Towards Effective Watershed Governance: A Case Study of the Grand River Basin

by
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Author’s Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.
I understand that my thesis may be made electronically available to the public.

Abstract

Watersheds across the country and around the world are governed by many different forms of watershed governance, all of which have their own challenges and benefits. None of them have so far been the perfect solution for water governance issues or concerns. Through a case study of the Grand River Basin (GRB), this study establishes a definition for what is effective watershed governance in Canada, and determines if an example is already being used or implemented in the country via the GRB. The GRB has produced many benefits and controversies surrounding its effectiveness from a variety of stakeholders. Through a series of video and audio interviews with stakeholders in the GRB and other watershed governance knowledge holders, data was collected to determine if the GRB is an example of effective watershed governance that can then be modeled across the country in a variety of different basins. The use of interviews provide the research team with an understanding of all the challenges and opportunities regarding watershed management in Canada. The study identified the pros, cons and opportunities for improvement within the governance of the GRB, and notes that IWRM is taking place in the basin. The study also develops a definition of effective watershed governance based on the participants' responses to the interview questions, and through a comparison of this definition to the GRB, it is identified that the GRB is being effectively governed. The study also identifies the role that watershed management and IWRM plays in effective governance.

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Dedication

This thesis would not have been complete without the support of my husband, Kyle Rogers, who has provided insight, support and compassion during this journey. It is a result of the hard work of my parents, Robert Timberg and Heather Dick, who always believed in me. Finally, Baxter, who made sure I took breaks and reconnected with nature once a week.

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Chapter 1

Introduction

The central focus of this research project is the Grand River Basin in Southern Ontario, Canada. In particular, the research focuses on stakeholder perceptions concerning the performance of the Grand River Conservation Authority (GRCA) in water resources management. The thesis speculates that through effective river basin management the GRCA contributes to improved basin-wide water resources governance. Armed with what we define as 'convening power', the GRCA helps overcome fragmentation in basin wide decision-making. This fragmentation manifests in two particular ways: one in terms of issues and interests among basin stakeholders (de facto fragmentation); the other in terms of governance structures (de jure fragmentation).

Water governance in Canada is complicated by jurisdictional fragmentation and overlap. Different levels of government hold different and sometimes competing responsibilities, which can create overlaps and gaps in jurisdiction. Pursuant to the Canadian Constitution, jurisdiction for resource management, which includes water governance, is jointly shared between provincial and federal governments (Shrubsole et al., 2017). The federal government is responsible, among other matters, for waters and water governance as it relates to Indigenous peoples and Indigenous communities, as well as having jurisdiction over fisheries, transboundary waters, and trade (Shrubsole et al., 2017; Bakker & Cook, 2011; Mitchell, 2016). Their responsibility for water as it relates to Indigenous peoples is considered by them to be "a shared responsibility between First Nations and the federal government" (Government of Canada, 2020).

Provinces on the other hand have jurisdiction for waters and natural resources which fall outside federal jurisdiction such as hydropower, recreation surrounding water, drainage basins, agricultural irrigation, and water quality including drinking water quality within the province (Shrubsole et al., 2017; Bakker & Cook, 2011). Some responsibilities have been delegated from provinces to municipalities who now hold responsibility predominately for water supply, including drinking water supply and wastewater (Bakker & Cook, 2011; Mitchell, 2016; Dunn, Bakker & Harris, 2014). Canada's three territories, Yukon, Northwest Territories and Nunavut, are unique as they do not have the same responsibilities and jurisdictions for resource management as provinces, and all waters in these areas are the responsibility of the federal government as long as no agreement has been reached between federal and territorial

governments (Mitchell, 2016). At the time of writing, water within Nunavut and the Northwest Territories is owned by the federal government, and managed by the Department of Indigenous and Northern Affairs Canada (INAC) (Government of Canada, 2020).

The shared responsibility of water governance between three levels of government creates significant fragmentation and leaves many areas open for improvement. In the past, the different jurisdictional responsibilities mentioned above have been surrounded by poor coordination and communication, jurisdictional overlap creating additional solutions for the same issue, inefficient data and research collection, and poor monitoring of water issues and jurisdictional enforcement (Bakker & Cook, 2011). Fragmentation has also meant that no one level of government would take responsibility for environmental issues and the possible solutions needed to combat them (Bakker & Cook, 2011; Mitchell, 2016). As well, the federal government has no desire to compete with provinces to create solutions for issues and take over jurisdiction previously delegated (Bakker & Cook, 2011). This prevents developing and using nation-wide solutions to common water problems (Mitchell, 2016). Similar to the federal government, provinces would not act on certain issues as it may be outside their responsibility and jurisdiction (Mitchell, 2016), leading many issues to go unresolved. As such, each province creates their own solution for their local water issues, with limited communication or coordination between neighbors. In worst case scenarios, the responsibility is passed off to another jurisdiction and if no one chooses to act, the problem persists.

Fragmentation in jurisdictions was most notably apparent during the recent Covid-19 global pandemic with mask mandates in Canada. The federal government through Transport Canada mandated masks be worn during air and train travel (Government of Canada, 2022a), Ontario mandated masks to be worn in indoor public areas, workplaces and on public transit (Rocca, 2020), and the City of Toronto had its own mask mandate for indoor areas open to the public and common areas of buildings (City of Toronto, 2022). While this is a different example from watershed governance, it highlights the issues that can arise from fragmented jurisdictions. Three levels of government instituted mask mandates. The federal mandate was only for federal jurisdictions, the provincial was for provincial areas and the City of Toronto was for municipal areas. They expanded on each other, but still highlighted the same area because they were all still enforcing the same initial mandates.

This example showcases some of the challenges with federalism in Canada. Canada is a federation. Federalism is a system where "government power and responsibility is divided between a federal legislature and state or provincial legislatures" (McIntosh and Smyth, 2020). Both the federal and provincial governments in Canada split jurisdiction over Canadian citizens. Canadian federalism is enshrined in the Constitution and protected by the Supreme Court of Canada so each level of government does not supersede the other and overstep their jurisdictional boundaries (Hueglin, 2021). Yet each level of government must still act for the betterment of the entire country and to promote societal equality (Hueglin, 2021). When a disagreement does arise regarding who has jurisdiction over the other regarding an issue, the Supreme Court of Canada is able to make a final decision, should they be invited into the conversation (Hueglin, 2021).

Canada's federalism was born out of Confederation and the founding of the country. All of the individual colonies included in the British North American Act (the BNA) were trying to be unified into one country to provide unified economic benefits, but this posed challenges as each colony had its own unique culture and identity such as Quebec (Hueglin, 2021). The solution to ensure unity while also acknowledging individuality of different regions or provinces was federalism. It was determined that the federal government would have jurisdiction and responsibility over anything related to "nation-building and nation-maintaining" including elements such as trade or defense (Hueglin, 2021).

This thesis argues that governance issues may be able to be resolved with a form of resource management called Integrated Water Resources Management (IWRM). IWRM is "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 SAS, 2018). It was developed out of the four Dublin Principles in 1992, when world leaders came together to discuss the need to protect the world's freshwater resources (World Meteorological Organization [WMO], n.d). The four principles are: (i) recognize water being a necessity for life; (ii) acknowledge the role women play in protecting water; (iii) believe that water is beneficial for the economy, and; (iv) that managing water must involve multiple stakeholders and levels of government (GWP SAS, 2018). IWRM "promote[s] democratic participation in governance,"

and specifically involves all stakeholders including those often marginalized or left out of the conversation (GWP SAS, 2018; Vieira et al., 2020). Today, it is increasingly recognized that sustainable resource governance and management must recognize the value of different forms of knowledge and enable all relevant stakeholders within a basin to participate in a meaningful way (GWP SAS, 2018; Wright, 1992).

1.1 Research Objective

Sustainable Development Goal (SDG) 6 promotes water and sanitation for all. Target 6.5 states that "by 2030, implement integrated resources management at all levels, including through transboundary cooperation as appropriate" (United Nations, 2015). Thus as a signatory to the SDGs, Canada has committed to achieving IWRM by 2030. How well prepared are we to achieve this and does IWRM actually contribute to the effective governance of watersheds? In this thesis, we investigate this question through the case study of the Grand River Basin (GRB) in Southern Ontario.

The literature review shows that IWRM may be taking place in the GRB as the form of resource management structure taking place. Based on this understanding, the overall objective of this research is to determine if an example of effective watershed governance is taking place in the country, and if IWRM is being used in the basin.

1.2 Research Questions

The central hypothesis of this research is that the Grand River Basin (GRB) and its governance structure, primarily the Grand River Conservation Authority (GRCA), is an example of effective watershed governance. The emphasis in the thesis is on gauging informed opinion of basin stakeholders, not in establishing empirically testable parameters.

The hypothesis will be tested by addressing the following research questions: 1) what type of watershed governance is taking place in the GRB, and what are its pros, cons, and opportunities for improvement; 2) what is effective watershed governance, and; 3) how does the watershed governance of the GRB compare to the definition of effective watershed governance determined

by this research, and is the GRB considered effective? The findings specific to the GRCA are assessed in relation to the broader literature on water resources governance and management.

1.3 Chapter Layout

This research is divided into several chapters. Chapter 1 is an introduction to the topic and the rest of the research. The second chapter is a literature review looking at water governance in Canada, and different forms of resource management such as IWRM, and SDGs. The third chapter looks at methodology and describes the steps which were taken for conducting the research and interview process. That is followed by the fourth chapter which is the case study of the GRB including an overview of the GRB and GRCA, and showcases the results of the interview process. A fifth chapter discusses the results of the case study in relation to the hypothesis, objectives and literature review. Finally, the conclusion is included in the sixth chapter which summarizes the case study and provides conclusions to the research.

Chapter 2 Literature Review

Several key terms will be repeated throughout this thesis. These terms were defined based on the literature review and by assessing the definitions included in several different articles. A complete summary of the key terms is included in the table below with the corresponding citation to the literature.

Table 1: Key Terms and Definitions

Term	Definition	Source
Good governance	Governance of shared resources through the establishment of and participation in institutions. Good governance focuses on governing through administration avenues such as goal setting for an organization, political avenues including stakeholder engagement, and systemic governance which focuses on governance throughout an entire system (i.e. economic system).	(Woodhouse, P., & Muller, M, 2017) (Rhodes, 1996)
Water Governance	Water governance is the governance of water resources which focuses on governing water resources from an overarching perspective. Water governance includes the institution which governs water resources, its goals and objectives, engagement with all interested parties, collaboration and a contextual understanding of issues and resources. Within Canada, water governance is fragmented with different governing institutions having different responsibilities regarding water governance and water resources.	(Woodhouse & Muller, 2017) (von der Porten & de Loë, 2013) (Bakker & Cook, 2011) (Brisbois & de Loë, 2016) (de Loë & Patterson, 2017)

		(OECD, 2015)
Good water governance	Good water governance is good governance that focuses solely on governing water resources. Good water governance has several key components such as it is collaborative, it engages all interested parties surrounding the water resources, incorporates different forms of knowledge, and is transparent and accountable. Within Canada, good water governance also actively and meaningfully engages Indigenous nations and Indigneous peoples on a nation-to-nation basis while incorporating Free and Prior Informed Consent.	(Wilson, 2020) (von der Porten & de Loë, 2013) (Maclean, 2015) (de Loë & Patterson, 2017)
Watershed Governance	Watershed governance is a scale of water governance focusing on governing water from the perspective of the entire watershed. It is a holistic approach which focuses on water issues and engagement with all interested parties both upstream and downstream in the watershed.	(Woodhouse & Muller, 2017) (Cervoni et al., 2008)
Effective Watershed Governance	Effective watershed governance was established by this research to be water governance which focuses on a watershed scale, and is able to meet the needs and goals of the governing bodies. It has several pillars to it including: transparency, stakeholder engagement, collaboration, a mutual understanding or common agenda, communication, multi-level, accountability, and a holistic approach.	(Veale and Cooke, 2017) (Brisbois & de Loë, 2016) (Bakker & Cook, 2011) (Godinez-Madrigal, 2019)

	This definition coincides with the pillars of IWRM, as well as other definitions of effective watershed governance identified in the literature review.	
Water Management	Water management is the day-to-day management of water resources. It focuses on more specific activities required for managing water resources such as funding activities, staffing, and developing and planning different activities needed to achieve water governance goals.	(Woodhouse & Muller, 2017) (Water Management Plan Team, 2014)
Water Security	Water security for this research was defined as access to safe and secure drinking water. This includes having a lack of access due to water quality or water quantity concerns. A lack of water security can raise many concerns or risks for individuals including economic and health risks.	(Van Hofwegen, 2008) (Six Nations Community plan, 2021) (Plummer et al., 2013) (CBC, 2018) (O'Gorman, 2021) (Kerins, 2020) (de Loë & Patterson, 2017)
Integrated Water Resources Management	IWRM is typically 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	(GWP SAS, 2018) (UNEP, 2002 & cited in Meran, Siehlow, et von Hirschhausen, 2021) (Vieira et al., 2020) (Veale & Cooke, 2017)

	ecosystems and the environment" (GWP SAS, 2018). This definition is used by many researchers and practitioners including multiple researchers cited in this thesis. It incorporates pillars defined by the UNEP and used to measure IWRM within this research. The measurable pillars are: integrative management, using a systems approach, full stakeholder engagement, social dimensions, capacity building, central government, women in management, transparency, financing, full-cost pricing, equitable allocation of water, economic good, and new technology and practices. Several other researchers also cited in this research identify similar or identical pillars to IWRM as stated by the UNEP.	(Shrubsole et al., 2017) (Scott et al., 2017) (Goyal et al., 2020) (Godinez-Madrigal, 2019) (Cervoni et al., 2018)
Collaboration	Collaboration is the coming together of all interested parties including stakeholders, governments, nations, and organizations within an area to tackle pressing issues, share knowledge, share resources, and develop shared goals and agendas. It can reduce conflict and creates open dialogue amongst all those involved.	(Water Management Plan Team, 2014) (von der Porten & de Loë, 2013) (Scarlett, 2013) (Brisbois & de Loë, 2016) (Bodin, 2017)
Collaborative governance	Collaborative governance is a governance structure which uses collaboration amongst all	(Bodin, 2017) (Wilson, 2020)

	interested parties to govern a particular area and its natural resources. It focuses on recognizing the role everyone plays in governance and can be most effective on a smaller scale such as a watershed or municipality.	(Water Management Plan Team, 2014) (von der Porten & de Loë, 2013) (Stefanelli et al., 2017) (Scarlett, 2013) (GRCA, 2020a) (Brisbois & de Loë, 2016) (Ansell and Gash, 2007)

2.1 Water Governance

The governance of an organization is very different from the organization's management. Governance is the bigger picture of the organization. It is "the strategic task of setting the organisation's goals, direction, limitation and accountability frameworks" (Appio, 2013). Water governance therefore refers to the problems, as they relate to water, which are tackled, how they are addressed, and why this is being done (de Loë & Patterson, 2017). Norman et al. (2010: 30), drawing on Bakker (2002), define water governance as:

> the decision-making process through which water is managed. This includes the entire range of political, organizational and administrative processes involved in managing the water supply: from the time when communities articulate their interests, and that input is absorbed, to the time when decisions are made and implemented,and decision-makers are held accountable for the development and management of water resources and the delivery of water services

This definition echoes that of the OECD (2015: 5) which states that water governance is:

> the range of political, institutional and administrative rules, practices and processes (formal and informal) through which decisions are taken and implemented, stakeholders can articulate their interests and have their concerns considered, and decision-makers are held accountable for water management.

