, yeah, so if you regard that, they are not really taking surface water, they are taking water that comes off of the impervious surfaces, but then drained to the sewers and then they clean them. So, it is not actually a surface water taking, it is a surface water cleaning activity, ha-ha, it is like a surface cleaning activity, that then eventually goes to the surface water, so it's not, they are not using the surface water to... to clean the water coming from the sewers. They are just... SP1: No, I was more thinking, I was thinking that maybe we could regard this stormwater ponds, they are also surface waterbodies, right? They are... SP2: Okay, if you look at it that way, yeah if you look at it that way, yeah, then I think, that's true. They are creating more stormwater management ponds, wherever there is an opportunity, or they are expanding them, potentially increasing the size of them, or converting dry ponds to wet ponds, making what was not a surface water system into a surface water system, for the purposes of managing water quality. SP1: Yeah. SP2: And that is likely to increase and not decrease, but it is not going to increase by a lot, because there is not much land. So yes, that is likely to increase.	U2-Managing water quality



ID	Quotation Content	Codes
	<p>SP1: And why do you think that it is increasing? What's the driver behind this?</p> <p>SP2: I think it is increasing... because much of Toronto was developed without stormwater management. And now, whenever there is a major redevelopment, stormwater management is required by law, and by the City of Toronto standards. And therefore, there would be more of these kinds of facilities in place over time, as more and more of the city becomes redeveloped. And certain areas that are underdeveloped are developed. So, there are areas in Toronto that are underdeveloped and they will be developed, because there is big money in developing them. And when they develop them, they will be required to do water quality management. And the primary means by which water quality management is done in this city, is through stormwater ponds, and other small infrastructure, but for the most part stormwater ponds are usually required for flood control. So, yeah, I think, yeah, so I think it will increase because of that. Because, there is no stormwater management and there is push on in the city to increase the amount of stormwater management in the city. And if you look at – I don't know if you have looked at the Toronto wet weather flow management Masterplan?</p> <p>SP1: No.</p> <p>SP2: It is a very large document, gigantic document with many, many appendices, that was produced in 2003. And from which the wet weather guidelines were sourced for Toronto.</p> <p>SP1: M-hm.</p> <p>SP2: And that was a, basically a masterplan for how water would be managed in the city.</p> <p>SP1: M-hm.</p> <p>SP2: I think it would be an important source for you, I don't know if they have it online, you probably have to get it somehow.</p> <p>SP1: Can you send me an email with the title, and the organization as the author, I can find it. I found that most documents are really easily to find online, so.</p> <p>SP2: Yeah, I know it... I think I've looked for this online, I don't think the full masterplan is available online, so that's why I sort of say. It's called the Wet weather flow management masterplan, but I can send you an email, yeah. Yeah, Wet weather flow management masterplan, and it... it was done by Watershed, so they did it for the whole CSO-area, and for each of the watersheds there would be separate reports and separate plans.</p> <p>SP1: Yeah.</p> <p>SP2: And, those kind of lay-out, the plans, over a 25-year period.</p> <p>SP1: Okay.</p> <p>SP2: Yeah, so it would still be in effect.</p> <p>SP1: So, to get this clear for me: so, you say that because there was not a lot of stormwater management in place, now whenever there is new development there is a need...</p> <p>SP2: Or redevelopment.</p> <p>SP1: ...to build stormwater management ponds for the sake of flood management.</p> <p>SP2: And treating water.</p> <p>SP1: That is increasing. And besides these, there is... the stormwater management ponds are also increasing, and they have an effect on water quality. Do you think that they are also... Are they also intended to improve water quality? Or is this just a side-effect?</p> <p>SP2: No, they are intended to improve water quality.</p> <p>SP1: Yeah, okay. And you also mentioned that there is a trend to move from dry ponds to more wet ponds. Is that right?</p> <p>SP2: Yes, in the old days they used to put dry ponds in parks.</p> <p>SP1: Yeah.</p> <p>SP2: So, there would be a number of dry areas where water would be detained for a period of time and then released slowly after an event for flood control purposes; these are called water quantity ponds, they only have one function, and that is to control the quantity of the wage of flow, for flood control purposes. And so, they're not... They aren't really in favour anymore, because they don't really do a good job of water quality. So typically, when they have a new development, they are saying now you have to a wet pond, and that wet pond has to meet certain water quality criteria, and it has to be sized for water quality, and it also has to do the water quantity function as well.</p> <p>SP1: Yeah.</p> <p>SP2: So, it is really just kind of an evolution of the thinking in stormwater management; we now do more with the same thing. Same area.</p> <p>SP1: Yeah, more functionality. Okay. And how certain are you of this increase? In stormwater management ponds, both for water quantity and water quality management?</p> <p>SP2: Very certain.</p>	
12:68	Very certain.	C-Very certain
12:70	And that is likely to increase and not decrease, but it is not going to increase by a lot, because there is not much land. So yes, that is likely to increase.	T-Increase



ID	Quotation Content	Codes
12:71	<p>SP2: Yes, I mean, eh... stormwater ponds are... are likely to become more than less over time, yeah, so if you regard that, they are not really taking surface water, they are taking water that comes off of the impervious surfaces, but then drained to the sewers and then they clean them. So, it is not actually a surface water taking, it is a surface water cleaning activity, ha-ha, it is like a surface cleaning activity, that then eventually goes to the surface water, so it's not, they are not using the surface water to... to clean the water coming from the sewers. They are just...</p> <p>SP1: No, I was more thinking, I was thinking that maybe we could regard this stormwater ponds, they are also surface waterbodies, right? They are...</p> <p>SP2: Okay, if you look at it that way, yeah if you look at it that way, yeah, then I think, that's true. They are creating more stormwater management ponds, wherever there is an opportunity, or they are expanding them, potentially increasing the size of them, or converting dry ponds to wet ponds, making what was not a surface water system into a surface water system, for the purposes of managing water quality.</p> <p>SP1: Yeah.</p> <p>SP2: And that is likely to increase and not decrease, but it is not going to increase by a lot, because there is not much land. So yes, that is likely to increase.</p> <p>SP1: And why do you think that it is increasing? What's the driver behind this?</p> <p>SP2: I think it is increasing... because much of Toronto was developed without stormwater management. And now, whenever there is a major redevelopment, stormwater management is required by law, and by the City of Toronto standards. And therefore, there would be more of these kinds of facilities in place over time, as more and more of the city becomes redeveloped. 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And from which the wet weather guidelines were sourced for Toronto.</p> <p>SP1: M-hm.</p> <p>SP2: And that was a, basically a masterplan for how water would be managed in the city.</p> <p>SP1: M-hm.</p> <p>SP2: I think it would be an important source for you, I don't know if they have it online, you probably have to get it somehow.</p> <p>SP1: Can you send me an email with the title, and the organization as the author, I can find it. I found that most documents are really easily to find online, so.</p> <p>SP2: Yeah, I know it... I think I've looked for this online, I don't think the full masterplan is available online, so that's why I sort of say. It's called the Wet weather flow management masterplan, but I can send you an email, yeah. Yeah, Wet weather flow management masterplan, and it... it was done by Watershed, so they did it for the whole CSO-area, and for each of the watersheds there would be separate reports and separate plans.</p> <p>SP1: Yeah.</p> <p>SP2: And, those kind of lay-out, the plans, over a 25-year period.</p> <p>SP1: Okay.</p> <p>SP2: Yeah, so it would still be in effect.</p> <p>SP1: So, to get this clear for me: so, you say that because there was not a lot of stormwater management in place, now whenever there is new development there is a need...</p> <p>SP2: Or redevelopment.</p> <p>SP1: ...to build stormwater management ponds for the sake of flood management.</p> <p>SP2: And treating water.</p> <p>SP1: That is increasing. And besides these, there is... the stormwater management ponds are also increasing, and they have an effect on water quality. Do you think that they are also... Are they also intended to improve water quality? Or is this just a side-effect?</p> <p>SP2: No, they are intended to improve water quality.</p> <p>SP1: Yeah, okay. And you also mentioned that there is a trend to move from dry ponds to more wet ponds. Is that right?</p> <p>SP2: Yes, in the old days they used to put dry ponds in parks.</p> <p>SP1: Yeah.</p> <p>SP2: So, there would be a number of dry areas where water would be detained for a period of time and then released slowly after an event for flood control purposes; these are called water quantity ponds, they only have one function, and that is to control the quantity of the wage of flow, for flood control purposes. And so, they're not... They aren't really in favour anymore, because they don't really do a good job of water quality. So typically, when they have a new development, they are saying now you have to a wet pond, and that wet pond has to meet certain water quality criteria, and it has to be sized for water quality, and it also has to do the water quantity function as well.</p> <p>SP1: Yeah.</p> <p>SP2: So, it is really just kind of an evolution of the thinking in stormwater management; we now do more with the same thing. Same area.</p> <p>SP1: Yeah, more functionality. Okay. And how certain are you of this increase? In stormwater management ponds, both for water quantity and water quality management?</p> <p>SP2: Very certain.</p>	U2-Managing water quantity



ID	Quotation Content	Codes
12:72	<p>SP1: Okay. ... Okay. And are surface water bodies intentionally being used for climate regulation? For either global climate regulation or local climate regulation, influencing local temperature for example?</p> <p>SP2: ... Hm... Well, we did have that one example of Enwave. The Enwave system was using it for...</p> <p>SP1: Yeah, that is ...</p> <p>SP2: ... emissions reductions, energy reduction.</p> <p>SP1: M-hm.</p> <p>SP2: Yeah, so I think it is used. But I can't think of any other use, for this, that, yeah.</p> <p>SP1: I didn't find any other examples either. And do you have information about the future demand? Apart from the thermal system of Enwave.</p> <p>SP2: I don't have any information on that, no.</p> <p>SP1: And for...</p> <p>SP2: Maybe it's happening.</p>	U2-Global climate regulation by reduction of greenhouse gas concentrations
12:73	I don't have any information on that, no.	No information
12:74	<p>SP1: And for influencing local climate?</p> <p>SP2: No, I wouldn't say... So... There is a lot of talk about vegetated systems, vegetated stormwater management systems, reducing the heat island effect in the city, so green roofs are often touted as a way of doing that, bioretention systems, anything that encourages latent heat transfer, through evaporate transpiration is potentially going to slightly cool, provide a slight, slight cooling effect, and if there is enough of them, maybe a more significant cooling effect, in the city. But the ponds are not generally thought to do that. They actually probably do do that, to some extent – ha-ha – but they are not generally thought to be a heat island mitigation measure.</p> <p>SP1: No.</p> <p>SP2: They aren't talked about in that sense, they never talked about in that sense. So, while they might actually be having that effect, they are not encouraged for that reason ever.</p> <p>SP1: What do you think in terms for demand? The trend for that?</p> <p>SP2: Not going to increase, no...</p> <p>SP1: And also no decrease?</p> <p>SP2: No decrease no.</p> <p>SP1: So, it stays the same.</p> <p>SP2: Do you do that in The Netherlands, do you do local climate regulation with surface water?</p> <p>SP1: No, I don't have examples of that. There is research going on on the impact of surface waterbodies on local temperature, but I don't think that I found any examples of this, no. So, you think that the demand will stay the same, and how certain are you?</p> <p>SP2: Somewhat certain.</p>	U2-Local climate regulation
12:75	<p>SP2: Not going to increase, no...</p> <p>SP1: And also no decrease?</p> <p>SP2: No decrease no.</p> <p>SP1: So, it stays the same.</p>	T-No change
12:76	Somewhat certain.	C-Somewhat certain



ID	Quotation Content	Codes
12:78	<p>SP1: Okay. Okay, let's move to the next category, that is the one of cultural use functions, many of them are recreational uses. The first one is primary contact recreation. So, that means recreation where there is full body contact with the water, so that is swimming or diving. You already mentioned the beaches along Lake Ontario. Do you have any idea about the future trend, for swimming in surface water in Toronto?</p> <p>SP2: There will be an increase in demand, very certain.</p> <p>SP1: Yeah. And why do you think that it increases?</p> <p>SP2: It will increase because the city is really pushing that, I think there's a lot of marketing campaigns associated with that. And, because the city is attempting to try to provide areas that are cleaner. So, they are trying to improve the water quality, as are other areas north of Toronto, to... and for Toronto the main reason is to try to improve occupancy at the beaches. So, I guess it's kind of... Because they have a marketing campaign, because they want... They have a specific objective associated with that, with swim, swimmable beaches and also because many of their actions over time are helping to improve the water quality, along the waterfront, specifically in those areas. So, I think it will increase.</p> <p>SP1: Yeah, and that is specifically for the waterfront of Lake Ontario...</p> <p>SP2: Yeah.</p> <p>SP1: ...not for the rivers, or ponds or...?</p> <p>SP2: Yeah, that was really talking about the waterfront. The rivers ... will ... probably increase – ha-ha -it probably will increase as the density of population increases in Toronto. And especially down at the waterfront, and there is a lot of development along the waterfront, I would expect that the recreational use of those waterways would increase.</p> <p>SP1: Also in the rivers?</p> <p>SP2: Yes, in the rivers too, yes.</p> <p>SP1: Ja. And how certain are you for that trend in the rivers?</p> <p>SP2: Somewhat certain.</p> <p>SP1: Okay, and any other waterbodies?</p> <p>SP2: It's really associated with population increase.</p> <p>SP1: Yeah.</p> <p>SP2: There are specific areas where they targeted... they targeted growth areas. So, there is this area the Portlands, that used to be contaminated fill, all in the Portlands, and they have cleaned it all up, and they have changed it, and they have added flood berms, and they made a huge, huge efforts to try to create a huge development down there. And it's been successful, and that land will have huge number of people on it, and it's right down on the waterfront, and it's right next to those rivers.</p> <p>SP1: And which river are we talking about then?</p> <p>SP2: The Don River.</p> <p>SP1: Oh, that's the Don, oh ja, ja, oh ja. Okay, and, and the other waterbodies, are the ponds used for swimming for example?</p> <p>SP2: The ponds, uhm, no, and I don't think they will be.</p> <p>SP1: Okay.</p> <p>SP2: The ponds.</p>	U3-Primary contact recreation
12:79	There will be an increase in demand	T-Increase
12:80	very certain.	C-Very certain
12:82	Somewhat certain.	C-Somewhat certain
12:84	as the density of population increases in Toronto.	D-Population growth
12:85	And especially down at the waterfront, and there is a lot of development along the waterfront, I would expect that the recreational use of those waterways would increase.	D-Redevelopment close to water
12:87	<p>P1: Yeah, and secondary contact recreation, so that's things like canoeing and kayaking, you already mentioned that this is happening today. But what do you expect for the demand, towards 2040?</p> <p>SP2: Yeah, that's kind of what I was referring to before, the recreational uses of the rivers will increase, and that will be one of the uses: canoeing and kayaking.</p> <p>SP1: Yeah, so that's on the rivers, and...</p> <p>SP2: Yeah, on the river, especially on the rivers, because it is a lot more attractive, ha-ha-, doing it on the rivers, than it is on the waterfront.</p> <p>SP1: Yeah, and what would drive this increase?</p> <p>SP2: Population growth.</p> <p>SP1: Yeah. And how certain are you of the increase?</p> <p>SP2: Uhm, somewhat certain.</p> <p>SP1: Okay.</p> <p>SP2: I am very certain that there is a population increase, ha-ha...</p> <p>SP1: Yeah.</p> <p>SP2: ...and I am somewhat certain that that will spill over in to some of these recreational uses.</p>	U3-Secondary contact recreation
12:88	the recreational uses of the rivers will increase	T-Increase
12:89	Population growth.	D-Population growth
12:90	I am somewhat certain that that will spill over in to some of these recreational uses.	C-Somewhat certain



ID	Quotation Content	Codes
12:91	<p>SP1: Yeah, and what about boating? SP2: Boating, yeah. SP1: I found that there are a few and you already mentioned sailing, uhm...? SP2: Yeah boating, boating will also increase, sailing will increase, motorboating, boating of all kinds along the waterfront will increase with population growth. Because there is a number of marinas and those marinas are only expanding over time, as more and more people live... A lot of the big, big developments and the condo developments are right down there on the waterfront, right. So, as these increase, there is gonna be increases in those recreational uses for sure. SP1: Yeah, and how certain are you? SP2: I'd say very certain. SP1: Okay. And this is about the waterfront, so Lake Ontario. Is it the same for other waterbodies? Like the rivers or ponds, or? SP2: No, no, I wouldn't, I mean I am somewhat certain that the kayaking and canoeing might increase with the population increase. But in terms of other boating, like you don't sail on the river of course, and you don't really motorboat on the river, you are not allowed take motorboats at the river, I don't believe, but I think that's... SP1: Hm, so this is on the lake? SP2: Well, yeah, no to tell you the truth, no that's not true actually, you know what there is a marina on the Humber River, and it's just kind of maybe two kilometres from the waterfront, so yeah, no the sailing will start there too, yeah. The people load their boats in there too, and that would become more frequent. So, it's the rivers and the waterfront, but just the lower parts of the rivers. SP1: Yeah, okay. SP2: Usually there is an obstruction of some sort, that you know makes it so you can't boat up beyond a certain spot in the river, yeah.</p>	U3-Recreational boating
12:92	Yeah boating, boating will also increase	T-Increase
12:93	sailing will increase, motorboating, boating of all kinds along the waterfront will increase with population growth.	D-Population growth
12:94	A lot of the big, big developments and the condo developments are right down there on the waterfront, right. So, as these increase, there is gonna be increases in those recreational uses for sure.	D-Redevelopment close to water
12:95	I'd say very certain.	C-Very certain
12:96	A lot of the big, big developments and the condo developments are right down there on the waterfront, right. So, as these increase, there is gonna be increases in those recreational uses for sure.	D-Densification
12:97	I am somewhat certain	C-Somewhat certain
12:100	<p>SP1: Yeah, okay. And, what about recreational fishing, you already mentioned it, at the beginning, that there is a government programme to monitor the quality of the fish. What do you expect for the demand, to consume the fish that is caught by recreational fishermen? SP2: I expect it to increase. SP1: Yeah. SP2: Because the quality of the fish will likely increase, and there is... Well, they've been stocking fish, so they specifically stock fish to increase it. So, I think, because there is a marketing campaign, because there are efforts on the way to stock the rivers with certain fish, recreational fish particularly, like salmon, that the fishing has to increase, yes. I would be somewhat certain about that, although I am not a fish person, I would say somewhat certain about that. SP1: Yeah, and this marketing campaign, where does it come from? Who is doing this marketing? SP2: Toronto. Toronto does it. SP1: The city? SP2: Yeah, yeah. And I think the province also is helping, so the province is also helping to fund this kind of thing. SP1: Okay. SP2: Because those fish that grow up in the spawn in the rivers, of course are available all the way across Lake Ontario for fishing. And so, for a provincial point of view, their marketing campaign is really attached to all of Ontario, or anyone living around Lake Ontario, or any of the big lakes. Whereas Toronto of course is focussed on their area. SP1: And do you have any idea why the city and the province want to promote this? SP2: Uhm... SP1: Why do they think it's... SP2: ...I think they see it as a, potentially a tourist draw. SP1: M-hm. SP2: And I think that they... yeah, it is a good question, why they want to do that, I think they just... They know people like to fish, and they know people would want to fish, so it's really... And these are public agencies, and so they tried to meet public demand.</p>	U3-Recreational fishing
12:101	I expect it to increase.	T-Increase
12:102	Because the quality of the fish will likely increase, and there is... Well, they've been stocking fish, so they specifically stock fish to increase it.	D-Water quality improvement