Management, in comparison, focuses on the details, "the allocation of resources and overseeing the day-to-day operations" of a group (Appio, 2013). In the water sector, governance sets out the structure and processes by establishing appropriate laws, policies and administrative structures, identifying which interested parties are to be included in decision-making, the organizational structure for action, and how the necessary financial, human and technical resources will be accessed and deployed. Water management constitutes the operationalization of these elements. Water governance and management are connected, each informing the other. Good water governance constructs mechanisms by which management outcomes inform and improve governance processes and vice versa.

In the Canadian context, water governance is shared between three levels of government: federal, provincial and municipal. This shared responsibility of water governance can create significant fragmentation and leave many areas for improvement. Different jurisdictional responsibilities have historically been surrounded by poor coordination and communication, jurisdictional overlap creating additional solutions for the same issue, inefficient data and research collection, and poor monitoring of water issues and jurisdictional enforcement (Cook & Bakker, 2011). The fragmentation has also meant that no one level of government will take responsibility for environmental issues and the possible solutions that are needed (Cook & Bakker, 2011; Mitchell, 2017). As well, the federal government has no desire to compete with provinces for creating solutions and taking over jurisdiction once it has been delegated out (Cook & Bakker, 2011) which prevents any nation-wide solution to common water problems from being developed (Mitchell, 2017). Similar to the federal government, provinces will not act on certain issues as it may be outside their responsibility and jurisdiction (Mitchell, 2017), leading many issues to go unresolved. This is understandable because it goes against Canadian federalism. Yet it can be challenging as each province creates their own solution for their local water issues, with potentially limited communication or coordination between neighbours.

As with other federal states – e.g. the United States, Australia, Mexico (Woodhouse and Muller, 2017) – federalism poses challenges for effective water governance in Canada. Some of these challenges have been identified above. However, federalism in Canada can become an example of "political accommodation" for a more diverse and multicultural global world (Hueglin, 2021). Federalism and the different jurisdictional boundaries may be beneficial for resource

management and water governance, but first we must look at how federalism plays out in different areas of water governance. The different areas which will be looked at are: drinking water, groundwater, transboundary waters, and waters as they affect Indigenous peoples.

Within Canadian water governance, two key pieces of legislation should be singled out at the federal level: the Canadian Environmental Protection Act (EPA) and the Canada Water Act (CWA). The Canadian Environmental Protection Act, 1999 (S.C. 1999, c. 33) was first written in 1991 and recently updated in 2021. The goal of this act is to protect the environment, reduce pollution, protect human health in relation to the environment, and focus on sustainable development (Government of Canada, 2021). The EPA established multiple committees, like the national advisory committee, to help enforce the act and bring together multiple stakeholders (Government of Canada, 2021). Within the EPA's mandate of preventing pollution and protecting the environment, the protection of Canadian waters is also included, meaning substances cannot be released into waterways regardless of if they are considered under federal or provincial jurisdiction (Government of Canada, 2021).

The second piece of legislation is the Canada Water Act (R.S.C., 1985, c. C-11) (CWA) which focuses on the management of Canadian waterways, particularly surrounding "the conservation, development and utilization of water resources" (Canada Water Act, 2014). One of the primary roles of the CWA is to identify how jurisdictional responsibility surrounding water is divided between the different levels of government (Canada Water Act, 2014). The CWA also establishes intergovernmental committees between the provinces and the federal government to help protect waterways, develop different policies, assist with implementing the new policies, and collaborate through the sharing of information, data or research (Canada Water Act, 2014). The committees also allow for boundaries to be established to ensure that one government does not overstep into the other's jurisdiction or authority (Canada Water Act, 2014). Both the EPA and CWA are federal legislation that set up the basis for water governance across the country. They established who has jurisdictional responsibilities over water and the environment, and also provide the basis of all legislation for protecting waters and the environment.

In the context of Canadian water governance, certain issues have come to the forefront: drinking water quality; groundwater; transboundary waters; and water for Indigenous peoples. We now turn to a brief discussion of each of these issues in relation to water governance challenges.

2.1.1 Drinking Water

According to Norman et al. (2010), when it comes to setting standards, across Canada there is far more emphasis on water quality than on water quantity. This is even more so since the Walkerton[1] crisis (Norman et al., 2010). Drinking water is a vital issue in Canada for three reasons. First, for a long time, there were no universal, legislated and thereby enforceable standards for drinking water across the country (Dunn, Bakker & Harris, 2014). Different provinces and territories had different definitions of what is and is not acceptable, and also have different methods for testing water quality. There had been attempts to regulate this process with the Federal-Provincial-Territorial Committee on Drinking Water (FPTCDW), which developed a set of universal drinking water standards that could be used by all jurisdictions (Dunn, Bakker & Harris, 2014). The FPTCDW created the Canadian Drinking Water Quality Guidelines (CDWQG) which would allow for national drinking water standards, but neither the FPTCDW nor CDWQG could be enforced, and it was up to the provinces and territories to choose to use them (Dunn, Bakker & Harris, 2014; Our Living Waters, 2020). The CDWQG also only provides "the maximum acceptable concentrations of substances in drinking water and the basic parameters every water system should strive to achieve" (Our Living Waters, 2020).

Drinking water standards, or a lack of enforceable standards, is still an issue today. As recently as 2020, Canada did not have any "enforceable drinking water standards at a national scale" (Our Living Waters, 2020). National drinking water standards are needed to ensure that citizens across the country have access to safe and secure drinking water, and would ensure environmental protection while also promoting equity amongst all citizens.

Yet, even without these processes and guidelines being legislated, there has been some success with provincial and territorial responses to drinking water quality issues. Over 50% (8 out of 13) had enforceable drinking water quality regulations, and an additional 30% (a further 4 out of 13) had non-enforceable standards (Dunn, Bakker & Harris, 2014). The Northwest Territories is the only province or territory to have instituted all 94 regulations of the CDWQG with enforcement, while three others implemented all regulations without enforcement (Dunn, Bakker & Harris,

[1] The Walkerton crisis took place in 2000 when the water supply in the town of Walkerton was contaminated with E. coli (CBC News, 2010). This resulted in at least 2300 people becoming sick, several of whom passed away (CBC News, 2010). This crisis resulted in the Ontario provincial government contributing $25 million to ensure that a drinking water crisis of this magnitude never occurred ever again in the province (CBC News, 2010).

2014). There is at least one province or territory which had not implemented the 94 regulations and their water quality was significantly different than the others (Dunn, Bakker & Harris, 2014). Therefore while most provinces and territories follow the CDWQG, a universal policy (even if it is the CDWQG) that is enforceable is still required to ensure that there is a bare minimum for drinking water standards across the country. Otherwise while many jurisdictions may have implemented the same standards, water quality could deteriorate and cause major health concerns for which no one will be held responsible.

Secondly, municipalities provide drinking water services to their residents (Cook & Bakker, 2011; Mitchell, 2017; Dunn, Bakker & Harris, 2014). However, challenges arise because different municipal jurisdictions have different resources and management abilities which affect their ability to adequately provide this resource. The gap is particularly evident when the size of municipalities are compared as larger ones have the ability to institute, test and enforce stronger regulations due to having greater resources (Dunn, Bakker & Harris, 2014). Smaller municipalities do not have the resources to enforce regulations, provide accurate data and testing of water, or even the financial ability to pay for new infrastructure when it is needed (Dunn, Bakker & Harris, 2014). The gap between municipalities, including the discrepancy in resources, funding and capacity, must be addressed otherwise the residents of smaller or rural municipalities will be disproportionately affected.

Thirdly, drinking water as it pertains to Indigenous peoples showcases extreme gaps in regulations and jurisdictional fragmentation. Many Indigenous nations and reserves do not have access to safe and secure drinking water, and as of July 16, 2022 there are 891 water advisories[2] across Canada. Drinking water quality as it pertains to Indigenous peoples on reserves is the responsibility of the federal government, not the provincial government as it is for anyone else (Dunn, Bakker & Harris, 2014). There are discussions for it to fall under provincial jurisdiction (Dunn, Bakker & Harris, 2014), but this will pose additional challenges as provinces will have to find new resources, including financial ones, to supply Indigenous reserves, as well as the capacity to act which is often missing from the discussion on Indigenous water quality and

[2] Water advisories are issued by the federal government to warn individuals about potential health concerns associated with drinking water (Government of Canada, 2022b). Water advisories are classified into three different types: boil water advisories (BWAs), do not consume advisories (DNCs), and do not use advisories (DNUs) (Government of Canada, 2022b). This statistic of 891 water advisories shows that across the country, there are 891 advisories issued which are either classified as a BWA, DNC or DNU.

access. This gap between Indigenous and non-Indigenous communities must be addressed otherwise there will always be second class citizens living in this developed country. It also negatively affects the health, well-being, economy, and culture of Indigenous peoples which must be acknowledged.

Federalism within the context of drinking water is challenging to understand because it is hard to know who is responsible and under whose jurisdiction it falls. Drinking water in regards to Indigenous peoples is a federal responsibility, but what about for everyone else? Having federal guidelines, even though they are not enforceable, would mean that drinking water quality is a federal issue, but as provinces and territories are the main levels of government instituting guidelines, it is the provinces who have the responsibility to act. A question is raised here about if federalism is beneficial or not because drinking water quality standards should be universal across the country to ensure that everyone is treated fairly and undue harm is not put onto others.

2.1.2 Groundwater

Groundwater is another area of water governance posing challenges in the Canadian context due to the fragmentation of governance, federalism and different issues, such as climate change and overuse, which are on the rise.. Groundwater is under the jurisdiction of the provinces and territories, but protecting it often focuses on addressing the infrastructure which supplies water to residents and protecting the groundwater sources themselves (de Loë & Kreutzwiser, 2005; Ground Water Canada, 2020).

However, while groundwater is a provincial responsibility, municipalities and other smaller agencies also play a role in its protection and governance (Ground Water Canada, 2020). In fact, the most effective protection and solutions are those which are created and developed by local stakeholders and municipalities (de Loë & Kreutzwiser, 2005). This is another section of the fragmentation and decentralization occurring in Canadian water governance. Those who are best to protect and conserve an aquifer, in this case a municipality, do not have the jurisdiction to do so. As well, it is the residents of those local municipalities which are most affected by groundwater contamination or overuse. Yet, smaller, local groups often do not have the resources or capacity to implement and enforce solutions (de Loë & Kreutzwiser, 2005). Nor do they have the ability to take on more responsibility, especially for smaller municipalities where resources

are already limited. As de Loë & Kreutzwiser state, the lack of resources and capacity create weak institutions which become the biggest challenge to groundwater protection (2005).

While groundwater is governed between the provincial and municipal governments, it is also governed in conjunction with the federal government. Different federal departments such as Environment Canada, National Resources Canada, and Health Canada all play a role governing groundwater across the country (Ground Water Canada, 2020). Some other agencies such as Agri-Food Canada also have a role governing groundwater resources because of their mandates and need to assist on irrigation and water issues within the agricultural industry (Ground Water Canada, 2020). This shows another challenge of federalism. Provinces and territories have primary responsibility with protecting groundwater, but the federal government also plays a role. This could easily allow for jurisdictional overstep or if governments wanted to avoid that, it could mean that they do not act. Groundwater also raises the issues of how municipalities can get involved. Due to federalism, municipalities do not have any jurisdiction surrounding groundwater, but as previous reports state they are the level of government with the most at stake and potentially the greatest capacity to develop and undertake groundwater protection planning and action.

2.1.3 Transboundary Waters

Transboundary waters are federal jurisdiction, but gaps are increasingly being seen in this area and within who has a right to act, compared to who can enforce or create binding legislation. The federal government has jurisdictional responsibility, but often allows smaller groups such as provinces, municipalities, stakeholder groups, and Indigenous nations to participate and work with other organizations surrounding issues within a transboundary water (Morris & de Loë, 2016).

In Canada, all transboundary water policies are coordinated between the Canadian federal government and the United States federal government (Cook & Bakker, 2011). The first instance of formal cooperation between the two countries occurred in 1909 with the development and signing of the Boundary Waters Treaty (BWT). The BWT wanted to maintain a strong alliance between the two countries, allow for collaborative governance and management of shared waters, and to create a framework that would allow for future solutions to be effectively

implemented. From there, the International Joint Commission (IJC) was created under the BWT to mediate any future conflict arising between the two countries resulting from water issues. For a period of time, the IJC was one of the most dominant forces governing transboundary waters in North America even though it did not and still does not have legislative and enforceable powers (Norman & Bakker, 2015). Over time, the IJC began to include more local stakeholders, including provinces and states, in decision-making which further increased after the signing of the North American Free Trade Agreement (NAFTA) (Norman & Bakker, 2015; Norman & Bakker, 2009). Today the role has reversed and the IJC is less involved in transboundary water decisions as it cannot commence an investigation into an environmental issue, nor can it support sustained participation from the public or stakeholders (Norman & Bakker, 2015). The move from a nation-to-nation focus when looking at transboundary water issues, to a more localized focus has allowed greater participation while also showing fragmentation as it is still the federal governments who have jurisdiction over the waters, but the municipal and provincial governments which are also acting.

Having more provinces and municipalities become involved in decision-making also alters the scale of transboundary water issues to a localized and watershed based scale. This decreases the power and jurisdiction federal governments have in decision-making (Norman & Bakker, 2009). Yet, having a watershed approach also poses challenges because as previously stated, smaller stakeholders may not have the resources to participate particularly when participation must occur across international boundaries (Norman & Bakker, 2009). While more Indigneous nations are also being consulted, there is still limited engagement for including Indigenous peoples and traditional IK in decision-making (Morris & de Loë, 2016).

Federalism shows that the federal government is responsible for transboundary water issues, but they have allowed other levels of government to participate in the process. This is an interesting aspect of federalism as there is often the desire to not overstep jurisdictions and boundaries to avoid getting Canadian courts involved. Yet transboundary waters are one area where the federal government has allowed other levels of government to enter the decision-making table. It shows that federalism is constantly flowing and evolving, and is not a static decision with hard and fast rules.