ID	Quotation Content	Codes
12:104	<p>Well we could also think about hunting as a recreational activity, and I think that it – and you already confirmed it – that it's not allowed to hunt any aquatic animals in Toronto.</p> <p>SP2: Right.</p> <p>SP1: So, what do you think for the demand towards 2040?</p> <p>SP2: Increase.</p> <p>SP1: Increase?</p> <p>SP2: It won't.</p> <p>SP1: Oh no.</p> <p>SP2: It will not increase.</p> <p>SP1: So, it's stays...</p> <p>SP2: Somewhat certain.</p> <p>SP1: ...the same or declines?</p> <p>SP2: It stays the same.</p> <p>SP1: Yeah, okay.</p> <p>SP2: There might be nothing happening, ha-ha, so I am not sure, really, I mean it might go from zero to zero.</p> <p>SP1: Yeah, and why do you think it stays zero?</p> <p>SP2: Well, I think there is regulations, and the regulations aren't becoming less stringent over time, they are becoming more stringent if anything.</p> <p>SP1: Yeah, okay.</p> <p>SP2: Hunting is huge, in Ontario, there is hunters that love to go up, but they go up north and they hunt, they don't hunt in Toronto, they not do that.</p> <p>SP1: Yeah.</p> <p>SP2: And if any hunting requires the use of guns, forget it, you know. That's just gonna be not popular.</p>	U3-Hunting aquatic animals
12:105	It stays the same.	T-No change
12:106	Somewhat certain.	C-Somewhat certain
12:107	Well, I think there is regulations, and the regulations aren't becoming less stringent over time, they are becoming more stringent if anything.	Db-Regulations don't allow the use
12:108	<p>SP1: Yeah, that's what I found as well. And, when we started this interview, you already mentioned that the people also enjoy the landscape that is characterized by water, I didn't really find information about it, I know that there's a waterfront trail along the shoreline of Lake Ontario, and that birdwatching is mentioned as a popular activity on the waterfront as well. But I didn't find any document, that use of the water like this, no figures about how many people cycle along the water or hike along the water.</p> <p>SP2: Yeah, yeah.</p> <p>SP1: Do you know anything about that.</p> <p>SP2: I don't... I know there is probably documentation of that, for sure, because the trail system along the waterfront has become better and better over time, the bike trail, pedestrians' trails have become better and better over time. They used to, you know start and stop, and you'd have to get onto the road and so, but they have pretty much a bike trail all the way across the waterfront, right through the downtown section now. And there are various parks, like Tommy Thompson Park, which is managed by TRCA, that are... And there's a lot of work been done, a lot of money being invested to make that into a more usable area, from the perspective of birdwatching and habitat and so on. So, I think that... the surface water system along the waterfront will become more and more a destination. There will be more and more demand for it, for recreational, just for kind of aesthetic purposes, just for enjoying life you know.</p> <p>SP1: Yeah.</p> <p>SP2: Just enjoying the view than it was in the past. Because there's a lot of efforts being put on by Toronto to improve various sections of the waterfront. The waterfront is its main resource, of all the things that Toronto has to offer, the waterfront is in their view the best, of everything, right everything, that is where all of the downtown area is centred, right. So, they want to make it more walkable, more liveable, more bikeable, everything. And they want to bring nature back to many areas along the waterfront as well. And there is big efforts and big money being put into that, not only by Toronto, but either private companies well investing. So yeah, I think definitely, very certain, that that will become a bigger... there will be more demand for that aesthetic function.</p> <p>SP1: So that's... Do I understand correctly that you think that this is mainly driven by improvements in the facilities and in...</p> <p>SP2: Improvements in the facility and population growth.</p> <p>SP1: yeah, okay.</p> <p>SP2: Particularly along the waterfront.</p> <p>SP1: Yeah.</p> <p>SP2: And the development of big new areas, like the Portlands.</p> <p>SP1: Yeah, okay.</p> <p>SP2: Where a number of big wetlands are going to be put in, for recreation-, for aesthetic purposes primarily. So, there would be, some of the old wetlands that used to be there in the past, they are going to be restored, you know, they will recreate those, and that will be part of the developments. So yes, the surface water system there would be very much a part of that development, it's being centred around that actually. The development is kind of being centred around the wetlands and so on, and the nature, that surface water provides.</p>	U3-Enjoying a landscape characterized by surface water
12:109	very certain	C-Very certain
12:111	for recreational, just for kind of aesthetic purposes, just for enjoying life you know.	D-Popularity of the activity



ID	Quotation Content	Codes
12:112	there will be more demand for that aesthetic function.	T-Increase
12:114	population growth.	D-Population growth
12:115	Where a number of big wetlands are going to be put in, for recreation-, for aesthetic purposes primarily. So, there would be, some of the old wetlands that used to be there in the past, they are going to be restored, you know, they will recreate those, and that will be part of the developments. So yes, the surface water system there would be very much a part of that development, it's being centred around that actually. The development is kind of being centred around the wetlands and so on, and the nature, that surface water provides.	D-Revitalisation of traditional habitats
12:116	SP1: Yeah, okay. And what about ice-skating? I didn't find any information about ice skating on surface water, but maybe you know more about it? SP2: Eh yes, ice skating is very popular on surface waters. For instance, Grenadier Pond in High Park, which is close to where I live, has ice skating. But it is not allowed, ha-ha, there are signs up, saying not to do it, but the city just ignores those signs. The city puts those signs up to precover themselves, but everyone just goes and ice skates anyways there. So, it is, yeah, it's probably become more popular over time, but I don't... I can't say that for sure, because the city always discourages it on surface waterbodies, and that is because... Well, let's say it's probably not going to be more popular over time, and the reason is, because we are getting warmer temperatures, and so there is more melt events – and that is kind of proven, that there is more melt events happening in Toronto – so it's less likely that there is thick enough ice to skate on, and there will likely be more efforts put on by the city to keep people off of those areas, because of fears that, you know, the ice might crack, and there might be a problem. So, yeah, I think ice skating on surface waters is likely to decrease, because of change in climate. SP1: Yeah, so you think that the demand will decrease? SP2: The demand will decrease because of the change in climate, yeah. And because of the increase regulatory scrutiny on that activity. SP1: Yeah, and how certain are you? SP2: Somewhat certain. SP1: Okay. SP2: Well, I mean, as certain as I am in climate change I guess, yeah, which is very certain, put very certain – ha-ha.	U3-Ice-skating
12:120	I think ice skating on surface waters is likely to decrease, because of change in climate. SP1: Yeah, so you think that the demand will decrease? SP2: The demand will decrease	T-Decrease
12:121	Well, let's say it's probably not going to be more popular over time, and the reason is, because we are getting warmer temperatures, and so there is more melt events – and that is kind of proven, that there is more melt events happening in Toronto – so it's less likely that there is thick enough ice to skate on, and there will likely be more efforts put on by the city to keep people off of those areas, because of fears that, you know, the ice might crack, and there might be a problem. So, yeah,	D-Temperature increase due to climate change
12:122	Well, I mean, as certain as I am in climate change I guess, yeah, which is very certain, put very certain – ha-ha.	C-Very certain
12:123	P1: Okay. I know that the Humber River is designated as a Canadian Heritage River. SP2: Yeah. SP1: So, that there is a formal recognition of the importance of the river to the people. I don't know if there are other examples of a designation of the cultural heritage value of surface waterbodies in Toronto? SP2: No, that I know of no. But there might be down at the bottom of some rivers, I've been told that there is a sort of gatherings, I am not sure that they are actually designated as such though, but that, yeah that you have to ask one of the archaeologists about, yeah. SP1: Yeah, do you think that the demand for this type of formal recognition of the importance of the water system, do you think that the demand for this will change? SP2: I think that likely there will be more and more areas designated for heritage use, for their heritage value. And that might increase the use of those areas, by certain groups. But I am somewhat uncertain about that, because it is not my area. SP1: Yeah. SP2: But there is always an attempt to try to better document where indigenous communities used to have their villages and where they used to live and what the historical use of this area was. And that is always increasing over time, it is always increasing over time, as we do more and more research on it and find those areas through different archaeological programmes. It's only likely to increase, but I am somewhat uncertain about that. SP1: Yeah, and the reason is that there is more and more knowledge about it, because of the research? SP2: Yeah, yes. SP1: Yeah, okay. SP2: Yeah, knowledge is the driving factor there, yeah. SP1: Okay, and is there any... SP2: And I think I'd say there is more and more emphasis and more and more concern put on... or more and more awareness of indigenous issues and more and more concern and awareness about indigenous issues. And that, I think, more and more people appreciate the value of that activity, so that is another driver. SP1: Yeah. SP2: So, even in the schools, they regularly talk about it to kids in the school, you know, they make mention of the original... the original in habitats of different areas. So yeah, I think it's something that will increase as the result of that too.	U3-Designation of cultural heritage value



ID	Quotation Content	Codes
12:124	I think that likely there will be more and more areas designated for heritage use, for their heritage value. And that might increase the use of those areas, by certain groups	T-Increase
12:125	But I am somewhat uncertain about that, because it is not my area.	C-Somewhat uncertain
12:126	And I think I'd say there is more and more emphasis and more and more concern put on... or more and more awareness of indigenous issues and more and more concern and awareness about indigenous issues. And that, I think, more and more people appreciate the value of that activity, so that is another driver. SP1: Yeah. SP2: So, even in the schools, they regularly talk about it to kids in the school, you know, they make mention of the original... the original in habitats of different areas. So yeah, I think it's something that will increase as the result of that too.	D-Awareness about First Nations heritage
12:127	SP1: Also for the water system, yeah, yeah, okay. I didn't find any examples of religious use of the water, but do you know if this is happening? SP2: No, I don't know that it is happening. I am sure that there are certain communities, that might make religious use. Particularly those that would have in their own culture, from where ever they came, make use of the river for that purpose. The Ganges is kind of a typical one, you know, but... But, they are not allowed doing what they do in the Ganges here in Toronto, ha-ha, so the religious use of it would be relatively limited and I am not certain at all about, you know, whether in fact anyone is doing that, or whether in fact that would increase over time. SP1: So... SP2: But we do have a sort of a very large community of inhabitants from different parts of the world, including India, and other sort of areas where rivers are treated as sacred, so it might very well be something that is happening right now. And that might increase slightly but I am not at all certain about that. SP1: Okay, so you are very uncertain about that? SP2: Very uncertain, yes. SP1: Yeah, so you say it may increase, I am very uncertain about it, but what would be the driver of this increase? SP2: The driver would be increased immigration from those areas, which is likely, given that we have a very, very large area and they are bursting up the scenes in some of those parts of the world. So, there are really a lot more immigration pressures. And we are very open to immigration in Canada, because we have a declining indigenous population, indigenous meaning native Canadian population. Not native people, not first nations people I am talking about, just people that are Canadian born. And have ancestry that sorts of date back two or three generations. So, that would be one driver. But I don't think it's gonna increase, because... Well, any sort of religious use that might in any way contaminate the water, no not gonna happen, not allowed and not encouraged. So, I think it's yeah, really don't have a lot of information on that one. SP1: Yeah, so you said it would increase, and now you say it will not increase, so in the end what would you say is the trend: increase, decrease or no change? SP2: No change	U3-Religious use
12:128	Very uncertain, yes.	C-Very uncertain
12:130	SP2: No change.	T-No change
12:131	Well, any sort of religious use that might in any way contaminate the water, no not gonna happen, not allowed and not encouraged. So, I think it's yeah, really don't have a lot of information on that one.	D0-Ecological protection ambitions Db-Regulations don't allow the use
12:132	Okay, shall we move on to the last section, it's not a very big one. It's about using the space that is provided by the surface water system. And that can be the, either the space on the surface or the space under water, like the volume of the water. So, if we start with the space of the surface, is there any building on water? And this may be permanent or temporal buildings? Stages, houses, floating houses, floating offices, I don't know. Is there any of these in Toronto? SP2: Uhm, well historically we basically filled in a huge part of the waterfront to build on it, and so there is historically, kind of a lot of that has gone on. I think it's... no, not happening that much more. And certainly there is a lot of development along the waterfront, but they are not actually filling in different parts of the lake in order to build out further, as far as I know. SP1: No, you could think about it that way, about filling in, so creating new land in the water, but what I mean here: are there any houses build on the water, like houses on piles in the water or floating houses or floating stages on the water, it can be anything? SP2: No, not other than houseboats. Houseboats are kind of the boats that might be moored at the marinas, and they... People will actually live on them, there might be some of those, but not very many. Not very many people would do that. SP1: No. And do you have any idea about the future demand to build on the water? SP2: No, that's not my area, I'd say very uncertain about that. SP1: So, do you say I don't have information, or do you have information but ... SP2: Yeah, I don't have information to comment on that.	U4-Building on water
12:133	Yeah, I don't have information to comment on that	No information

ID	Quotation Content	Codes
12:134	<p>SP1: Okay that's fine. And is there any use of the space under the water? For storage of items, or for buildings, or I don't know? Anything?</p> <p>SP2: Well we do use it of course to get cool water for that Enwave project, and we also use it to treat water, pipes under the water are discharged from the treatment plants, and the dilution capacity of the lake is used to treat the water to some extent, although it's very highly treated before it's discharged, and off course we have pipes that take water for drinking water purposes. Those are all under water usage, not storage but they are under water usage.</p> <p>SP1: Yeah, not a use of the space under water?</p> <p>SP2: There are project like for instance, one in Etobicoke called the Etobicoke float balancing system and the Dunkers flow balancing system in Scarborough that use the water, on the waterfront as a treatment facility.</p> <p>SP1: M-hm.</p> <p>SP2: So, there used to be a kind of degraded wetland in those areas, and they dug it out and made it into a treatment facility and are using that to treat combined sewer overflows and other discharge from the... surface discharge from developments that are occurring there. So, you know, it's a situation where yeah, they have a big development, they are putting up big, massive condominiums, and they don't have any space to treat the water, so they are using the waterfront as a way of doing that. And by cordoning off a certain area, and assuring kind of unidirectional, for the most part unidirectional flow out into the lake.</p> <p>SP1: Yeah.</p> <p>SP2: But as the lake levels rise, of course water also comes into those facilities, that's why they call it a flow balancing system, it basically allows water to flow in and out. But during really large rain events, flow is mostly flowing out, so it's using it as a treatment facility for stormwater management. So yes, it does happen. There have been proposals to do more of that, they are not easy to get approved. But, if anything, they will be increasing, not decreasing and I am somewhat certain of that. So, for treatment, stormwater treatment.</p> <p>SP1: Yeah, but I don't understand it completely, so this treatment facility, I mean, is it like building with a facility, or is it more...</p> <p>SP2: No.</p> <p>SP1: ...like a huge wetland...?</p> <p>SP2: It's like a stormwater management pond on the waterfront...</p> <p>SP1: Ja...</p> <p>SP2: ...but it's actually directly connected to the lake, it's directly connected to the lake. So, if you go, on our website, if you go to the Dunkers flow balancing system, you can see a picture of one those things. Basically, they have taken what was just a degraded wetland, that already had berms around it, and they've converted it in... they dug it out further and converting it into a treatment facility, according to the various guidelines that need to be met for stormwater treatment facilities.</p> <p>SP1: Jaja. Okay, I see, ja.</p> <p>SP2: Yeah, yeah. And it's kind of a neat idea, actually, I like it, I mean it is an interesting idea.</p> <p>SP1: Okay.</p> <p>SP2: Frenchman's Bay is also like that; do you know Frenchman's Bay? Frenchman's Bay is a highly recreational area actually. So, people around Frenchman's bay they live there, because that is...you know, they just love the recreational opportunities, they boat on there, they swim in there, they do all kinds of stuff, sail, everything, in the Frenchman's Bay. It's outside of Toronto, but just outside, kind of on the... No, let me see is it... Yeah, I think it's just outside of Toronto but it's another area where, yeah, it's specifically the Bay is kind of configured and managed for recreational purposes and...</p> <p>SP1: Oh ja, I see it, oh it's outside Toronto but... yeah, I see, yeah.</p> <p>SP2: Yeah, if you do some research, that's a classic kind of area where the surface water is being used for a whole range of different recreational purposes and the community is, oh, very in tune with that – ha-ha.</p>	U4-Under water storage/infrastructure
12:135	if anything, they will be increasing, not decreasing	T-Increase
12:136	I am somewhat certain of that	C-Somewhat certain
12:137	<p>So, there used to be a kind of degraded wetland in those areas, and they dug it out and made it into a treatment facility and are using that to treat combined sewer overflows and other discharge from the... surface discharge from developments that are occurring there. So, you know, it's a situation where yeah, they have a big development, they are putting up big, massive condominiums, and they don't have any space to treat the water, so they are using the waterfront as a way of doing that. And by cordoning off a certain area, and assuring kind of unidirectional, for the most part unidirectional flow out into the lake.</p> <p>SP1: Yeah.</p> <p>SP2: But as the lake levels rise, of course water also comes into those facilities, that's why they call it a flow balancing system, it basically allows water to flow in and out. But during really large rain events, flow is mostly flowing out, so it's using it as a treatment facility for stormwater management. So yes, it does happen. There have been proposals to do more of that, they are not easy to get approved. But, if anything, they will be increasing, not decreasing</p>	D-Stormwater management



ID	Quotation Content	Codes
12:138	<p>Okay. There are three other functions I would like to discuss with you. First, the transportation of goods. I think that Lake Ontario is used for this, hè there is an international port where... that facilitates the transport of bulk materials.</p> <p>SP2: Yeah.</p> <p>SP1: I don't know if there is any transportation of goods on the rivers or creeks?</p> <p>SP2: No.</p> <p>SP1: No, there isn't?</p> <p>SP2: No, it's mainly, the ports are located along the waterfront, and those ports are likely to become more busy over time as population grows. But that is just a population thing. Same thing for transporting persons.</p> <p>SP1: Yeah.</p> <p>SP2: More people will be transported and there will be more cruises along the waterfront. It's a kind of a common activity, you know, people book cruises along the waterfront and have big parties along the waterfront in these cruise boats. And that is likely to become more popular, more common, a bigger use over time as population grows.</p> <p>SP1: Yeah.</p> <p>SP2: So, both of those, transporting goods and transporting persons are related to population growth.</p> <p>SP1: And is this transporting of people, you mentioned the cruises, is it just the cruises, or is it also public transport?</p> <p>SP2: No, not public transport.</p> <p>SP1: Okay.</p> <p>SP2: Eh wait, I sort of cracked myself, yes there is public transport from Toronto to the Toronto Islands, there is a very short, hah, there is a very short boat...</p> <p>SP1: Yeah, I found that yeah.</p> <p>SP2: ...it goes from the shore to the Toronto Islands regularly, so yes, in that case yes. But, like they wouldn't be going across the lakes to the States or anything like that, generally, not as far as I know anyways. Maybe there is something like that, but I don't know about it.</p> <p>SP1: Yeah, and how certain are you that transportation of goods and persons will increase?</p> <p>SP2: Very certain.</p>	<p>U4-Transporting goods U4-Transporting persons</p>
12:139	<p>those ports are likely to become more busy over time as population grows. But that is just a population thing. Same thing for transporting persons.</p> <p>SP1: Yeah.</p> <p>SP2: More people will be transported and there will be more cruises along the waterfront. It's a kind of a common activity, you know, people book cruises along the waterfront and have big parties along the waterfront in these cruise boats. And that is likely to become more popular, more common, a bigger use over time as population grows.</p>	<p>D-Population growth</p>
12:140	<p>And that is likely to become more popular</p>	<p>D-Popularity of the activity</p>
12:141	<p>Very certain.</p>	<p>C-Very certain</p>
12:142	<p>hose ports are likely to become more busy over time</p>	<p>T-Increase</p>