2.1.4 Indigenous Peoples

The federal government has the responsibility to provide resources for and adhere to the treaties signed with the Indigenous nations and peoples across the country. With the federal government having jurisdiction and responsibility for Indigenous peoples in the country, questions around co-governance between Indigenous peoples and the Canadian government arise. Co-governance is when multiple levels of government "share authority or jurisdiction on a nation-to-nation basis" (as cited in Wilson, 2020). Co-governance therefore recognizes Indigenous peoples as their own nation which can work in collaboration with the Canadian government sharing responsibilities between the two groups. Challenges arise when co-governance tries to work alongside federalism. Under federalism only the provinces, territories and the federal government are given power and responsibilities, and Indigenous nations and peoples are not included in this definition. It raises concerns because how co-governance can occur where jurisdictions or authorities are shared between Indigenous peoples and the federal government, if Canadian federalism does not give Indigenous peoples those jurisdictions or power.

When Canada was founded, colonization of the continent meant that Indigenous peoples, lifestyles, cultures, worldviews and knowledge were suppressed (Parsons, Fisher and Crease, 2021). This goes against co-governance and different areas of resource management, and it has created many water issues within Indigenous communities and on reservations. O'Gorman (2021) found that Indigenous peoples living on reserves are more likely to have drinking water advisories (DWA), can have varying wastewater treatment services, have treated drinking water that is still considered unsafe, require water to be trucked in, or pumped from contaminated wells. Indigenous peoples often live on average 11 years less than the average Canadian, have higher rates of suicide and infant mortality, and overall more health concerns such as higher rates of asthma (O'Gorman, 2021; Wiebe, 2012). Mental health is also affected and a lack of clean and safe water plays a role. O'Gorman found that residents living in a home with running water are 80% less likely to experience depression (2021). Since the 1970s, the federal government has stated that it will pay for better infrastructure within Indigenous communities, and when the federal government is supporting new water and sanitation infrastructure they provide 80% of the funds while the Indigenous nations must provide the other 20% (O'Gorman, 2021).

At Six Nations of the Grand River, drinking water quality has been an ongoing challenge. The community draws in water from the Grand River from an area which has poor water quality (Plummer et al., 2013). A 2013 study also found that within private wells in the Six Nations of the Grand River, 97% had vermin in them, and 21% of all dug wells and 15% of all drilled wells had E. Coli contamination (Plummer et al., 2013). This shows that even within the study area of this research, in the GRB, Indigenous nations are struggling for safe and secure drinking water. Chapter 4 will provide an analysis of how this lack of water security compares to that of research participants.

There are options of what can be done to improve water issues within Indigenous nations. One option is a co-governance agreement between the federal government and an Indigneous nation. Co-governance agreements have been developed with Indigenous nations, but these agreements often ignore the resources Indigenous nations require in order to grow and develop (Parsons, Fisher and Crease, 2021). A second option is a municipal type agreement (MTA) which can dramatically help Indigenous nations and communities through elements such as improvements being made to drinking water quality (O'Gorman, 2021). A MTA is an agreement between an Indigenous nation and a neighbouring municipality with the intention of having the Indigenous nation use the treated water from the municipality (O'Gorman, 2021). MTAs in the past have been beneficial with Indigenous nations who participate in a MTA having an 11% decreased chance of having a boil water advisory (O'Gorman, 2021). These two options can support Indigenous nations, but may pose challenges under federalism. A co-governance agreement between the federal government and an Indigenous nation would not supersede or override the powers of the federal government, but a MTA may. As the MTA is between a municipality and an Indigenous nation, it puts the responsibility on the municipality to supply water to the Indigenous nation. This overrides federal jurisdiction which currently has the responsibility to do so. In order to get around this, a MTA would need approval from the federal government before beginning.

2.2 Different Approaches to Governance Structures

Similar to having different management approaches, there are also several governance approaches to be considered. Three approaches are dominant in the literature: multi-level governance, collaborative governance, and co-governance. We describe each in turn.

Multi-level governance uses multiple stakeholders and government bodies to separate the different avenues for “day-to-day operations, regulation, and policymaking” in the hopes that they can all be achieved by separate groups (Lele, 2017). There are many more stakeholders involved in the process and each can carry out their own task.

Lele (2017) describes this form of governance in the context of forests in India where decades of conflict, tension, and protests resulted in people being evicted from living in the forests. Like water, forests provide different benefits for different actors with widely varying capacities: from forest dwellers who eke out a living gathering non-timber forest products to large firms harvesting timber. Sustainable forest management therefore requires a governance arrangement that respects these different needs and interests, and thus involves all stakeholders in a meaningful way. For Lele (2017):

> Forest governance is, thus, much more than making management choices (which trees to plant, how to protect and what to harvest). It is about deciding which stakes are recognised as legitimate, which stakes are to be prioritised and where, allocating rights and responsibilities to groups and organisations, and structuring their interactions (what Schlager and Ostrom [1992] call ‘constitutional’ choices as against "operational" choices) to realise these goals.

There are many aspects of the forest that may benefit and improve society, and in turn, society helps shape the forest and these benefits (Lele, 2017). Decisions are made regarding a forest which can have a much broader impact than only on the ones making the decision, and it is important that the correct people are participating in the conversation and being given rights to become involved (Lele, 2017). For this, Lele claims, multi-level governance is needed because it allows the local communities most affected by the decisions surrounding the forest a right to participate and have a say in the decisions being made (Lele, 2017). Different layers of stakeholders and individuals affected different avenues in the forest creating multi-level governance.

Multi-level governance can be beneficial because it gives more stakeholders in an area the ability to participate and make decisions. It also puts some decision-making on the individuals most affected by an issue or by a resource. Multi-level governance could also work very well with IWRM which has the pillar of including all stakeholders in participation. This is shown by Pahl-

Wostl who argues that multi-level governance can be more adaptive and resilient to changes (2009). The ability of interested parties to participate in multi-level governance increases knowledge sharing and collaboration as knowledge can be shared amongst the different levels as individuals move throughout (Pahl-Wostl, 2009). This allows for strong engagement as many different individuals or groups can be participating, sharing their ideas and thoughts, and influencing decision-making. A multi-level approach and engagement of all interested parties also increases innovation and developing sustainable solutions which can allow for stronger governance with increased adaptation capabilities and resiliency (Pahl-Wostl, 2009). Resiliency and adaptiveness can be increased and improved by stakeholder engagement, while also capturing the ability of a governance structure to be both bottom-up and top-down (Pahl-Wostl, 2009).

Collaborative governance is the use of collaboration and collaborative measures to govern an area or a resource (Bodin, 2017). It is a controversial form of governance with research finding both pros and cons to its use (Bodin, 2017). The cons to collaborative governance relate to the collaboration that needs to take place and how this can be challenging or not always beneficial for environmental issues, particularly if it delays acting on a pressing issue like a wildfire. Collaboration requires significant time for it to take place and requires a diverse group of stakeholders, from sovereign states to members of the public, to ensure that all ideas and backgrounds are addressed and included (Bodin, 2017; Brisbois & de Loë, 2016). Similar to multi-level governance, collaboration can also be challenging when the stakeholders involved do not get along. Stakeholders must want to collaborate with each other and make significant decisions, but if they do not do this it can mean the collaborative governance is ineffective as nothing can be done (Bodin, 2017). It also requires everyone who is participating to have the ability and knowledge to meaningfully contribute to the conversation (Brisbois and de Loë, 2016). This can be challenging, especially when there is a pressing environmental issue such as a fish die off in a lake, both of which must be addressed very quickly (Bodin, 2017). Collaboration works best for long-term environmental issues, such as climate change, which require long-term, sustainable solutions (Bodin, 2017). When collaborative governance is used over long periods of time, it can be very effective in meeting its goals (Bodin, 2017).

Collaborative governance could be beneficial for IWRM and for water governance. Water governance requires long-term approaches to governing a basin and identifying the goals and objectives to be addressed. Using collaborative governance could help to ensure that all stakeholders in a basin are included in all types of decision-making through an institutionalized structure that brings stakeholders to the table (Ansell and Gash, 2007). Within collaborative governance, "the institutionalization of a collective decision-making process is central" to this form of governance (Ansell and Gash, 2007, p. 548). Collaborative governance could be beneficial with IWRM because it will include multiple stakeholders.

The two forms of governance, multi-level and collaborative, have several similarities particularly regarding having multiple stakeholders participate in decision-making processes. However, the difference between the two lies in how stakeholders are engaged. Collaborative governance brings together stakeholders to all collaborate on one particular issue while multi-level governance has different stakeholders addressing different issues. However, they are not mutually exclusive: multi-level governance can function collaboratively depending on the organizational structure in place (Armitage, Berkes and Doubleday, 2007).

Co-governance is a third type of governance arrangement that is described as highly specific to Canada, but is also found in Australia and New Zealand (see:https://www.dfo-mpo.gc.ca/oceans/publications/advisorypanel-comiteconseil/2018/finalreport-rapportfinal/page01-eng.html; also Godfery, 2022). It is most often used when discussing relationships between Indigenous nations and the federal government. Co-governance has been defined as two governments sharing responsibilities and power "on a nation-to-nation basis" (Wilson, 2020). Co-governance is often hard to achieve because the federal government often does not want to share jurisdictions and responsibilities with Indigenous nations (Wilson, 2020). It also requires significant levels of collaboration to already be taking place in institutionalized settings (Phare et al., 2018).

Co-governance is used in Yukon, Canada with the Yukon First Nations participating in co-governance with the federal government through both self-government agreements and modern-day land claims (Wilson, 2020). This co-governance acknowledges that the Yukon First Nations are given powers on a nation-to-nation level which gives them the ability to meaningfully participate in decision-making and governance (Wilson, 2020). However, Wilson determined

that this co-governance is limited with the Yukon First Nation not having complete authority over water resources (2020). This is seen with the Yukon Water Board (YWB) which co-manages and makes decisions on water resources, such as approving water licenses during resource development (Wilson, 2020). Yet, within the YWB approval process, many Indigeous peoples feel as if their concerns and voices regarding the applications are not acknowledged (Wilson, 2020).

As seen in Yukon, what is deemed "co-governance" still does not fully provide Indigenous peoples with decision-making roles or abilities. Federal, territorial or provincial governments wield primary power over decisions. It could be argued that this is due to federalism which acknowledges that these levels of government are given specific powers and responsibilities which do not extend to Indigenous nations.

2.3 Management Approaches

Management approaches are intertwined with governance structures and can be more or less effective depending on the governance structure in place. The interconnectedness is important to understand, and will be discussed particularly within the Grand River Basin in a later chapter. Of the management theories used around the world, several identified strategies are top-down management, community-based natural resource management (CBNRM), the precautionary approach and adaptive management. These four strategies are not the only ones available, however they were chosen for several reasons. Importantly, they have emerged over time in the literature as remedies for resource-based socio-ecological/economic problems attributed to top-down forms of decision making and action: e.g. lack of transparency, lack of accountability, lack of flexibility leading to lock-in, limited perspectives based on particular types of expert knowledge, exclusion of particular stakeholder groups (see Conca, 2006 for details). Nevertheless, and as described below, each strategy comes with its own challenges and successes with implementation which must be addressed.

Top-down management involves the resource management of natural areas including fisheries and marine protected areas, which is organized and controlled by governments from the top-down (Arceo et al., 2013; Nava & Ramírez-Herrera, 2011). Zagonari (2008) emphasized that top-down management typically occurs in developed countries and is most effective in basins or

areas where there are many people indirectly benefiting from the environment. Nava and Ramírez-Herrera (2011) studied top-down management in Zihuatanejo, Guerrero. They found that the studied top-down management approaches would often disregard "the effect of land use changes" along the coast, and discovered that including multiple levels of government in projects could prevent the overall project goals from being achieved (Nava and Ramírez-Herrera, 2011). The results of this study found that a community-led approach was better suited for resource management of the protected area than top-down management, and that community members living in areas where top-down management was being used could actually provide better management than governments could (Nava and Ramírez-Herrera, 2011).

Areco et al. (2013) focused on the use of top-down management to create marine protected areas (MPAs) in the Mediterranean Sea. They discovered that top-down management does not always improve sustainability in the MPAs because there is often not enough stakeholder engagement (Areco et al., 2013). The best method would be for a co-management system to be developed as all stakeholders, including the government, play a vital role in the sustainability of those areas (Areco et al., 2013). As both studies show, a challenge with top-down management is that it often includes limited knowledge from local communities or stakeholders outside of the policy-making sphere (Arceo et al., 2013; Nava & Ramírez-Herrera, 2011). A lack of inclusion from all stakeholders will prevent the development of sustainable policies and projects while also harming the implementation of top-down actions (Arceo et al., 2013; Nava & Ramírez-Herrera, 2011). However, when there are many people benefiting from the ecosystem who do not require it for basic survival, top-down management is the best option (Zagonari, 2008). In contrast, CBNRM and IWRM include engagement of all stakeholders within a resource management area. While this solves some of the more problematic elements of top-down management, it doesn't guarantee that certain powerful groups within the management arrangement will not dominate decision making in relation to their interests (Swatuk, 2005a, b and c).

On the positive side, CBNRM focuses on resource management projects which are led by local communities or are community-based (Dyer et al., 2014). They can be more cost-effective than other strategies while directly benefiting "the most vulnerable people" in an area (Reid, 2016). CBNRM includes local communities and local knowledge which top-down management, as shown above, can be missing. However, it can exclude assistance from governments and

individuals of a top-down level, which Hutton et al. (2014) found can impact achieving project goals as the community members involved are not always completely knowledgeable about the issues needing to be solved (as cited in Dyer et al., 2014). Goals are also sometimes not met because there can be poor communication throughout the different steps of the project (Dyer et al., 2014). If a project failed due to these challenges, it could force future projects to switch to a different strategy such as top-down management. A switch could eliminate any participation from local communities or the inclusion of local knowledge in the future.

However, Zagonari (2008) concluded the opposite to Dyer et al. by stating that CBNRM is more beneficial in developing countries where community members directly rely on the ecosystem or environment for survival. He argued that CBNRM can be more effective than top-down management because CBNRM is directly linked to the communities who rely on the area (Zagonari, 2008). As well, communities can enforce compliance to the rules, compared to top-down management where a separate entity would have to be used for enforcement (Zagonari, 2008). CBNRM generally focuses on a geographical scale that does not specifically align with a river basin. For example, CBNRM in southern Africa concentrates primarily on areas bordering national parks (Child, 1996; Child and Barnes, 2010; Jones, 2010; Swatuk, 2005a). These conservancies overlap with river basins and often inform decision-making in the context of river basin organizations (Swatuk, 2005a). CBNRM programs ensure that local knowledge informs resource management practice, and when enshrined in law can form a firm foundation for effective multi-level governance (Galvin et al., 2018).

The precautionary approach is not an organizational approach to effective resource management but a strategy that takes precautionary measures to prevent any harm to people, the environment and natural resources (Winter & Hutchings, 2020). As a concept, it can serve to inform all management and governance practices. The precautionary approach derives from the widely known ‘precautionary principle’, which Bourguignon (2015) traces first to German law in relation to air pollution and internationally to the Vienna Convention for the Protection of the Ozone Layer. Put simply, a precautionary approach argues that where there is ambiguity regarding a particular issue, it is best practice to act on the part of safety. For example, Bourguignon (2015, p. 5) cites “the 1987 Ministerial Declaration of the Second International Conference on the Protection of the North Sea which states that: 'in order to protect the North

Sea from possibly damaging effects of the most dangerous substances, a precautionary approach is necessary which may require action to control inputs of such substances even before a causal link has been established by absolutely clear scientific evidence'".

To ensure only a small negative impact is made, science must be used to develop actions and the overall strategy being implemented by policy makers in the area (Winter & Hutchings, 2020). Unlike other approaches which may not prioritize science in decision-making, the precautionary approach must do that. Yet, this does not always occur. An example is the Canadian Department of Fisheries and Oceans which uses the precautionary approach in their work, but Winter and Hutchings (2020) discovered that even when using this strategy, science often did not meaningfully inform policy development.

Canada also uses the precautionary approach when working with other countries and fisheries in the central Arctic Ocean (Pan & Huntington, 2016). The precautionary approach can improve science within shared waters and can also allow for science diplomacy to occur which can produce better cooperation between neighboring countries or states (Pan & Huntington, 2016). This study concludes that the precautionary approach will allow for more collaboration between countries in shared waters as everyone will be acting for the overall benefit of the resource and to ensure its sustainability, compared to developing their own competing actions (Pan & Huntington, 2016). However, as Winter and Hutchings (2020) pointed out, if policy makers do not allow for science to meaningfully contribute to policy making, the precautionary approach will not be effective.

The fourth form of resource management discussed here is adaptive management which states that resource management of an area should always be adapting as different strategies and actions become implemented (Williams, 2011). This emphasizes flexibility as the first implemented actions will alter the environment, and this could then alter which issues must be addressed and the extent to which they must be addressed (Williams, 2011). It can never be understood how actions will affect the rest of the ecosystem as they can create ripple effects which have greater impact, positively or negatively, than previously thought (Williams, 2011). As shown in Figure 1 below, action plans must be responsive to impacts and provide pathways for critical reflection and change. Management strategies must continually change based on

structured, scientific assessments completed throughout the length of the project (Williams, 2011). “Scientific investigations during the monitoring phase of the AM [adaptive management] process are an ongoing cornerstone to address uncertainty” (Ebberts et al., 2018).

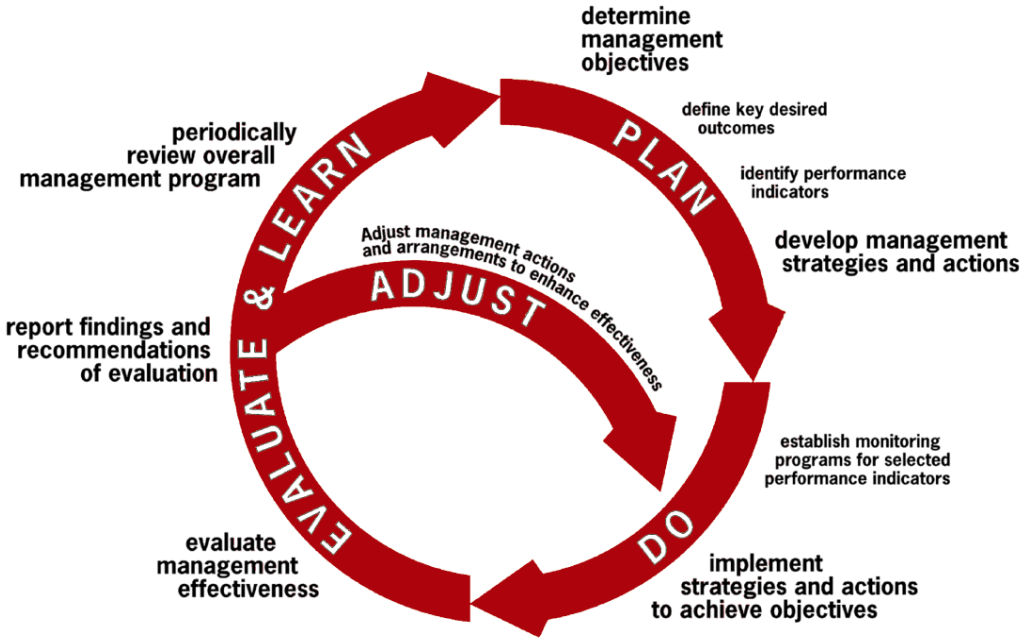


Figure 1: Adaptive Management Cycle. Available at: https://reefresilience.org/management-strategies/reef-management/adaptive-management/

The benefits of adaptive management are that it promotes flexibility in work and understands that new issues, which can be more pressing than previous one, can arise at any moment. As well, previously identified issues can be solved earlier than anticipated. Yet, adaptive management has challenges. It only works if the institutions and organizations managing an area are actively using adaptive management in their day-to-day structure (Ebberts et al., 2018). If it is only being used for one particular project or being used on a trial phase, decision makers will not want to alter their previous decisions already developed and will not understand the reason behind adapting (Williams, 2011; Ebberts et al., 2018). As well, when feedback assessments are conducted, different stakeholders including scientists and policy makers, can interpret the results using different means and because of their different perspectives and backgrounds (Scarlett, 2013). This can produce differing beliefs about what needs to be addressed next or what is important (Scarlett, 2013). Overall, this will create a gap and tension between the different

stakeholders and could produce significant differences in the opinions on what actions should be taken. The different opinions on actions can each affect the ecosystems in very different manners.

Yet, there are successful implementations of adaptive management. Ebberts et al. (2018) focused on the use of adaptive management within the Columbia Estuary Ecosystem Restoration Program and found that any success related to the program was because of the use of adaptive management. While adaptive management was a success here, an important gap that can be missing is the use of other forms of knowledge like IK. If IK is not considered "science" and not involved in policy and decision making, then not all stakeholders will be involved and there will still be uncertainty within the projects and systems. Including IK will be especially important in basins which reside in the traditional territories of Indigenous nations.

2.4 Integrated Water Resources Management

IWRM is promoted by the United Nations and implementing IWRM in basins around the world by 2030 is target 6.5.1. SDGs have been in place since 2015 with the goal of global achievement by 2030. However for SDG 6.5.1, countries around the world are lagging behind. There are 107 countries that have not made significant progress towards this goal which means that implementation rates globally must double by 2030 (UN Water, 2021). Canada in particular is drastically falling behind. They are one of the few countries in the world who have not provided any data about the rates of implementation within the country (UN Water, n.d.).

This is important because Conservation Authorities in Ontario promote integrated management of watersheds and try to follow an integrated approach when governing and managing basins (Watson et al., 2019). While the GRB has included stakeholders in decision-making, researchers have both suggested that the current approach of governance may not be working while others argue that it is working. It has also been argued that conservation authorities, including the GRCA, operate under a form of IWRM (Watson et al., 2019).

As shown in Tables 1 and 2, IWRM remains controversial, having nearly as many detractors as supporters. For example, Biswas (2004) offers a critique of IWRM primarily due to its definition. He describes the definition as "unusable, or un-implementable, inoperational" and that

it lacks clarity which does not inform or aid policy makers with implementation in a basin (Biswas, 2004, p. 250). Furthermore, Biswas (2004) emphasizes that there is no explanation as to what an integrated water basin looks like. Biswas' research highlights some points that have come up in the literature on IWRM regarding the lack of a clear definition.

Table 2: Perceived Weaknesses of IWRM

Author	**Criticism**
Biswas, 2004	IWRM is 'a vague, indefinable, and un-implementable concept' (p.251)
Watson, 2007	How well the framework can be implemented is unclear
Van Koppen et al., 2007	The regulatory measures introduced through IWRM not only pay scant attention to long-standing community-based institutional arrangements in the Global South, but too often undermine them
Shah and Van Koppen, 2006	Whereas the typical ingredients of IWRM may work in the Global North, they are inappropriate and often harmful in the 'informal water economies of the developing world'.
Molle, 2008	Describes IWRM as a vague "Nirvana concept" where every sort of advance in water management can be claimed as a result of IWRM.
Warner et al., 2009	Kazakh IWRM was formulated in terms of European standards through consultancy without taking into account ground level or local problems, and was thus largely ignored

Giordano and Shah, 2014a	In developing countries 'IWRM tends to be driven not by indigenous need but rather by foreign intervention where it arises and is enforced "through international organizations, loan conditionality, expert consultations, and economic as well as political pressure"' often at the expense of alternative solutions and paths' (p.37; also quoting Laube, 2007).
Giordano and Shah, 2014b	'This transformation of an idea into a "sanctioned discourse" (Allan, 2003, p. 21 – 22), of a means into an end (backed by loan conditionality), can divert attention from actual water problems and national priorities.' (p.366)
Lenton and Muller, 2009	IWRM reforms tends to focus on the higher levels of scale, on policy and legislation reforms at national level and the establishment of river basin organizations.
Wester and Warner, 2002; Blomquist and Schlager, 2005	IWRM framework usually focused on large catchment or river basins as the only or best management.
Merrey et al., 2005	'Lack of concern for people, poor and marginalized'. Authors described the framework as biased against those who are really affected compared to their overall goals.
Cleaver, 1999; Currie-Alder, 2007	Rather than power-sharing and more empowering forms of participation, most are limited to activities about informing or consulting people, while there is always a risk of co-optation and power play.
Bruns, 2003; Butterworth et al., 2010	People's participation is poorly assessed by IWRM.

Allan, 2006; Gyawali et al., 2006; Wester et al., 2003; Blomquist and Schlager, 2005; Mollinga, 2006	IWRM ignores local level politics when it comes to integrated management.
Lankford and Hepworth, 2010	IWRM is often 'excessively comprehensive and too formal to be effectively implemented and for certain African basins may not be sufficiently tailored to circumstances, especially the unpredictable dynamism in water supply and demand found there.' (p.83) IWRM is a 'cathedral' model where management is based on regulatory legal authority when what is often needed is a 'bazaar' model of flexible, informal, polycentric water resources management.
Cashman, A., 2017	IWRM cannot function in the context of weak formal institutions.
Cullet, 2018	'IWRM is a limited framework that makes specific assumptions about the water sector, including seeing water mostly as an economic good and focusing on private property rights. This leads it to privilege efficiency over equity, appropriation over sharing, giving in effect more importance to economic regulation of water than to human rights.' (p.333)
Godinez-Madrigal, Van Cauwenbergh, & van der Zaag, 2019	Practical applications of IWRM do not necessarily improve the livelihoods of all stakeholders, particularly poor or marginalized members. Gaps exist with implementing IWRM and other water

	management systems, where not all stakeholders have a voice or can express their concerns in the basin.
Mao et al., 2020	IWRM implementation in rural China had some successes when it solved pre-existing water issues but has also created new problems. In theory it is a successful management style, but in practice it can create additional issues to be solved.
Yahn Filho, 2020	In transboundary basins like the Columbia River Basin, there are too many stakeholders and no independent governing body to oversee the basin.
Bezerra et al., 2021	IWRM was implemented in different basins across Latin America but was ineffective because of poor communication amongst stakeholders and poor water governance. Additional programs would be needed to help with implementation and ensure success.
Ngene et al., 2021	IWRM must have support to be successful and many institutions in Nigeria do not support it. It can be seen as “neo-colonialism.”
Ben-Daoud et al., 2021	Gaps in stakeholder engagement and general management structures hinder IWRM. Stakeholders may not be engaged due to barriers such as limited financial capabilities.
Whiten, 2019	IWRM did not work in Dawson Creek, BC because of a lack of involvement from many stakeholders, particularly Indigenous nations.

Table 3: Perceived Strengths of IWRM

Author	Strength
Moriarity et al. 2004	One strength of the IWRM paradigm is that it makes conceptual space for real and significant improvements in water management at all levels – from the household to the international basin – by individuals and institutions applying its principles in the context of their own abilities and opportunities.
Muller, 2006	'IWRM provides a framework within which to consider tradeoffs between different development objectives and, where possible, to identify win-win water investments. By aligning and integrating interests and activities that are traditionally seen as unrelated or that, despite obvious interrelationships, are simply not coordinated, IWRM can foster more efficient and sustainable use of water resources…' (p.1)
Smith and Cartin, 2011	The IUCN's Water and Nature Initiative (WANI), aimed to mainstream an ecosystem approach into catchment planning and management. Evidence showed that IWRM processes (stakeholder engagement; joint planning) facilitated positive outcomes at different scales across Global South pilot projects.
Hileman et al. (2016)	'A general strength of IWRM is that it emphasizes the importance of the human dimension – water-users, stakeholder groups, and institutions – of water development. IWRM is a participatory, inclusive, and multi-stakeholder process, and addresses conflicts as they arise between parties with diverging goals for water resources management.' (p.6)

Ait Kadi, 2014	'In essence IWRM is a means for solving problems and not a formula as it has been sometimes promoted. It deserves constant reinforcement through technical and political requirements.' (p.14)
Hernández, 2012	Micro-basin Management Committee was created with support from the Foundation of Municipalities of El Salvador; The Committee with stakeholders adapted IWRM framework and participatory action to overcome indifferences and by 2008 water sharing problems were solved in the community.
Abu-Elseoud et al., 2007	The village in Damya relocated after the Arab-Israel war had shortages of irrigation water. A local CBO engaged with villagers in water data analysis training and generated new ideas about how to save and distribute water in the village. Top-down inertia was overcome through community participation.
Goyal et al., 2020	Within local waterways in the Bundelkhand region, IWRM has been successful when stakeholders and the general public participated from the beginning of implementation. Their inclusion meant that basin issues were identified prior to developing action strategies & that actions/solutions were more easily accepted by smaller communities.
Shammout & Shatanawi, 2021	IWRM was implemented in the Zarqa River Basin (ZRB) to solve increasing water issues resulting from basin mismanagement. IWRM can be used to solve the ZRB's main concern of poor water management and address other issues which stem from this overall cause of mismanagement.
Vieira et al., 2020	IWRM could be used to solve mismanagement concerns by allowing individuals in charge to look at long term, interconnected solutions. This is occurring in Iran and differs from their current processes of short-term, disconnected solutions.

Watson et al., 2019	IWRM must be flexible and developed based on the context it will be operating in. When this is allowed it can be very successful as seen by comparing its use in Ontario to Oregon.
The Yakima Basin Integrated Plan (2019)	The Yakima River Basin in Washington, U.S.A. covers roughly 10,000 km2. Over 30 years of conflict and cooperation, an integrated management plan was enacted in 2013. The plan is the result of collaboration among a diverse array of state, civil society and private sector stakeholders in the Basin.