ID	Quotation Content	Codes
12:143	<p>And this water, the surface water being used as a barrier, a physical barrier? SP2: Well, there is a proposal, and I think it likely will happen. But there is a proposal to divert the Humber watershed flows further offshore, so that they don't impact the beach. So, what they gonna do, is they are gonna build this berm, they are going take a berm that is already there, they are going to extent berm out into the lake, so that the flows from the Humber watershed river, don't impact the beach during wet weather. And that will result in the beach being open more often. Is that what you mean by using water as a barrier? I mean basically you are using land as a barrier. SP1: Yeah, it's not using the water as a barrier, well I was thinking that maybe you could use the water to keep people or animals in or out, like you, mean the idea of a moat for example. SP2: Oh, the idea of moat Uhm. Am not aware of any of those, I am not aware of anywhere keep people out, no. SP1: I didn't find it in Toronto, no. SP2: No. There are some... Sp1: Any idea about the future demand. SP2: There are some castles in Europe, I am sure they do that – ha-ha. SP1: Or it can be a modern facility, like a prison or I don't know. SP2: Oh yeah, interesting okay. I don't know of any in Toronto. SP1: No, do you think that the demand for this will change? SP2: No, I don't think so. Not really on... SP1: And why do you think it will not change? SP2: I don't think it will change, because there is no awareness of it as it being a management option. And I don't know that there are any demands for it, like I don't know where we would benefit from such a thing. SP1: Yeah, okay. And how certain are you of this? SP2: Somewhat uncertain. SP1: Somewhat uncertain? SP2: Yeah, I don't really... It's not my area, so I don't know. I will mention, sort of, because we are kind of getting to the end here, but there is a lot of activity and TRCA does a lot of this in terms of wetland creation along the waterfront. So, right at the kind of near the mouth of the Humber, there is the Humber Bay Islands and so on, these were all significantly modified to create habitat, for wetland habitat. As well as right at the mouth of the Humber and all the way along the waterfront, there are a huge number of projects that have occurred over time and they continue to occur, and it will likely occur more frequently, that are being developed to bring habitat back to these areas. So, the wetlands are sort of a key area were fish will spawn and fish attracted to, as well as other animals. And not necessarily for the purposes of human use, but just for the purposes of nature, a lot of these wetlands are being created along the waterfront. SP1: Yeah, so there are a lot... SP2: ... all... SP1: ...foreseen in the habitats. Okay. SP2: Yeah, so it is habitat creation, habitat creation will only increase over time, I think. There is more and more interest in doing that, there is a lot of investment that's already been put on it. And it's kind of related, to some extent, to creating a more attractive waterfront, but it's also just... related to the drive to be more concerned about... or have Toronto be more inviting to wildlife and to fish. SP1: M-hm. SP2: Whether they are used or not. SP1: Yeah, so just for the sake of nature, okay. SP2: Yeah. SP1: It's good to mention</p>	U4-Using water as a barrier
12:144	<p>No, do you think that the demand for this will change? SP2: No, I don't think so. Not really on...</p>	T-No change
12:145	Somewhat uncertain.	C-Somewhat uncertain
12:147	<p>I think that there is just not that much interest in catching animals and cleaning them for consumption, you know. It would be... The knowledge just isn't there and the interest isn't there. And I don't meet anyone – put it that way – or I don't talk to anyone or I don't see anything in the literature that suggests that that is indeed something that would be a trend.</p>	D0-This is not a habit/lack of knowledge
12:148	<p>Uhm. Well, it is minor because there are not very many groups that know anything about aquatic plants, or how to harvest them for consumption purposes. SP1: Yeah. SP2: And so... I mean, your regularly person in Toronto is gonna know nothing about that. And the same with algae, uhm... SP1: Yeah, just don't know about it. SP2: ...so the indigenous people, you the very, very far and few between, and most of them probably don't harvest aquatic plants, and there is just a very limited number that would harvest the plans for consumption</p>	D0-This is not a habit/lack of knowledge
12:149	<p>I don't think it will change, because there is no awareness of it as it being a management option. And I don't know that there are any demands for it, like I don't know where we would benefit from such a thing.</p>	D0-This is not a habit/lack of knowledge
12:150	<p>I wouldn't say that is likely. I think likely what is gonna happen, is they are just going use more main supply water, going to use more lake water to irrigate. SP1: Lake water or drinking water? Potable water? SP2: Yeah, drinking water, lake water, well lake water... When I say lake water, it is drinking water. So, it goes to the treatment plant and thenup and then treat it, so then it is drinking water.</p>	Db-Preference for other source of water



ID	Quotation Content	Codes
12:152	Because, in order to fight a fire effectively, you need to respond quickly, and if... And the quickest response is to connect to a hydrant.	Db-Preference for other source of water
12:153	because much of Toronto was developed without stormwater management. And now, whenever there is a major redevelopment, stormwater management is required by law, and by the City of Toronto standards. And therefore, there would be more of these kinds of facilities in place over time, as more and more of the city becomes redeveloped. And certain areas that are underdeveloped are developed. So, there are areas in Toronto that are underdeveloped and they will be developed, because there is big money in developing them. And when they develop them, they will be required to do water quality management. And the primary means by which water quality management is done in this city, is through stormwater ponds, and other small infrastructure, but for the most part stormwater ponds are usually required for flood control. So, yeah, I think, yeah, so I think it will increase because of that. Because, there is no stormwater management and there is push on in the city to increase the amount of stormwater management in the city. And if you look at – I don't know if you have looked at the Toronto wet weather flow management Masterplan?	D-Stormwater management
12:154	there would be more of these kinds of facilities in place over time, as more and more of the city becomes redeveloped. And certain areas that are underdeveloped are developed. So, there are areas in Toronto that are underdeveloped and they will be developed, because there is big money in developing them. And when they develop them, they will be required to do water quality management	D-Urbanization/land use change
12:155	But the ponds are not generally thought to do that. They actually probably do do that, to some extent – haha – but they are not generally thought to be a heat island mitigation measure.	D0-This is not a habit/lack of knowledge
12:156	So, they are trying to improve the water quality, as are other areas north of Toronto, to... and for Toronto the main reason is to try to improve occupancy at the beaches. So, I guess it's kind of... Because they have a marketing campaign, because they want... They have a specific objective associated with that, with swim, swimmable beaches and also because many of their actions over time are helping to improve the water quality, along the waterfront, specifically in those areas	D-Water quality improvement
12:157	Because there is a number of marinas and those marinas are only expanding over time, as more and more people live... A lot of the big, big developments and the condo developments are right down there on the waterfront, right. So, as these increase, there is gonna be increases in those recreational uses for sure	D-Urbanization/land use change
12:158	So, I think, because there is a marketing campaign, because there are efforts on the way to stock the rivers with certain fish, recreational fish particularly, like salmon, that the fishing has to increase, yes. I would be somewhat certain about that, although I am not a fish person, I would say somewhat certain about that.	D-Ambitions to promote the use/activity
12:159	It will increase because the city is really pushing that, I think there's a lot of marketing campaigns associated with that. And, because the city is attempting to try to provide areas that are cleaner. So, they are trying to improve the water quality, as are other areas north of Toronto, to... and for Toronto the main reason is to try to improve occupancy at the beaches. So, I guess it's kind of... Because they have a marketing campaign, because they want... They have a specific objective associated with that, with swim, swimmable beaches and also because many of their actions over time are helping to improve the water quality, along the waterfront, specifically in those areas. So, I think it will increase.	D-Ambitions to promote the use/activity
12:160	So, it is not something that is going to increase, whether they use existing dams for that purpose, probably not, because they are not designed for that purpose	Db-Other functions prevail/conflict between users/lack of space
12:161	There is definitely not any desire to put in dams specifically for energy production. That's just something that is out of fashion, it used to be in fashion, and now it is completely out of fashion because of the other by-products of that, of those dams	Db-Concerns about ecological impacts
12:162	I think they see it as a, potentially a tourist draw. SP1: M-hm. SP2: And I think that they... yeah, it is a good question, why they want to do that, I think they just... They know people like to fish, and they know people would want to fish, so it's really... And these are public agencies, and so they tried to meet public demand.	D-Tourism growth
12:163	Because there's a lot of efforts being put on by Toronto to improve various sections of the waterfront. The waterfront is its main resource, of all the things that Toronto has to offer, the waterfront is in their view the best, of everything, right everything, that is where all of the downtown area is centred, right. So, they want to make it more walkable, more liveable, more bikeable, everything. And they want to bring nature back to many areas along the waterfront as well. And there is big efforts and big money being put into that, not only by Toronto, but either private companies well investing.	D-Redevelopment close to water
12:164	And they want to bring nature back to many areas along the waterfront as well. And there is big efforts and big money being put into that, not only by Toronto, but either private companies well investing	D-Remediation Plans



APPENDIX V

Drivers of Change Urban Water

12 June 2020

SEBASTIAN RIVADENEIRA
MASTER'S THESIS

The following table presents the full list of drivers mentioned in section 5.2.3 of the thesis report, as part of the FUNqyWATER analysis for Toronto.