IWRM has been implemented in basins around the world with varying degrees of success. In the Lerma-Chapala Basin in Mexico IWRM was considered to be successfully implemented there, but it actually had negative consequences (Godinez-Madrigal et al, 2019). The implementation of IWRM resulted in smaller, local farmers being considered ineffective (Godinez-Madrigal et al., 2019) which shows an actual gap in IWRM because it is meant to include all stakeholders in decision-making, but in this case smaller stakeholders were left out and IWRM did not include the poorest and most marginalized in decision-making. However, contrasting this example is a case study in India where in the Bundelkhand region, IWRM was implemented and stakeholders were included in the development of the basin governance from the very beginning (Goyal et al., 2020). This ensures that stakeholders are not left out of the decision-making process, and that implementation of IWRM has a greater likelihood of success because everyone is allowed to participate and have a say in establishing the structure which becomes the basis for the entire governance structure.

In the Senegal River Basin, a third party organization was established to help ensure IWRM was successfully implemented, but also to allow for increased communication and dialogue amongst stakeholders (Faye, 2019). This basin is a transboundary basin, shared between multiple countries, but their success with using a newly-created institution to improve implementation and stakeholder engagement can be used as a model for how other basins could operate. Whether a transboundary basin or not, other basins could begin establishing organizations or institutions which could improve dialogue. This raises questions whether another organization already in

place, such as a conservation authority, could be used within this process in a local or regional basin.

Within the GRB, Watson et al. (2019) and Veal & Cooke (2017) both argue for Integrated Water Resources Management (IWRM), but they have competing starting points. Watson et al. (2019) believe a version of IWRM is already implemented in the basin, while Veal & Cooke (2017) believe that IWRM is currently absent from the GRB although current management practices share aspects of IWRM. Other researchers have different opinions about the governance of the basin. Plummer et al. (2005) emphasize the history of governance within the GRB and how it has changed over the years, while also highlighting the need for a new form of governance for the basin. Complete IWRM would be the best governance structure for the basin. Veale & Cooke (2017) argued for IWRM after analyzing current issues with the GRB. This is similar to an argument made by Plummer et al. who believe that it is watershed agencies, whether that is the GRCA, other Conservation Authorities or another type of governing agency, that are the best bodies and scales for implementing IWRM (Veale and Cooke, 2017). This also aligns with Butterworth et al. (2010; see Table 1 above), who suggests that IWRM does not need to be a hard and firm structure, but a fairly well fleshed out framework guiding action. Conservation Authorities are used as an example and model to showcase how IWRM is present in many different principles and opportunities (Plummer et al., 2005).

Cervoni et al. (2008) found that when comparing Ontario and Nova Scotia, both provinces face similar challenges with water governance and implementing IWRM. One of these challenges is that neither province has developed a framework on how to implement or include IWRM in their water governance structures (Cervoni et al., 2008). Better information on how to implement IWRM and how it will alter basins must be known as it is a common challenge. Mukhtarov & Gerlak (2014) argue that IWRM requires multiple forms of knowledge apart from purely using Western knowledge, for it to be included in policies and for stakeholders to become involved in governance solutions. They argue that this will help legitimize IWRM (Mukhtarov & Gerlak, 2014). This highlights the need to include Indigenous Knowledge (IK) within IWRM because IK is a form of knowledge often ignored in watershed governance. Scott et al. (2017), via a case study of the North-Bay Mattawa Conservation Authority (NBMCA), illustrate some of the difficulties faced in attempts to implement IWRM. Over the years the NBMCA has utilized

multiple strategies and exercises which have helped it implement different principles of IWRM (Scott et al., 2017). For example, public committees were established to help increase engagement by all interested parties, and collaborating with universities helped increase capacity building and the use of new technology with the basin (Scott et al., 2017). Yet, complete implementation requires multiple organizations working together, with a core component of those groups being the Indigenous nations within the basin (Scott et al., 2017).

2.5 Indigenous Knowledge

Indigenous Knowledge (IK) is defined by Berkes (2008) as "a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment" (as cited in Wilson et al., 2015). It is often shared orally and can be beneficial in understanding the physical history of an area (Wilson et al., 2015). Both within a Canadian context, and internationally, it is widely recognized that IK is an important element for implementing IWRM (Whiten, 2019; Ndlovu et al., 2022; Patrick & Bharadwaj, 2016).

Through its support for stakeholder participation, IWRM has run into the thorny issue of what to do about previously marginalized groups and peoples. Existing resource governance arrangements throughout the world bear the problematic imprint of colonial interests supplanting Indigenous interests. Indigenous peoples have lived in their traditional territories from time immemorial, and Indigneous Knowledge (IK) is therefore an important component of basin management. However, most basin management and governance structures do not include IK even when other stakeholders are involved. Yet, Carr (2015) argues, total stakeholder engagement allows for more widely accepted and therefore more sustainable decisions. IK must be included; it is a more holistic form of knowledge than Western knowledge which can offer different perceptions of problems and solutions, and can be beneficial for environmental research and studies. Wilson et al. (2015) researched IK within the Yukon River Basin and found that IK can enhance Western knowledge, show potential areas of concern to be studied further, and highlight problems that western knowledge may not have recognized as an issue. IK can work

with and enhance Western knowledge and be beneficial for future governance and management of basins.

There are however several barriers for including IK within water governance and resource management, and these vary depending on the location of the basin. Within the United States, one challenge is that not all Indigenous nations are recognized by the federal government, and therefore non-federally recognized nations have different levels of involvement within governance (Emanuel & Wilkins, 2020). Barriers to participation were categorized into four different groups: "adherence to minimum standards, power asymmetries, procedural narrowing, and "color-blind" planning" (Emanuel & Wilkins, 2020, p. 3). Von der Porten & de Loë (2013) offer important research into barriers that exist within Canada as their study focused on how Indigenous people are perceived in Canada by both themselves and by non-Indigenous people. Results showed that often non-Indigenous people view Indigenous people as only stakeholders within governance issues, while Indigenous peoples see themselves as self-determining nations (von der Porten & de Loë, 2013). These differences create barriers to including Indigenous nations in Canadian water governance structures. They also highlight the difference between governance (i.e. Indigenous nations as a 'fourth tier of government') and management (i.e. Indigenous people in a particular watershed as stakeholders in relation to that watershed alone).

Institutions can play an important role in helping to dissolve barriers to inclusion. Maclean (2015) highlights how research can bridge a gap between Western knowledge and IK through helping translate information about IK and culture into terms more easily understood by western researchers. This supports Stefanelli et al. (2017) who argue that academic institutions such as universities play a key role in combining both IK and Western knowledge within academic literature and water governance. Mi'kmaq elder Albert Marshall coined the idea of 'Two-Eyed Seeing' to articulate the belief that Indigenous and Western forms of knowledge must be combined to ensure sustainable resource use. Different circumstances or situations will require individuals to rely on IK or Western Knowledge more for the context, but both ways of knowing must be present (Kavanagh, n.d.). These articles highlight the need for the proposed research to be cognizant of the role it can play in the inclusion of IK in water governance, water management and particularly IWRM.

Chapter 3: Methodology

3.1 Methodological Overview

At the start of the study a literature review was conducted to provide the researcher with an understanding of the GRB, the GRCA, different models of watershed governance and management, and SDGs. This was necessary for developing appropriate interview questions for pursuing primary data collection on the topic. This research also included reviewing provincial legislation including the Conservation Authorities Act R.S.O. 1990, c. C.27 and the Clean Water Act S.O. 2006, c. 22 to help understand water governance in the GRB and throughout Ontario. These statutes highlight the role the provincial government plays in water governance in Ontario, provide additional details on how water resources are protected, governed and managed, and emphasize the role of Conservation Authorities. They also set the basis for understanding why certain perspectives on watershed governance in the GRB may exist and how they may have come to be.

After the literature review was complete, a set of interview questions was developed and then approved by the University of Waterloo's Research and Ethics Board before interviews were conducted to collect primary data.

3.2 Case Study Selection

The GRB is an optimal basin to study as the timeframe and significant history of governance and management in the basin, particularly through the Grand River Conservation Authority (GRCA), allows a deep dive into the governance changes that have occurred over the years and into how they may have affected the watershed. This also allows for an understanding of how the governance structure has affected other elements including stakeholder engagement, environmental protection and use of the basin. Based on the literature review, the GRB is a complex basin with different researchers having differing opinions of the basin's governance structure, management processes and overall resource effectiveness. Through a series of interviews, the study provides stakeholder perspectives on and perceptions of the effectiveness of the application of the Conservation Authorities Act through the GRCA in basin governance and management.

The GRB was also selected due to the timeline of the research. As the researcher was residing close to the GRB when completing the thesis, it was most effective to study a nearby basin where there was both a connection with and an opportunity to potentially visit tributaries or sections. However the research and master's program also was predominantly conducted online due to the Covid-19 pandemic which eliminated international basins from being studied as the research team was unable to travel during most of the research timeline. These factors all combined to make the GRB the selected basin of study.

3.3 Interview Design

Based on the literature review of resource management, water governance in Canada, and an understanding of the GRB and the GRCA, a set of interview questions were developed (see Appendix A) and the process of interviewing participants began. The interview consisted of 13 questions focusing on the governance and management of the GRB, the role of the GRCA, and how the respondents were either engaged or not engaged in basin governance and management. Five supplementary questions were used if time permitted within the interview to provide additional assessments on general watershed governance and management. These supplementary questions were not specific to the GRB or GRCA, but allowed the participants to discuss water governance from a broader perspective.

The interviews were video interviews conducted over Zoom or Microsoft Teams depending on the respondent to ensure that the respondent and interviewer remained safe during the pandemic, and were able to virtually meet while the University of Waterloo halted in-person research. This also allowed a greater diversity of respondents from a greater geographical area to be contacted and interviewed. There were no concerns about meeting in person or not being able to meet due to distance and proximity. All interviews were recorded with their consent to allow for flawless transcription post interview, and copies of the recordings were saved on an external hard drive.

3.4 Study Participants

Originally the study intended to only interview stakeholders in the GRB, but this was expanded to include non-basin stakeholders who were still able to provide information on watershed governance, conservation authorities or specifically on the GRB itself. All respondents were divided into five categories: Conservation Authority (primarily the GRCA), municipal

government, provincial government, Indigenous nation or other. The classification for these categories was derived from the list of partners on the GRCA's website.

An initial group of potential participants were contacted to participate in the research. Once interviews commenced, snowball sampling was used to find other participants. Respondents were asked if they could recommend an individual or organization to be contacted to participate, and many respondents provided at least one additional name. A total of 129 individuals or organizations were contacted of which 24 agreed to participate. The other 105 respondents either did not wish to participate, did not feel as if they could contribute to the topic or never responded. By the 24th interview, respondents were also either not providing any new information to the researcher or were repeating the same names and organizations to be contacted for participation. The decision was made at this point to stop recruiting for additional interviewees.

It is important to note that due to the limited timeline of conducting interviews, and the impact of the pandemic, a community engagement plan was unable to be developed in collaboration with either Six Nations of the Grand River or the Mississaugas of the Credit First Nation. No Indigenous representatives or individuals were interviewed for this research, and so an assessment of several publicly available documents on their websites were analyzed to determine if those documents could provide answers to the research questions (see Chapter 4). Several Indigenous professors and Indigenous-led organizations were contacted regarding potential participation, but they either did not respond or were unable to participate.

3.5 Data Collection

All data was collected through the interview process and literature review. The interview process also was recorded with the respondents consent to ensure that when the interviews were being transcribed, there was limited concern about inaccuracy in the transcription process. These interviews were transcribed manually by the researcher. A copy of the video and audio recordings is saved on an external hard drive which will be kept for a minimum of one year post-completion.

3.6 Data Analysis

The platform, Nvivo, was used to analyze the interviews and data collected. It allowed the researcher to analyze respondents' answers to look for quantitative results such as numerical measurements to certain questions, similar themes or responses both per individual question or overall interview themes and similarities, and qualitative responses to questions. It also allowed the researcher to identify important quotes and citations which could be shared in future reports.

A first analysis of the interviews occurred upon completion of the transcripts. This meant that the researcher read through the interviews, and they then identified potential themes and results. Once those initial themes were identified, the researcher went back and coded each interview per the identified theme and based on each question that was asked. This allowed the researcher to identify the most important themes and responses throughout the deluge of information. It also ensured that unexpected results could be analyzed and highlighted. Once that list of total themes was complete, the researcher narrowed it down based on the overall research hypothesis, objectives and based on the number of times a specific code and theme were identified. Due to the timeline and the variety of topics mentioned, the research team was unable to discuss all of the various themes and topics mentioned regardless of their perceived importance to the respondents, and focused on themes and topics important to the research.

From there and upon completion of analysis, results were derived and discussion topics were generated that coincided with the overall hypothesis and objectives of the research. The results and discussion are highlighted in the following chapters.

3.7 Ethical Considerations

All interviews were anonymous and confidential. This prevented potential ethical concerns from arising such as potential job loss or concerns about not being able to honestly share the respondents’ thoughts and opinions with the researcher. All respondents had to agree to have the interview recorded, to participate, and to have potential quotes shared anonymously in the final report. The respondents agreed to these elements after reading and signing a consent letter emailed to them prior to the interview.

This research received ethics board approval from the University of Waterloo's Research and Ethics Board. As previously mentioned, due to the limited timeline ethical considerations did not allow for the collaboration and participation from Six Nations of the Grand River and the Mississaugas of the Credit. A community engagement plan would have been needed to allow for participation from the two nations which would highlight protocols to be followed when conducting interviews, ownership of the data, where it would be stored and for how long, and what this research would provide the two nations with. A plan was also not able to be developed based on the time it takes to establish meaningful and reciprocal relationships with the two nations. In addition, the pandemic had a significant impact.

3.8 Limitations

The main limitation of the research and methodology was the lack of inclusion of Indigenous participants. While efforts were made to connect with Indigenous professors or Indigenous-led organizations outside of the two nations residing in the basin, they were unable to assist which meant that key demographic data and responses were not included in this conversation and research outcomes. The results of the thesis must be considered bearing in mind this limitation.

Chapter 4: A Case Study of the Grand River Basin

The Grand River Basin (GRB) is a basin in southern Ontario that has a striking combination of watershed governance and water management structures, and many different stakeholders ranging from different levels of government to the GRCA to different public stakeholders including farmers and civil society organizations (CSOs). In the literature review, different understandings of and approaches to resource governance and management were discussed. Specific water governance concerns surrounding drinking water, transboundary waters, groundwater and Indigenous peoples, were also assessed in Canada through the lens of federalism.

The central hypothesis of this research is that the Grand River Basin (GRB) and its governance structure, primarily the Grand River Conservation Authority (GRCA), is an example of effective watershed governance.