Table 1: Complete occurrence list for drivers of change in Toronto

DRIVER OF CHANGE\USE FUNCTION	U1-1	U1-2	U1-3	U1-4	U1-5	U1-6	U1-7	U1-8	U1-9	U1-10	U1-11	U1-12	U1-13	U1-14	U1-15	U2-1	U2-2	U2-3	U2-4	U3-1	U3-2	U3-3	U3-4	U3-5	U3-6	U3-7	U3-8	U3-8	U4-1	U4-2	U4-3	U4-4	U4-5	
D0-Acceptance of salinization	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D0-Access to surface water is unpractical	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D0-Alternatives are better	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D0-Ecological protection ambitions	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
D0-Local water system not suitable	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	1	0	0	0	0
D0-No reason for change/don't know	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
D0-Popularity declines	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D0-Potential capacity already fully used	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D0-Potential capacity is too small to be relevant	0	3	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
D0-This is not a habit/lack of knowledge	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
D0-This is not in people's system	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D0-Water is no longer a physical barrier	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D-Ambition to increase the low impact development	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D-Ambitions to promote the use/activity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
D-Awareness about First Nations heritage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0
D-Awareness about heat stress increases	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D-Awareness of animal welfare increases	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Db-Concerns about ecological impacts	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Db-Concerns about water quality	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Db-High costs	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Db-Other functions prevail/conflict between users/lack of space	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	
Db-Preference for other source of water	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Db-Regulations don't allow the use	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	1	0	1	0	0	1	0
Db-Transportation on land is faster	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Db-Unreliable source	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Db-Water quality deterioration/salinization	0	0	0	0	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Db-Water quality not reliable	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Db-Water quality not sufficient	1	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Db-Water quantity not reliable	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Db-Water quantity not sufficient	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0
D-Circular economy/re-use of waste streams ambitions	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D-Cost saving ambitions	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D-Data centers increase	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D-Densification	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0
D-Dry periods longer and/or more frequent due to CC	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D-Electricity demand increases	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D-Green areas/nature decline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

(CONT.) Complete occurrence list for drivers of change in Toronto

DRIVER OF CHANGE\USE FUNCTION	U1-1	U1-2	U1-3	U1-4	U1-5	U1-6	U1-7	U1-8	U1-9	U1-10	U1-11	U1-12	U1-13	U1-14	U1-15	U2-1	U2-2	U2-3	U2-4	U3-1	U3-2	U3-3	U3-4	U3-5	U3-6	U3-7	U3-8	U3-8	U4-1	U4-2	U4-3	U4-4	U4-5			
D-Green Infrastructure Development	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
D-Hydrogen factories expected	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
D-In case that pilot application is successful	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
D-Industrial use of drinking water increases	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
D-Lack of space on land	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0		
D-Land Value Increase	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
D-Limits to transportation on land (rail, road)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0		
D-Local food trend	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
D-New, bigger sea locks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
D-Opportunity becomes more rare	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
D-Opportunity to combine with increasing demand for water storage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
D-People have more free time	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D-People live longer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D-Popularity of the activity	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	1	1	0	0	0	
D-Population growth	1	1	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	1	5	0	0	5	3	3	1	4	0	3	3	0	0	0		
D-Rain storms more intense due to CC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D-Redevelopment close to water	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	4	0	1	2	3	0	0	1	0	1	1	0	0	0		
D-Remediation Plans	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
D-Revitalisation of traditional habitats	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D-Revitalisation of traditional systems	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	
D-Saving drinking water ambitions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D-Self-sufficiency ambitions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D-Ship size and number of ship increases	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D-Stormwater management	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
D-Sustainability ambitions	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	
D-Technological developments	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D-Temperature increase due to CC	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	
D-Tourism growth	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
D-Urban agriculture increase	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D-Urbanization/land use change	0	0	0	0	1	0	1	0	0	0	0	0	2	2	0	0	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	
D-Use and value of surface water increases	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D-Water quality improvement	1	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	2	0	1	0	0	0	0	0	0	0	
D-Water use efficiency	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D-Water use per capita increases	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
D-Welfare increase	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

In the horizontal direction the 33 use functions are shown with their respective code. In the vertical direction a thorough list of drivers is displayed. The numbers in the table body represent the times that each driver was mentioned as one of the underlying reasons for the change in future demand for the corresponding use function. Therefore, each number takes values between 0 and 5. The drivers are classified as follow. Drivers presented with “D0” code correspond to drivers that lead to no-change for the future demand. Those coded with “Db” are drivers that act as barriers leading to either a decrease or no change in demand. Those presented just with “D” are drivers that directly lead to an increase or decrease in demand. In this last group, specific drivers are in some cases mentioned as driver for increasing demand and in other cases the same driver is mentioned to cause decreasing demand.



Literature review for Drivers at a global scale

What does literature say about the drivers of demand for the multifunctional water use?

As the Earth system has entered an increased water scarcity phase, it becomes urgent to know and understand the factors that control water demands. This necessity is evident at a global scale, but particularly at the level of urban centres that concentrate large numbers of people in relatively small territories. In this regard, academic efforts have focused on studying the drivers of water demand mainly for extraction purposes, considering variables such as meteorological (precipitation, evaporation, temperature), demographical (e.g. population growth), socioeconomical, behavioural, political and regulatory variables (Hemati et. al, 2016).

Drivers of change directly related to different uses of water are not easily found in the literature, such as the categorization proposed by FUNqyWATER. For example, when searching for drivers related to recreational uses of water in cities and urban areas, the literature focuses mainly on quality aspects of water and the development of indices for the safety of citizens in contact with water. More easily found are drivers related to what the literature calls “domestic water consumption”, which is basically consumption at the household level for personal use, toilet, kitchen, lawn irrigation, etc. and efforts generally focus on studying the underlying processes that lead to a higher water use efficiency (WUE).

On the other hand, each study has its own focus, definitions and scope that makes hard to achieve a common ground to categorize the results found. Some studies raise the drivers from the perspective of the DPSIR analysis, in which drivers and pressures are differentiated (Diaz & Yeh, 2015; Sun et al. 2016). Other studies present drivers for water management approaches instead of drivers for demand changes (Hughes et al., 2013). Some analyse specific problems such as water reallocation from agriculture to urban use and the associated drivers (Meinzen-Dick & Ringler, 2008), and so on. However, the following are some interesting findings that can be useful in understanding the drivers of change for different water uses at the urban level.

DPSIR literature

In the literature related to the DPSIR framework for water resources in cities, the drivers of change are commonly explicitly mentioned. For example, Diaz & Yeh (2015) identified urbanization and climate change as the main drivers of change in water demands for the coastal city of Dunedin in Florida, USA. However, depending on the agreed definition, the identified "pressures" could also be considered as drivers. For example, for this study "development" was considered as one of the most relevant pressures. This could also be considered a driver for the purposes of this literature review, as new developments are either related to population growth or urban expansion, and at the end they both have an impact on water demand.

There are many examples of highly populated Asian cities that are assessed through the lens of the DPSIR approach regarding water demands. Sun et al. (2016) identified economic development, changes in society and the consumption structure of residents as the main driving forces of local water consumption for the city of Bayannur in China. A study conducted for the major Asian cities (Bangkok, Osaka, Seoul, Tokyo among others) stated that the intensive industrialization and the unprecedented population growth in urban areas are the common drivers that change the water system and the subsurface environment (Bianet Jago-on et al., 2008). The mentioned growth is related to population, economy and urban expansion. This in turn results in increasing water demand for cooling, manufacturing and cleaning purposes. A study conducted in Qatar to analyse the availability of water resources, recognized population growth, economic development and the unsustainable consumption of water as the major drivers of change (Ashfaq et. al, 2018). Although the cited examples in this paragraph correspond to Asian cities that experience different issues regarding to water availability and demand, rapid population growth is cited in all of them as a driver that strongly affects water demand. This might be relevant for certain western cities such as Toronto, where population projections still show significant growth for the near future.



Australian cities

There is a vast literature on water management for Australian cities and the driving forces that will determine future water demand. A common concept that crosses most of these studies is the sustainable urban water management (SUWM), which is intended to provide responses to the challenges related with rapidly growing urban population, environmental degradation and the consequences of climate changes in cities (Brown et al., 2009). In this regard, a series of studies (Brown et al., 2008; Brown et al., 2009; Wong & Brown, 2009) identified the key transition states in the development of water management for Australian cities. Along with the states, the related socio-political drivers were also identified. These drivers reflect regulatory and normative shifts on the relationship between the environment and the society. From the most basic to the most complex, these drivers are: (i) water supply access and security, (ii) public health protection; (iii) flood protection; (iv) social amenity, environmental protection; (v) limits on natural resources and (vi) intergenerational equity, resilience to climate change.

Hemati et al., (2016) analysed the climatic and anthropogenic drivers of water consumption for Melbourne. One of the major conclusions of this paper is that demand-side approaches (e.g. conservation) bring more benefits than supply-side approaches (e.g. desalination) when it comes to optimize the urban water consumption for drought periods. In fact, this was valid not only for Melbourne but for many other cities (Seattle, Boston, Queensland, Perth). Beyond drought periods, patterns in water consumption across cities are driven by meteorological and hydrological variables (e.g. for warmer summers, consumption increases) as is shown for Melbourne and three cities in Canada (Adamowski et al., 2012). However, anthropogenic drivers are also highly noticeable when there are, for instance, water conservation programs being implemented or there are changes in behavioural patterns.

Another study that aims to provide an assessment of urban water infrastructure through the lens of SUMW approach for Australian cities (Marlow et al., 2012) describes the drivers of change that led to the most important transformations of water infrastructure during the last century.. Thus, the main improvements to the water system have been driven by population growth, pollution, inadequacy of water supply, excessive demand, contamination of surface water with sewage, nuisance issues, impact on health, and so on.

A study that analysed the water supply diversity and the professional perception on the related drivers for Australian cities (Farrelly & Brown, 2008) mentions that the drivers of change for SUWM correspond to increasing demand of drinking water due to population growth, aging infrastructure and increasing climatic variability.

Drivers for water management

Two important concepts that also appear in the literature are Water Demand Management (WDM) and Integrated Resource Planning (IRP). WEDC (2011) concluded that in order that WDM can respond to water local issues, it is necessary to identify the major drivers related to water demand and thus implement an IRP response. These drivers can be direct (such as population growth or a supply gap), indirect (such as the impacts of climate change on runoff) or organizational (such as public policy strategies). In turn, these drivers influence the development strategy and its targets, which can be short, medium or long term.

A remarkable study was conducted in the city of Los Angeles to analyse the different drivers of water management changes (Hughes et al., 2013). It is concluded in this paper that the major changes regarding the relationship between the environment and the city with respect to water management has been driven by reinforcing regulatory, political and climatic shifts. The regulatory shift has to do with the unreliability of traditional supplies given by restriction in water deliveries. The political shift relates to the rise of environmental awareness. Finally, the climatic shift has to do with the unpredictability of water resources due to climate change.

A particular study was carried out by Russel & Fielding (2010) about water demand management from a psychological perspective. They argued that only the identification of the key social and psychological



drivers of water use, can lead to effective policy development to address water management at a city level. Among these psychological drivers the authors mention five categories of causes: attitudinal factors, beliefs, habits or routines, personal capabilities and contextual factors.

Drivers for water reallocation

A paper conducted in 2008 about water reallocation from the agricultural sector to cities in the western USA also identified population growth, economic growth and increasing urbanization as the major drivers of change for future water demand in cities (Meinzen-Dick & Ringler, 2008). These water transfers are made through different formal and informal mechanisms, including market-based transfers (or water rights trading), negotiations with communities and administrative reallocation. Water reallocation is a process that is also driven by investments in water supply systems in both cities and industrial zones. Decline in water consumption for irrigation purposes also account as an important driver for water reallocation. Besides these direct drivers, there are also indirect ones such as policies that contribute to the process. For example, industrial protection policies that can lead to inefficient water use, or preferences for more “powerful” urban user.

Socioeconomic v/s climatic factors

A relevant interdisciplinary study on the future evolution of regional water system, conducted in Crans-Montana-Sierre, Switzerland (Reynard et al., 2014), stated that socioeconomic factors have a greater weight than climatic factors in future water demands. It is concluded that water availability in the region is sufficient for the present and also for the year 2050, but water shortage is plausible for some areas within the region. Therefore, policy reforms must be taken to improve sound water management and thus avoid water shortage and management issues for 2050. Improvements in coordination, development of new infrastructure, improved data management are also part of the proposed solutions. In this same regard, the broader study conducted by Jaramillo & Destouni (2014) determined that water changes around the globe are more related to landscape-driven processes than direct climate-driven ones.

Domestic water use (potable water)

A couple of studies on urban water use and water use efficiency for cities in the US (Stoker & Rothfeder, 2014; Brelsford and Abbott, 2017) identified the major drivers of water consumption at the household level. In both case these drivers were related with the parcel vintage, indoor characteristics, outdoor characteristics and the climatic variables.

A study on urban water demand considers the coupled human-environment system theory and reviewed the advances of demand modelling over the past decades (House Peters and Chang, 2011). The authors mention that resource demands and human behaviour act as both constraints and drivers over ecosystem functions. In this regard, “urban water demand represents a coupled human and natural system, characterized by complex interactions between human and natural system variables at multiple spatial and temporal scales”. Local-scale processes in both environment and society are important driver of change, contributing to significant patterns of water demand. Water use efficiency (WUE) at a household level is also analysed. It is argued that WUE depends on several factors such as norm and values, garden and lawn preferences, conservation attitude, and so on. A broad literature review was conducted for this study, some relevant findings are for example the case of Corbella and Sauri Pujol (2009) who found that demographics, economy, climate, and urban design are the major drivers for domestic water demand. Another example is the study of Wentz and Gober (2007) that found that a one percent increase in the number of houses with pools led to a 1% increase in the average annual water consumption for the city of Phoenix, Arizona.



Thermal energy trends

A couple of studies were conducted by academics of the University of Barcelona on trends for cooling and heating and their associated drivers. for European cities (Serrano et al. 2016; Ürge-Vorsatz et al. 2015). The purpose of the research was to provide information about thermal energy in buildings, their drivers, past behaviour and future trends. Although the studies consider all types of energy sources for heating and cooling, a breakdown of the underlying drivers of change was made. Among the drivers mentioned are population migration to cities, increasing levels of wealth, decreasing household size trend, changes in people's lifestyles and the type and number of cooling and heating equipment. It is stated that 85% of the energy growth in buildings by 2050 will come from urban areas. Other relevant drivers for cities with significant population growth are rapid economic development followed by urbanization and changes in housing structures.

Urban fishing

A study on urban fishing in Prague, Czech Republic, showed the growing interest of the activity in this European city (Lyach, & Čech, 2018). Among the outcomes of the study, it is noted that the number of individuals practicing the activity has recently grown in urban areas. The main factor driving this growing interest would be the improvement in the economic welfare of the country. Therefore, people can save money and invest in the necessary equipment for fishing and maintain the hobby. A similar explanation is found in the study conducted by Dotson and Charter (2003) in which the popularity of the activity is correlated with financial wealth.

Water footprint of food consumption

Yang and Cui (2014) carried out a study on water footprint of food consumption across different continents for the period 1961 to 2009. They attempted to decompose the weight for each major driver of change, being these the agricultural practices, population and diets. The results show that possible water savings by improvements in agricultural techniques have been overshadowed by diet changes and population growth in recent decades. Furthermore, it is concluded for the near future that diet change is going to override population growth as the main factor related to water footprint for food.

Categorization of drivers

A research conducted by Amarasinghe et al. (2008) on future water demands recognizes drivers of change as either exogenous or endogenous. Although the object of research is India and the context is therefore different, this division is striking to understand the many factors that affect future water demand. The exogenous drivers can be related with the primary factors that set the pathway of future water demand. Some examples are: change in demographic patterns, changing life style, economic growth, private sector participation, technological advances, etc. The endogenous drivers are secondary factors related to the water system and they usually are responses to the exogenous drivers. Some examples are land use change, increasing water productivity, rainwater harvesting, expanding groundwater exploitation, environmental water needs, etc.

Conclusions

As already mentioned, it is a complicated process to establish clear relations between drivers of change with each of the different uses of water categorized by FUNqyWATER. This is due to the specificity of the available studies and the lack of research that categorize the different urban water uses in a similar manner. However, some general conclusions can be derived from the analysed papers. At the city level, population growth is one of the most cited drivers of change and crosses most of the literature. In this regard, the associated concepts of urbanization, densification and urban expansion also appear prominent and can explain the increase in demand for many of the use functions. Climate change is another of the most cited drivers and is used to explain the change in behaviour patterns of different uses. Economic growth as well as infrastructure development are also widely cited to explain the increase in total urban water demand. In this sense, the increase in people's wealth and the general improvement of economic welfare, are also mentioned to explain the change in demand for several use functions, such as the increase in the use of water for cooling or the increase in recreational fishing. At a different level, changes in social behaviours, such as changes in lifestyle, beliefs and habits, the rise of environmental awareness or changes in diets, also drive changes in water use trends, either to increase or decrease the total consumption. Regarding drivers that lead to decrease in water demand for certain uses, water quality deterioration, pollution of surface water with sewage, nuisance issues, among others, are cited.