The hypothesis is tested by answering the following research questions:

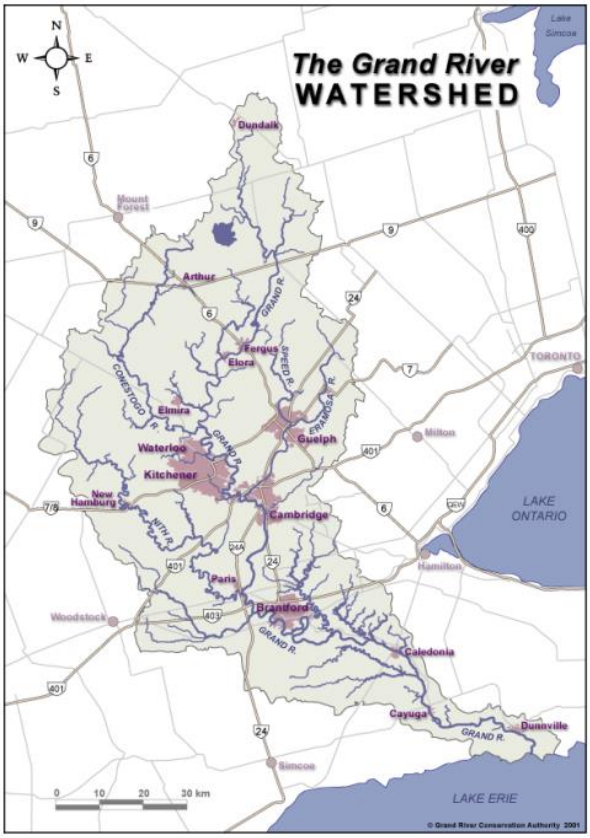
1. What type of watershed governance is taking place in the GRB, and what are its pros, cons, and opportunities for improvement?
2. What is effective watershed governance?
3. How does the watershed governance of the GRB compare to the definition of effective watershed governance determined by this research in Chapter 2 and is the GRB considered effective?

4.1 Site Description

The Grand River Basin (GRB) is a watershed in southern Ontario covering 6800 square kilometers with four major tributaries: the Nith, Speed, Conestogo and Eramosa Rivers, which run through 39 municipalities and two Indigenous reservations covering over 1 million people (GRCA, 2014; GRCA, 2022a; Veale & Cooke, 2017). The GRB has various ecosystems including rich agricultural lands, 70% of which are farmed, a combination of wetlands and forests covering 20% of the watershed and urban areas which take up an additional 7% (GRCA, 2014). The remaining 3% is not specified. Found in the unique ecosystems are six different

species of either endangered or threatened mussels, an increasing number of invasive aquatic species, and 54 animals considered “provincially rare” (GRCA, 2014).

Figure 2: Map of the Grand River Basin. (Etienne, 2014)



The character of the basin and its ecosystems have changed over time as population and industry have grown throughout the area. Agriculture, development, industries, and aggregate mining have altered and affected the watershed in many different ways from the resources available to the quality and quantity of the water. Water quality, in particular, was negatively affected by development when settlers first used the waterways of the basin as a method for disposing of their waste (Plummer et al., 2005).

Currently water quality appears to be improving, but issues are still present. Phosphorus and nitrate concentrations in the water have been improving since the 1970s, but are still causing eutrophication (GRCA, 2014; Veale and Cooke, 2017). Surface water quality is decreasing leading to an ongoing debate as to whether further increasing development, as is mandated by the

Places to Grow Act, 2005, will negatively affect hydrological processes or lead to additional degradation (Veale and Cooke, 2017; Plummer et al., 2005).

A Water Quality Index for the basin was completed recently in 2021 which ranks different areas of the basin out of a score of 0-100. The Upper Grand River of the basin, amongst several other areas, is classified as "good" with a score between 80-95 (Anderson, 2021). Yet this area is not immune to potential issues with increasing development resulting in more effluent from wastewater treatment plants entering the river and more runoff from urban areas (Anderson, 2021). Conestogo River has a score of "marginal" (45-65) due to increased contamination from agriculture in the area (Anderson, 2021). The central Grand River also scores "marginal" because of the agricultural contamination and effluent from wastewater in several key cities such as Waterloo and Guelph (Anderson, 2021). At the end of the Grand River right before Lake Erie in the town of Dunnville, water quality is considered "poor" (less than 45) due to all the contamination entering the water upstream (Anderson, 2021). As more growth is expected throughout the basin and is being pushed by the province, a concern identified by some participants, this could lead to negative consequences on water resources.

Other issues presently in the basin include aggregate mining with 246 pits and quarries needing water for wash ponds (GRCA, 2020a). Climate change is increasing average temperatures while decreasing winter snowfall and snowpack, both of which affect water quantity (GRCA, 2020a). Droughts brought on by climate change can cause aquifers to become disconnected from rivers within two years of excessively dry conditions (GRCA, 2020a). As groundwater affects river temperature, quantity, and quality (Water Management Plan Team, 2014), the ecosystem of the basin can be altered. Groundwater is also affected by urbanization and development which result in both quality and quantity issues. Runoff from developed surfaces affects water quantity because urbanization increases runoff resulting in greater likelihood of flooding (Water Management Plan Team, 2014).

4.2 The Grand River Conservation Authority

Water governance and management in the GRB has emerged piecemeal over time and is fragmented. The federal government has responsibility for water as it relates to Indigenous peoples. The provincial government is responsible for water as it relates to development, changes

to flow and water resource, surface water, groundwater and water quality concerns (Plummer et al., 2005). Municipal governments are responsible within their borders for water management that is affected by land use planning which also affects groundwater supplies (Plummer et al., 2005). They also have been delegated responsibility for drinking water supply and wastewater treatment (Water Management Plan Team, 2014), except in relation to Indigenous peoples. This affects how a river basin or watershed is managed because political jurisdictions almost never align with watershed boundaries (Plummer et al., 2005). The challenge becomes how to bring together all interested parties to effectively govern a watershed.

In the early 1900s, as water issues were increasingly becoming a concern throughout Ontario, the provincial government stepped in. In 1946, the Conservation Authorities Act (the Act) was passed. The Act allowed for watershed-scale governance to occur through the establishment of watershed agencies, called Conservation Authorities (Plummer et al, 2005). The purpose of the Act "is to provide for the organization and delivery of programs and services that further the conservation, restoration, development and management of natural resources in watersheds in Ontario" (Conservation Authorities Act, 1990). This is done by establishing "advisory boards" which provide the programs and resources necessary for meeting the Act's purpose and objectives (Conservation Authorities Act, 1990). Recently most watersheds covered under the Act also fall under drinking source water protection areas and therefore have additional regulations and restrictions (Clean Water Act, 2006). In many areas, this gives Conservation Authorities the power to act as the drinking water source protection authority and provide additional protection to watersheds (Clean Water Act, 2006).

The Grand River Conservation Authority (GRCA) has greatly impacted water governance in Canada as it is "the oldest water management agency in Canada and one of the oldest in the world" (GRCA, 2022b). Due to the GRCA's extensive history and its ability to act as a governing body through the GRB, the GRCA has managed to align well within the different levels of government. It works well within the confines set forth by the different laws and procedures governing water access and use in the GRB. Before the Act was enacted, the Grand River Conservation Commission (GRCC) was created due to a severe flood in 1929 which forced local municipalities to begin working together to govern the waterway (Plummer et al., 2005). At their first meeting in 1934, the GRCC consisted of eight municipalities who wanted to

focus on water quantity issues, and this objective allowed the GRCC to construct dams and reservoirs to control water flow and quantity (Plummer et al., 2005; Veale and Cooke, 2017). The Shand Dam, built in 1939, is an example of how water governance in the basin controlled the flow of water and addressed quantity concerns (Plummer et al., 2005). This also caused a further three dams to be built from 1942 to 1958 (Veale and Cooke, 2017). Initially, water quantity issues were the main concern for the GRCC, but other issues quickly began arising including erosion, degradation and pollution (Plummer et al., 2005).

The Act, once established, created a new agency called the Grand Valley Conservation Authority (GVCA) in 1948. The GRCC and GVCA operated as separate entities but amalgamated in 1966 to form the GRCA (Plummer et al, 2005; Veale and Cooke, 2017). The amalgamation led to increased work in the basin including studies on hydraulics, flood protection, and basin management (Plummer et al., 2005). As the GRCA developed and included the community in decision-making more and more, the provincial government took steps back to allow the agency to govern itself (Plummer et al., 2005). Over the years, the basin has received different awards and different management approaches have been practiced and undertaken. A Grand Strategy was developed which focused on watershed management which included the community, revolved around cooperation, reached a consensus, and all stakeholders were committed to it (Plummer et al., 2005). The Grand Strategy is one example of a management process that was developed to help improve governance in the basin.

The main interested parties present today in the GRB are: Conservation Authorities, particularly the GRCA; Municipalities, as 32 municipalities such as Waterloo and Halton Hills; Indigenous Nations which comprise the Six Nations of the Grand River and the Mississaugas of the Credit First Nation; the provincial government which includes Conservation Ontario and the different departments in the Ontario government such as the Ministry of the Environment, Conservation and Parks, and; a general other group which comprises all others remaining in the basin including members of the public, Civil Society Organizations (CSOs), industry and farmers to name a few.

Based on historical events which helped establish the GRCA and current water-related issues, municipalities are concerned with water quantity and water quality concerns in the GRB. These can include a wide variety of issues such as flooding, climate change, development or

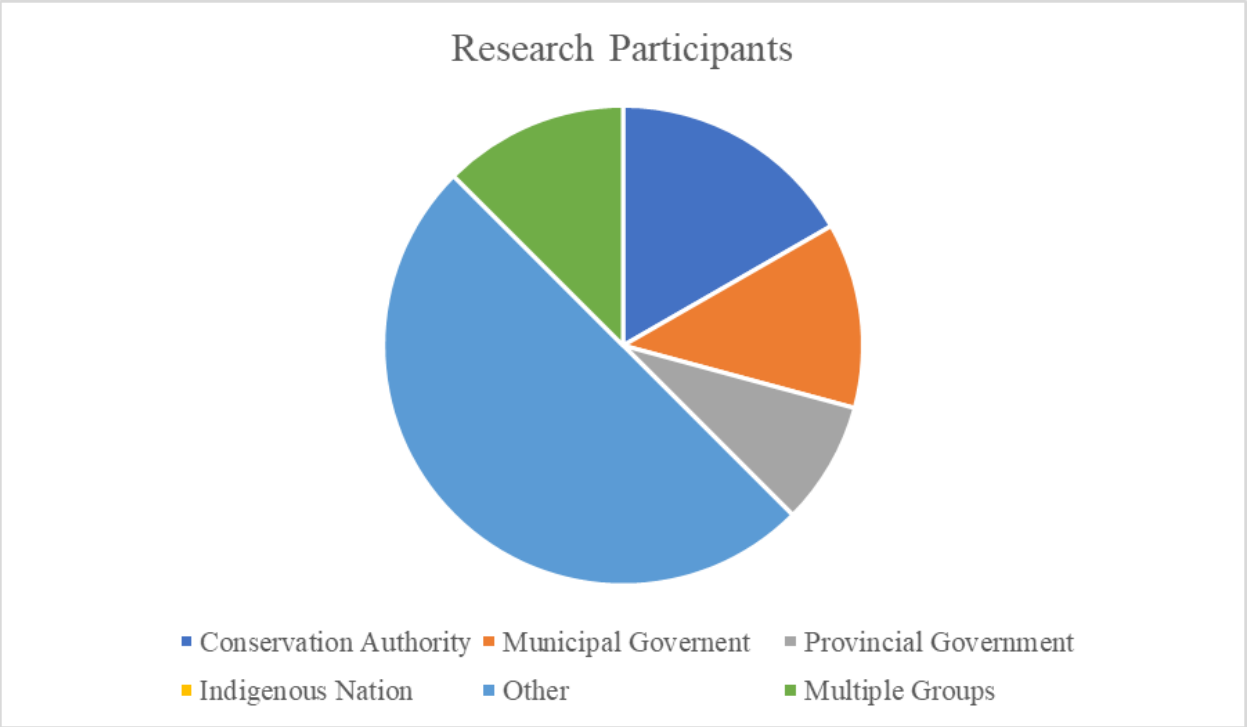
agricultural contamination. In 2014, there were also expressed concerns over how they would ensure water quantity for future generations (Etienne, 2014). The GRCA has the primary responsibility of flood protection, as historically mandated, and establishing new projects and programs based on the desire of the municipalities. The provincial government established and provided updates to the Act while also having responsibility for different areas of the GRB such as issuing and monitoring permits to take water. Indigenous nations have a variety of concerns (see section 4.8 Indigenous Documents) depending on the nation including the access to water security, land rights, and title claims to the water. Finally, the “Other” category of stakeholders has a wide section of interests depending on the individual, but these can also be categorized under water quality or quantity concerns.

4.3 Water Related Issues in the GRB

4.3.1 Profile of Interviewees

16.7% of interview participants were from a conservation authority, 12.5% represented municipalities, 12.5% represented both the GRCA and a municipality, 8.3% represented the provincial government and 50% represented other groups. One participant identified themselves as being from a conservation authority, but were not from the GRCA. One participant who identified as "Other" said that it was not a broad enough term, and additional stakeholders groups such as farmers or Civil Society Organizations (CSOs) should be used instead. As well, one participant identifying as "Other" also fitted under the category of "provincial government,” but as that is not what they identified in the interview, they were not categorized under both sections. A final participant did not identify a particular group, but they would have fit within “Other.”

Figure 3: Research Participants



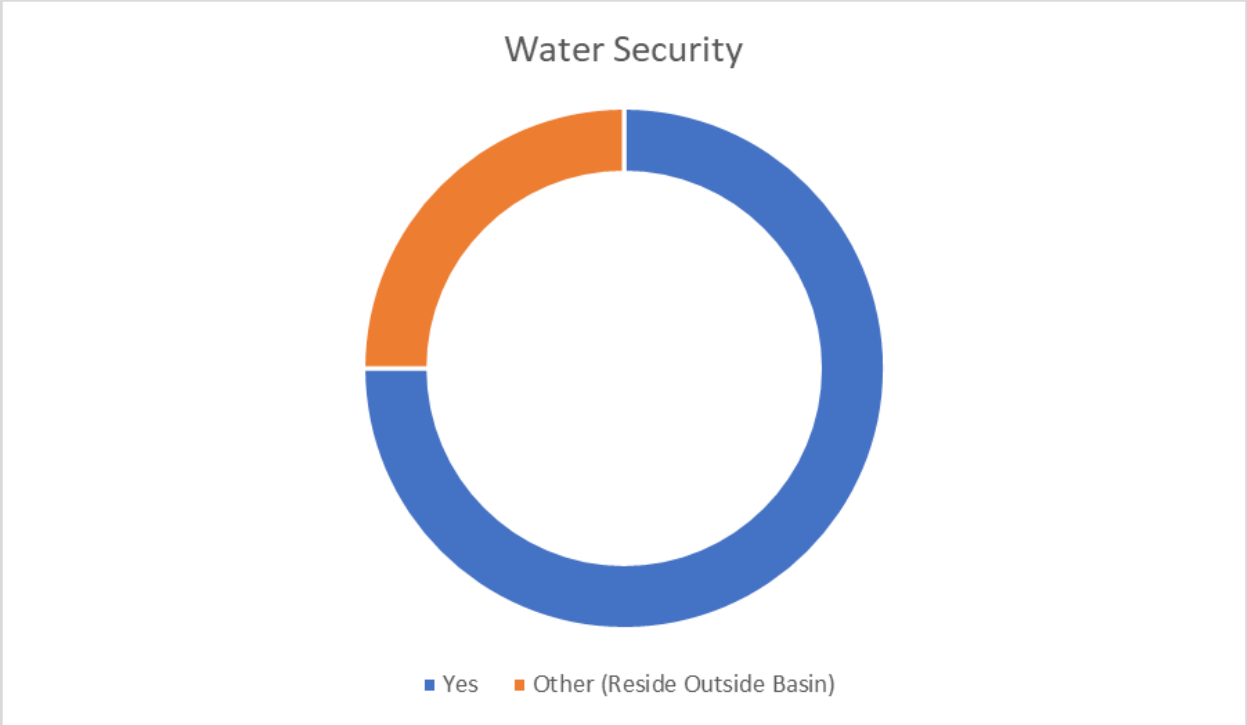
4.3.2 Perceptions of Water Security

According to Van Hofwegen (2008), water security 'is the perception of having the possibility of being provided under varying circumstances with the needed quantity and quality of water and of being protected against the adverse and destructive effects water may bring.' The emphasis here is on 'perception', as opposed to a verifiable condition, and while water security affects a broad manner of societal elements, within the interviews it was used to primarily assess access to safe and secure drinking water.

The respondents were asked if they had water security in the basin including access to safe and secure drinking water. The literature review identified that water security may be an issue in the basin, particularly for Six Nations where many residents do not have access to safe and secure drinking water (Out in the Open, 2018; Kerins, 2020). This question allowed the researcher to identify if additional parts of the basin do not have water security. The results highlight gaps in

governance between different jurisdictions and depending on the results, could show that the basin is not effectively governed and that the form of watershed governance occurring is not working. From the interviews, 75% of respondents said that they did have water security and the other 25% resided outside of the basin and could not answer the question. While respondents residing in the basin did have water security, they identified areas of water insecurity in the basin including Six Nations' lack of access to water, ongoing and future development concerns, water supply concerns and groundwater concerns.

Figure 4: Water Security in the Basin



4.3.3 Fragmented Government Arrangements

Several interviewees identified fragmentation in governance arrangements as an important issue in the basin. Indigenous access to water is a federal responsibility and the results show that the federal government is not fulfilling their duties and responsibilities within the basin. As well, the governance and management of the basin is fragmented because one goal of Indigenous access to water is governed and managed federally while most other goals are governed and managed elsewhere. The GRCA governs many areas of the basin, but it does not override the de jure responsibilities of the federal government. It also makes it challenging to understand how

effective basin governance is due to the de jure fragmentation of roles and responsibilities. This leads to additional questions regarding if an issue is not the responsibility of one level of government, are they then allowed to ignore it both legally and morally. While these issues cannot be assessed in this research, anecdotal evidence drawn from interviewees suggests that de jure fragmentation is perceived to be an important barrier to effective watershed governance in the Grand River basin.

4.3.4 Stakeholder Perceptions on Current and Future Issues Affecting the Basin

The main issues currently affecting the basin were categorized into four themes: management, water quality, water quantity and other issues. Two participants cited management issues as being a current issue including overall basin management and management studies. Eleven participants cited water quality as an issue, and other participants cited specific water quality issues such as salt contamination and agricultural contamination. Five participants cited water quantity as an issue, and others cited specific water quantity issues such as flooding and droughts to name a few. Finally, five water-related issues were categorized as other: Indigenous access to water, funding, and the Conservation Authorities Act. Several issues categorized under the themes of either water quantity or water quality fit within either category and those were concerns around groundwater, Lake Erie and aggregate mining. The full list of issues identified can be found in the Appendix B.

Future water issues identified by participants also fit into the same categories as current issues: management, water quality, water quantity and other. The top three water quality issues that were identified were groundwater contamination, general water quality, and agricultural contamination. The top three water quantity issues identified were water quantity as it related to future development in the basin, flooding, and climate change concerns. The other issues that were identified were Indigenous access to water, the fragmentation of governance in the basin, and the Conservation Authorities Act. Again sub issues of groundwater concerns, drinking water concerns and aggregate mining fit into both water quality and quantity issues. The full list of issues identified can be found in the Appendix B.

The current and future issues identified allow the researcher to assess if governance is effective in the basin. A component of governance is the overall goals and objectives of an organization. As the GRCA is the main governing body of the GRB because they represent almost all

interested parties, their goals and objectives must align with the current and future water issues of the basin. Asking all participants to state the issues that are currently affecting them or they are currently working on provides a broader overview than provincial legislation or organizational mandates and goals.

4.4 Perceptions on Stakeholder Engagement in the GRB

Participants were asked about their current engagement in decision-making in the basin and what they would like to see for future engagement. Many had multiple responses for both questions, and under the current engagement question, several participants fit two categories. This question was broader than the very first question asking which group an individual fit into because it allowed the respondents to further break down their answers and compare their current activities with ideal ones. It also allowed for a comparison to be made between members of different groups, what is currently happening and what they would like to see for the future. Seven participants were from the GRCA's Board of Directors, three were from CSOs and actively engaging the public in their work, three had either no engagement or resided outside the basin, two were farmers, two were from source water protection areas, one was a GRCA staff member, one worked on heritage rivers, one had previously been a staff consultant for the GRCA, one engaged with a variety of different groups throughout the basin, one was active on the previous water management plan, one represented a municipality, one was on the rural water quality committee, one was a resident and one did not offer a response.

For future engagement, the researcher expected that participants would want to be in different roles, positions of decision-making or levels of engagement within the GRB. However, most people were content with their current roles and did not want anything to change, and those who wanted change tended to fit outside the standard governance structure. Thirteen participants did not identify a desire for change or stated that they did not want anything to change, two provided no response, one thought they may increase their participation later, one wanted their current role to evolve and develop, one wanted to consult more with the GRCA and be paid for their work and knowledge, one wanted more public engagement to occur, and one wanted an active role in critical dialogue or decision-making. Five participants gave no discernable responses or could not answer the question.

Table 3: Current Levels of Engagement in the Basin

Current Levels of Engagement	Number of Participants
GRCA Board of Directors	8
CSO and Engaging the Public	3
No Engagement / Outside the Area	3
Farmer	2
Source Water Protection	2
Heritage River	1
Former Staff Consultant	1
Engaged with Different Groups	1
Rural Water Quality	1
Municipal	1
Water Management Plan	1
No Response	1
GRCA Staff	1
Resident	1
Agricultural Board	1
Academia	1

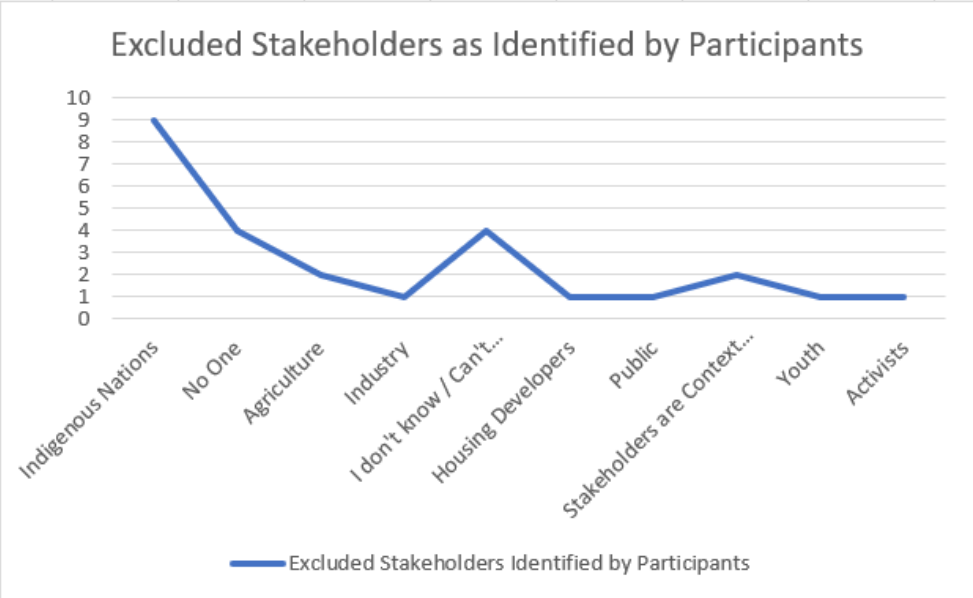
Table 4: Desired Future Levels of Engagement in the Basin

Desired Future Levels of Engagement	Number of Participants	What are the comparative current engagement levels
No Change (Includes Those Who Didn't Identify a Change)	13	GRCA Board of Directors CSOs Resident Academia

		Agricultural Board Source Water Protection Engaged with Different Groups Water Management Plan Former Staff Consultant
No Response / Can't Answer	5	GRCA Staff No Response No Engagement / Outside the Area
Evolve Within Current Role	1	Municipal
May Participate Later	1	Heritage River
Consult with the GRCA	1	Farmer / Rural Water Quality
Be Paid for Work	1	Farmer
Public Engagement	1	Source Water Protection
Critical Dialogue / Decision Making	1	CSOs and Engaging the Public

Participants were asked if there were any stakeholders or interested parties who were not included in the governance or management of the GRB but should be. Many had highlighted in their interviews how collaborative the basin and its governance is, so this question would help identify those who were missing from the conversations. As shown in Figure 5, nine participants said Indigenous peoples, two said agriculture, one said industry, one said housing developers, one said the public, one said youth, four said no one was missing, one said activists, and two said that all stakeholders and engagement are context specific and four could not identify one specific group. One participant stated that Indigenous representatives were invited to participate in the GRCA's board of directors in the 1990s, but had refused and they were now unsure if the topic had been revisited recently. Many participants did state that they were not 100% sure how engaged certain representatives are within decision making and while they provided answers, they stressed uncertainty around the accuracy of those responses.

Figure 5: Excluded Stakeholders Identified by Respondents



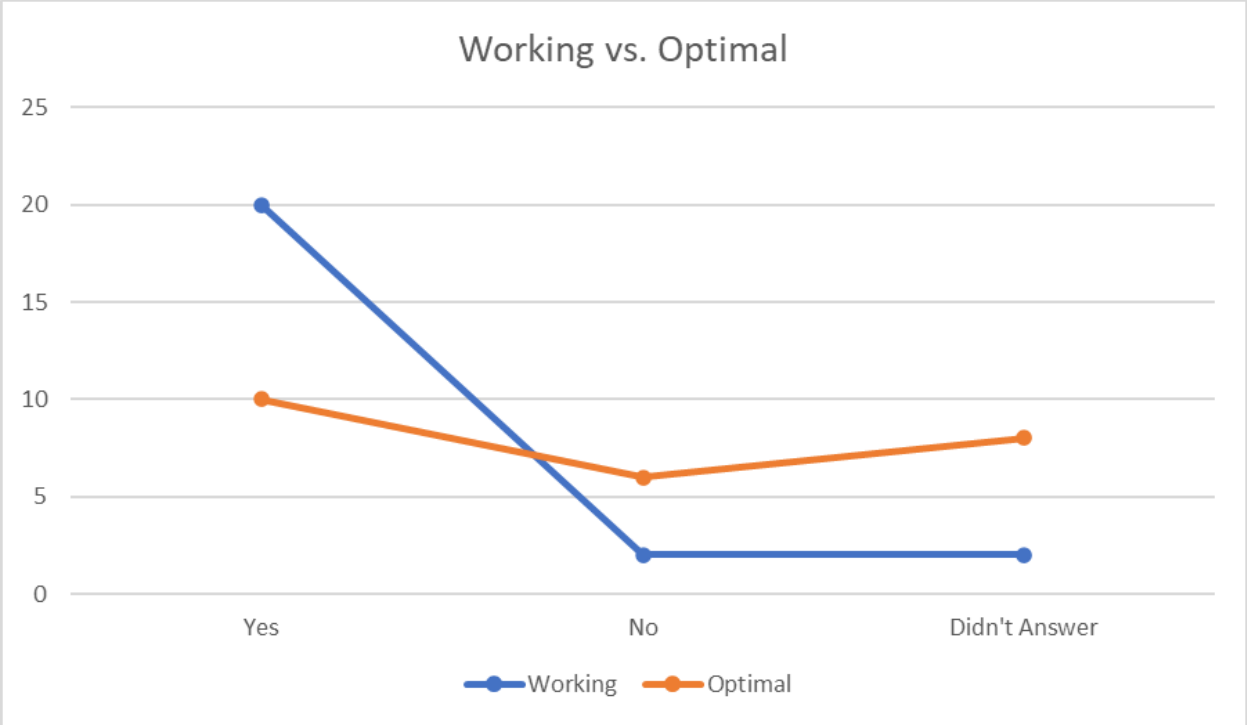
A supplementary question asked if different discourses about water governance could fit into a Canada standard or perspective. Fourteen participants said yes, one said no, one said to ask someone else, one said it depends on the context, three did not answer and four were not asked the question due to timing concerns. The reasoning behind these responses included that we need to think about our differences and that community and local knowledge is needed, which includes Indigenous knowledge. There were some comments which did mention that everyone must understand the system in order to participate, and that participation depends on the situation or context which affects who is involved. One participant did stress that this inclusion is very important but that we are not there yet and have not included everyone in decision-making conversations.

4.5 Perspectives on Water Governance and Management of the GRB

Several questions directly asked participants about the governance and management of the basin. Participants were asked if they believed that the current management structure of the basin was both working and optimal. Working means that the management structure is achieving the day-to-day functions it is set out to complete, that it is meeting its goals and that it can find solutions for problems as they arise. Optimal means that the management structure is the best option for

the basin and that there is nothing better. This question looked at the day-to-day management as opposed to the overall basin governance. 83.4% said yes the management was working, 8.3% said no and 8.3% did not answer. Regarding if the management structure was optimal, 41.7% said yes, 33.3% did not answer and 25% said no. More people easily identified if the management was working or not as opposed to whether or not it was optimal, and this second question was either predominantly not answered or participants grouped working and optimal together. Those who did not answer the question entirely, did not provide a conclusive answer as to their opinion on if the management was working or not.

Figure 6: Working vs Optimal



This question let the researcher understand the respondents' points of view directly on the GRCA which is important as the GRCA both governs and manages the basin. Several responses mentioned how the regulations that the GRCA must follow are challenging, which relates to other responses stating that the Conservation Authorities Act will be an issue in the future and that the province, through many different governments, is attacking Conservation Authorities across the province. It was also mentioned that the goals of the GRCA are outdated and no longer working, so the overall structure of the GRCA and its governance is not optimal. Those

responses both consider the GRCA from a governance perspective and do highlight how the governance may not be working because the goals are mismanaged. That being said, the participants noted that the GRCA does work well on the management side for what it is allowed to do, showcasing how functional elements such as management can work well despite other limitations (i.e. governance).