Table 2: Summary of consulted studies for Appendix V

Author	year	Geographic scope	Research topic	Drivers for	Drivers	How were the drivers determined?
Adamowski et al.	2012	Calgary, Montreal, and Ottawa	Climatological Influences on Daily Urban Water Demand	Water demand (consumptive)	Meteorological variables, e.g. increased temperatures, decreased precipitation	Mathematical model (Wavelet analysis; Fourier Analysis)
Amarasinghe et al.	2008	India	Future Water demand and availability at the country level	Water demand (consumptive)	Exogenous: change in demographic patterns, changing lifestyle, economic growth, private sector participation, technological advances, etc. Endogenous: Some examples are land use change, increasing water productivity, rainwater harvesting, expanding groundwater exploitation, environmental water needs, etc.	Cited source: <i>IWMI 2005. The India's Water Futures Analyses. Scenarios and Issues. Unpublished Proceedings of the Inception Workshop on the Project 'Strategic Analyses of India's Water Futures'</i>
Ashfaq	2018	Qatar	DPSIR on Availability of water resources	Water demand (consumptive)	population growth, economic development and the unsustainable consumption of water	Named in the methodology as part of the DPSIR analysis. Other studies are cited as source of information about the change on these drivers. The relationship between drivers and water demand is given by an explanation based on facts and data from scientific literature
Bianet Jagon et al.	2008	Highly populated Asian cities	Urbanization and subsurface environmental issues	Water demand (consumptive)	Intensive industrialization and growth related to population, economy and space	Named in the introduction as part of the DPSIR analysis. There is no evidence of how these drivers affect water demand.
Brelsford & Abbott	2016	Las Vegas, USA	domestic water use and water use efficiency	Water demand (consumptive)	parcel vintage, indoor characteristics, outdoor characteristics and the climatic variables.	Methods: calculations Data Sources: census, public dataset of neighbourhood water consumption, home infrastructure characteristics, and vegetation

Author	year	Geographic scope	Research topic	Drivers for	Drivers	How were the drivers determined?
Corbella & Sauri Pujol	2009	Barcelona	Domestic Water use	Water demand (consumptive)	Demographics, economy, climate, urban design, age structure of a given population	<p>Broad Literature review. Some cited papers:</p> <ul style="list-style-type: none"> - SCHUTTE, C.F. AND PRETORIUS, W.A. (1997): «Water demand and population growth». - NAUGES, C. AND THOMAS, A. (2002): «Long-Run Study of Residential Water Consumption» in Current Issues in the Economics of Water Resources Management. - MURDOCK, S.H., ALBRECHT, D.E., HAMM, R.R. AND BACKMAN, K. (1991): «Role of Sociodemographic Characteristics in Projections of Water Use» - CUBILLO GONZÁLEZ, F., IBAÑEZ CARRANZA, J.C. and Fernández Delgado, F.J.(2001): Estudio de la Demanda de Agua para uso urbano en la Comunidad de Madrid.
Díaz & Yeh	2015	Dunedin, USA	DPSIR Water supply resilience in coastal communities	Water demand (consumptive)	Urbanization, climate change and economic development	Named in the introduction as part of the DPSIR analysis. There is no evidence of how these drivers affect water demand.
Hemati et al.	2016	Melbourne	anthropogenic and climatic drivers of urban water consumption	Water demand (consumptive)	Climatic (temperature, precipitation) v/s anthropogenic (outdoor water restrictions; technological innovation/changing social norms)	<p>Calculations (wavelet analysis and multiple linear regression)</p> <p>Based on urban water consumption data and meteorological data</p>
House Peters & Chang	2011	global	Urban water demand	Water demand (consumptive)	<p>Climate, economy, urban design, and demographics.</p> <p>Resource demands and human behaviour. At the urban level: norm and values, garden and lawn preferences, conservation attitude.</p>	<p>Cited Corbella & Sauri Pujol (2009) as the source.</p> <p>And other sources:</p> <ul style="list-style-type: none"> - Grimm, N. B., J. M. Grove, S. T. A. Pickett, and C. L. Redman (2000), Integrated approaches to long-term studies of urban ecological systems - Martin, C. A., P. S. Warren, and A. P. Kinzig (2004), Neighborhood socioeconomic status is a useful predictor of perennial landscape vegetation in residential neighborhoods and embedded small parks in Phoenix, AZ - Pickett, S. T. A., et al. (2008), Beyond urban legends: An emerging framework of urban ecology, as illustrated by the Baltimore Ecosystem Study
Meinzen-Dick & Ringler	2008	Western USA and some Asian cities	water reallocation from the agricultural sector to cities	Water Demand (consumptive)	population growth, economic growth and increasing urbanization	The relationship between drivers and water demand is given by an explanation based on facts and data from scientific literature

Author	year	Geographic scope	Research topic	Drivers for	Drivers	How were the drivers determined?
Reynard et al.	2014	Crans-Montana-Sierre (Switzerland)	Interdisciplinary study on the future evolution of regional water system	Water Demand (consumptive)	Socioeconomic v/s climatic factors	Interdisciplinary research. The disciplinary sub studies: climatology, hydrology, glaciology, water use system, and water management analysis
Russel & Fielding	2010	Global	Water demand management from a psychological perspective	Water demand (consumptive)	Attitudinal factors, beliefs, habits or routines, personal capabilities and contextual factors	Literature review. Cited papers: <ul style="list-style-type: none"> - Stern, P. C. (2000), Toward a coherent theory of environmentally significant Behavior - Gardner, G. T., and P. C. Stern (1996), Environmental Problems and Human Behavior - Lam, S.-P. (1999), Predicting intentions to conserve water from the theory of planned behavior, perceived moral obligation, and perceived water right, - Trumbo, C. W., and G. J. O'Keefe (2005), Intention to conserve water: Environmental values, reasoned action, information effects across time, - Corral-Verdugo, V., et al. (2003), Environmental beliefs and water conservation: An empirical study
Stoker & Rothferd	2016	Salt Lake City, USA	domestic water use and water use efficiency	Water demand (consumptive)	Climatic variables, built environment variables (n° bedrooms, kitchen bath rooms, etc); incomes	Literature review and Mathematical model on water demand (ordinary least squares (OLS))
Sun et al.	2016	Bayannur, Mongolia	DPSIR regional water resources	Water demand (consumptive)	identified economic development, changes in society and the consumption structure of residents	Analytic hierarchy process (AHP). The AHP is a method for decision analysis and weighing factors based on multiple criteria to solve complicated problems
WEDC	2011	global	Water Demand Management	Water demand (consumptive)	direct (such as population growth or a supply gap), indirect (such as the impacts of climate change on runoff) or organizational (such as public policy strategies)	Named as part of the IRP and WDM theory frameworks. No calculations nor literature review.
Wentz & Gober	2007	Phoenix, USA	Urban water consumption	Water demand (consumptive)	Population growth. household size, the presence of swimming pools, lot size, and the prevalence of landscaping that requires a moist environment	Calculations using ordinary least squares regression (OLS). and geographically weighted regression (GWR) model

Author	year	Geographic scope	Research topic	Drivers for	Drivers	How were the drivers determined?
Yang & Cui	2014	Global	water footprint of food consumption	Water demand (consumptive)	Diet changes, population growth, agricultural practices	Calculations using data of diets from 1961 to 2009 from the Food and Agriculture Organization (FAO). The logarithmic mean Divisia index (LMDI) decomposition approach is used to analyze the contributions of the major drivers of Water Footprint
Dotson & Charter	2003	Southern California	Sport fishery	Water demand (non-consump.)	Financial wealth	No info.
Hussey, K, Pittock	2012		The Energy–Water Nexus:	Water demand (non-consump.)	Security of supply, environmental sustainability, and economic efficiency	Part of the argument in the introduction.
Lyach & Čech	2018	Prague, Czech Republic	Recreational Fishing	Water demand (non-consump.)	Improvement in the economic welfare	Just a hypothesis “The main driver is most likely an improvement in economic situation in the Czech Republic (Czech Statistical Office, unpubl. data)”
Jaramillo & Destouni	2014	global	water change spectra; water fluxes and resources on land	Water availability	landscape-driven processes v/s direct climate-driven ones	Statistical calculations with public dataset
Marlow et. al	2013	Australian cities	urban water management and infrastructure provision	Development of water infrastructure	population growth, pollution, inadequacy of water supply, excessive demand, contamination of surface water with sewage, nuisance issues, impact on health	Literature review: <ul style="list-style-type: none"> - Tarr, J.A., McCurley, F.C., McMichael, F.C., Voisie, T., 1984. Water and wastes: a retrospective assessment of wastewater technology in the United States. - Geels, F.W., 2005. Processes and patterns in transitions and system innovations: refining the co-evolutionary multilevel perspective - Brown, R.R., Keath, N., Wong, T.H.F., 2009b. Urban water management in cities: historical, current and future regimes.
Serrano et al.	2017	European cities	Thermal energy in buildings	Energy demand	Population migration to cities, increasing levels of wealth, decreasing household size trend, changes in people's lifestyles and the type and number of cooling and heating equipment	Cited Ürge-Vorsatz (2015) as the source

Author	year	Geographic scope	Research topic	Drivers for	Drivers	How were the drivers determined?
Ürge-Vorsatz	2015	European cities	Thermal energy in buildings	Energy demand	Population migration to cities, increasing levels of wealth, decreasing household size trend, changes in people's lifestyles and the type and number of cooling and heating equipment	The relationship between drivers and energy demand is given by an explanation based on facts and data from scientific literature
Wong & Brown	2009	Australian cities and Singapore	Urban water management in cities	Water management	(i) water supply access and security, (ii) public health protection; (iii) flood protection; (iv) social amenity, environmental protection; (v) limits on natural resources and (vi) intergenerational equity, resilience to climate change.	No info.
Farrelly & Brown	2008	Australian cities	Institutional Drivers and Barriers to Advancing Diverse Water Options	Water Management	increasing demand of drinking water due to population growth, aging infrastructure and increasing climatic variability	No info.
Brown et al.	2008	Australian cities	Transition States to Water Sensitive cities (Urban water management in cities)	Water management	(i) water supply access and security, (ii) public health protection; (iii) flood protection; (iv) social amenity, environmental protection; (v) limits on natural resources and (vi) intergenerational equity, resilience to climate change.	No info.
Brown et al.	2009	Australian cities	Urban water management in cities	Water management	(i) water supply access and security, (ii) public health protection; (iii) flood protection; (iv) social amenity, environmental protection; (v) limits on natural resources and (vi) intergenerational equity, resilience to climate change.	No info.
Hughes et al.	2013	Los Angeles, USA	drivers of water management changes in the city	Water Management	unreliability of traditional supplies, rise of environmental awareness, unpredictability of water resources due to climate change	No info.

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