If participants believe, whether true or not, that the provincial government is harming the GRCA and other conservation authorities, it poses negative consequences. Participants may not support or trust the province and may not believe they are acting in the interest of the people which harms both their governance and management. It also can affect other provincial policies such as the Places to Grow Act which pushes development across the province and within the Greater Golden Horseshoe and GRB. Secondly, if people believe that the GRCA no longer has the correct goals or mandates in mind, it affects how people will see basin governance. People may be less likely to support the GRCA as they may believe that it will be doomed from the beginning. Having faith and trust in the governance structures in the basin is vital for effective watershed governance as it offers support and faith in the projects and actions taken. It allows stakeholders to participate of their own free will and desire because they believe that their participation will be worthwhile and valuable. This means stakeholder engagement is both higher, more effective and more collaborative.

Respondents were asked to identify the strengths and weaknesses of the management structure of the GRB. The top two strengths identified were the daily management of the basin and the collaboration that takes place. Other strengths included the structure of the GRCA, the knowledge management teams have, source water protection activities and the watershed scale approach. The strengths varied greatly, but there was more consensus on the management weaknesses. The main weaknesses identified were: the provincial government's policies and the Conservation Authorities Act, multiple jurisdictions having a stake in the basin, funding, and the lack of enforcement and authority that the GRCA has.

Respondents were asked to rank the management of the basin on a scale of 1 to 10, with 1 being nonfunctional and 10 being 'perfect'. The average score was 6.8, but not everyone provided a quantitative answer. One participant ranked management "near the top" but did not provide a number. One participant was unable to rank the management. One participant who ranked the

management with a score of three predominantly included a Lake Erie focus to their responses and interview. Finally, one participant provided two different scores - 6.5 when comparing the basin management against others in Canada, and then a score of 3 when focusing on if the overall system was working. An average score of 6.8 shows that basin management is somewhat effective, but it does not provide information about the governance. We further unpack this finding in section 4.6 below.

4.6 The GRB as Effective Water Governance

Respondents were asked to define what they believe is effective watershed governance. In line with the widely accepted IWRM principle of basin-level governance and management (see Chapter 2), the question distinguished the watershed from the overall structure of water governance in a country. The most common responses were stakeholder engagement, transparency, collaborative governance, a key or mutual understanding and common agenda, good communication, multi-level governance, accountability, and a holistic point of view. Many other points were included by individual responses, but they were not repeated by others. See Appendix C for a complete list.

Participants were then asked if the way we are currently governing our waterways is effective. Nineteen said yes, one said it depends, two did not answer and two were not asked due to timing. The reasoning behind these responses was that the system is very organized and it is the best we can do. It was also brought up that the USA is looking at conservation authorities as models for governance. Several critiques were also offered. It is important to look into the future, including future sustainability and particularly to not pull water from the Great Lakes. In relation to Conservation Authorities and the Act, it was mentioned that the governance system of the Conservation Authorities feels as if it is being slowly ebbed away through changes to the Act, the role of Conservation Authorities, their goals and objectives, and the resources that are provided to them by other levels of government. We must still look at how to improve it, do better and place more value on our systems overall.

> “So, I think as long as conservation authorities can add value, information, expertise, whatever you want to call it, that helps inform decision making for the participating

municipalities that are part of the conservation authority - that they'll always be needed and valued." – Participant A1

4.7 Indigenous Documents

The Community Plan from Six Nations was assessed to try and provide responses to the interview questions. This represented an Indigenous nation's answer to question one. The document identifies some current water-related issues to be water quantity concerns, lack of access to water, and waste management. Climate change was considered a future water issue. The plan also stated that the water on the reserve is unusable and therefore they do not have water security. In engagement in current management, Six Nations participates in 25 working groups in the GRB, but the Community Plan did not state which groups. For what they desired for future engagement, it could be seen as advocating for better water treatment with the GRCA. Future resource management in the basin would also ideally include more natural spaces, cleaner water, better stewards of the environment, a healthier environment, more intact ecosystems, better funding, drinking water, and accessible wastewater treatment. Regarding the supplementary questions, effective watershed governance should include cultural aspects of water, water for everyone and address water quality and water quantity concerns. There was also the consensus that different discourses about water governance can fit into a Canadian standard.

The second document to be assessed was the Land Rights document also from Six Nations. This again provided an Indigenous perspective to the questions. The current water issues identified related to land rights and royalties, and no future issues were stated. Six Nations is currently engaged in the basin by fighting for more engagement and land rights and future engagement would see them having those two elements. The document did not address SDGs specifically, but did mention the United Nations, the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), and how important those two elements and documents are. This highlights the recognition that global pathways for sustainability or engagement of interested parties in an area or watershed are important, but a definitive answer to the questions was not provided.

The final document assessed was the Title Claim to Water Within Traditional Lands of the Mississaugas of the Credit First Nation. This offers an Indigenous perspective and shows that the MCFN are engaged through filing a title claim to water. This was a claim to all water, beds of

water and floodplains. However, no specific answers to any of the interview questions could be found.

These documents can be used to focus on how Indigenous peoples and IK can be incorporated into water governance in the GRB. The Mississaugas of the Credit First Nation and the Six Nations of the Grand River both clearly have a desire to be included in governance opportunities and can provide unique and vital perspectives and forms of knowledge. It adds another level of jurisdictional responsibility which right now can overlap with other jurisdictions, but which must be sorted out to determine who exactly should be governing which part of the basin.

4.8 Grand River Basin Governance (Qn. 1)

The results show that the GRB's existing governance structure has resulted in many success and benefits including ensuring water security levels for most residents are met, effective day-to-day management to achieve goals and objectives, strong collaboration amongst most stakeholders, significant engagement levels in the system, and based on the fact that many participants do not want their roles within the basin to change. As well improvements have been made to water quality and quantity issues over the past few decades seen through the literature review and from interview participants. The cons of the system reside in the fact are that there are current and future water quality and water quantity issues that need to begin being addressed today in order to prevent problems from happening, that management of the basin while working may not be optimal, any changes to the Act by the provincial government will affect the basin including its governance structure, and there are too many jurisdictions who have a stake in the basin posing challenges for solving issues.

The cons highlight the areas for improvement within current governance structures. These are to improve water security for Indigenous nations in the basin which is the responsibility of the Federal government. However, as they are not acting to improve this, they should allow the GRCA to step in and assist with the problem and solutions. This could be through providing them with the financial resources to act and working to ensure that the GRCA is supported in their efforts as they would be taking on additional responsibility. Having stronger collaboration with the different levels of government including provincial and federal will ensure that all responsibilities for governing the basin are covered and that gaps in the system do not occur.

A second area of improvement would be to ensure that the Act and the goals of conservation authorities including the GRCA are appropriate for changing and developing times. This would mean focusing on climate change and acknowledging that development could actually hinder solutions to water issues in the basin. Thirdly, increased collaboration particularly with CSOs and Indigenous nations is vital to ensuring successful governance. Many participants acknowledge the collaboration that is ongoing in the basin, but participants from CSOs and the public did state that they often are not engaged as much as they would like to be or that they are not compensated for their time. CSOs can provide resources and knowledge to the GRCA that will help with sustainable water solutions. Participating always on a voluntary basis is a challenge for individuals who may have to take time off work to participate and have their voice heard, may need to hire caregivers for their family members or who may not have the resources to participate at an in-person event. Opportunities for engaging everyone through financial compensation must be considered to have every voice heard and ensure many are able to participate. As the quotes below state, participants believe that conservation authorities are very beneficial for protecting natural spaces in the province, and changes to the Act which hinder the ability of the conservation authorities to achieve their goals and mandates will do more harm for the province and should be prevented.

> "I did want to say that conservation authorities in the province of Ontario are extremely valuable organizations that should maintain – should be maintained by all levels of government. They are the ones that are really helping to lead the way for municipalities in order to protect and value our natural heritage systems, for now and into the future". – Participant A2

> "I know in the past with a couple of governments, current one & I think before the Liberal government came in, there was a move afoot in some political parties provincially to strike down conservation authorities. And that would be a huge loss for the province of Ontario. So, we are really keen to continue to promote the benefit of conservation authorities, and we're really proud of ours". – Participant A2

Based on the interviews, the governance of the basin is working and is effective, but does have areas for improvement. The GRCA as a conservation authority with governing prowess over the

basin can be improved by adjusting its overall goals and mandates and allowing for even further stakeholder engagement. However, concerns with governance do arise as other jurisdictions come into play, including provincial and federal governments, and the Conservation Authorities Act. This forces more collaboration to occur between the different levels. The federal government must step up for Indigneous water security, and the provincial government must be careful that altering the Act might affect the governance of the basin negatively. Therefore overall governance is working with improvements still to be made.

4.9 IWRM in the GRB (Qn. 1 and 3)

A further question is, is the GRB an example of IWRM? Key elements of IWRM need to be assessed to determine if it is at play here. Separate from the original definition of IWRM by the GWP SAS, the UNEP (2002) established several key pillars of IWRM that are representative when it is in use. These pillars allow for a clear determination of if IWRM is present in a basin. They include: "Integrate water and environmental management, follow a systems approach, full participation by all stakeholders, including workers and the community, attention to the social dimensions, capacity building, availability of information and the capacity to use it to anticipate developments, full-cost pricing complemented by targeted subsidies, central government support through the creation and maintenance of an enabling environment, adoption of the best existing technologies and practices, reliable and sustained financing, equitable allocation of water resources, recognition of water as an economic good, strengthening the role of women in water management" (Meran, Siehlow, et von Hirschhausen, 2021).

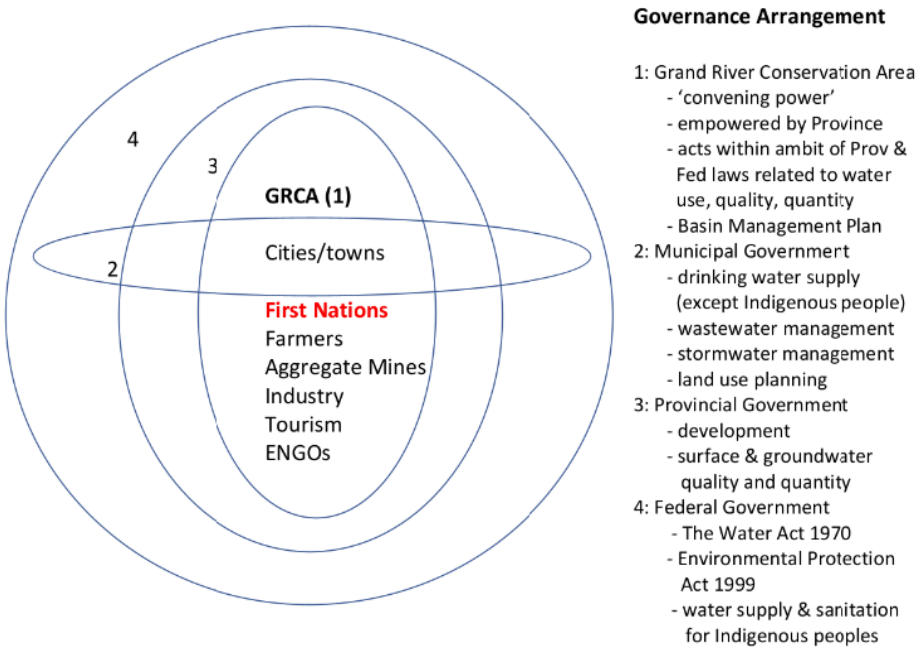
Based on the research findings, it is clear that stakeholders perceive the GRCA to have convening power in the basin, enabling it to bring together stakeholders in pursuit of their own interests but, in line with the Grand River Basin Management Plan, to work toward a common cause: access to appropriate quantities and qualities of water while maintaining resource sustainability. The GRCA acts as the focal point for the basin and allows primary, secondary and tertiary stakeholders the ability to participate and come to the table[3]. These primary stakeholders

[3] These terms of primary and key stakeholders are based on the definitions supplied in the Okavango Delta Management Plan (ODMP). Primary stakeholders are defined as those who are "directly dependent on" the basin, secondary stakeholders receive many benefits from the different resources in the basin, and tertiary stakeholders have interest in the basin but do not rely on it for their livelihoods (Department of Environmental Affairs, 2008).

are not always present in decision-making processes or at the table for every single issue and discussion, but their participation is considered context-dependent. The GRCA was established by the province of Ontario to help manage the basin, and their ability to control multiple factors – in particular balancing stakeholder interests – in the basin gives them a convening power that is often less prevalent in other basins. While the GRCA has additional powers bestowed upon it, it still operates within jurisdiction of the provincial and federal governments, adhering to laws like the Canada Water Act (R.S.C., 1985, c. C-11) and the Canadian Environmental Protection Act, 1999 (S.C. 1999, c. 33).

As shown in Figure 7, in terms of governance arrangements, the GRCA lies within a set of concentric circles of decision-making power. While empowered by the province, its formal powers are limited by the legal and administrative arrangements described above. In the diagram, we highlight 'First Nations' in red because while these groups are physically located within the basin, they do not participate due to de jure arrangements regarding water resources. Cities and towns cross cut the legal and institutional arrangements, which can act as a binding agent within the GRCA (e.g. in support of upstream-downstream water quality/quantity questions) but also as a divider (e.g. in relation to urban growth plans), depending on the issue.

Figure 7: A diagram of the stakeholders present in the GRB



The GRCA both governs and manages water resources on a watershed scale and combines managing the waterways with managing the surrounding environment. They have integrated both water and environmental management under one organization and within their activities. The pillar focusing on support from a central government is tricker to assess. In 1946, the provincial government established the Conservation Authorities Act which allowed for the GRCA to be created. However, as many participants mentioned in their interviews, recently the provincial government has altered the Act which has posed challenges for the GRCA. The changes to the Act included "improving transparency, consistency in operations and municipal/provincial oversight of conservation authorities", as well as "streamlining conservation authority roles and responsibilities in permitting and land use planning" (Environmental Registry of Ontario, 2020). These are broad summaries of the different themes surrounding all the changes made to the Act, but some of the individual changes include prevent Conservation Authorities from expropriating lands, decreasing the term length for the chairs of a Conservation Authority, allowing for more appeals surrounding canceled permits, or having a member of the agricultural sector on the Conservation Authority board of directors (Environmental Registry of Ontario, 2020).

In the interviews, the participants never stated which specific changes to the Act would negatively affect the GRCA. This is something that must be assessed in future research.

However, it is just as important that the participants are worried about the Act and its changes, without having seen or heard of them. They may not be supportive of the decisions of the provincial government which could pose challenges in helping the province meet its goals and mandates, and they may be viewing these changes as the province taking away the GRCA's freedoms and undermining their authority. It is our analysis that at one point a central government was creating an environment for IWRM to be established through the GRCA, but recently it has begun eroding and damaging said environment through the Act's changes.

Another pillar of IWRM is that a basin must follow a systems approach in their governing structure. A systems approach is a holistic way of looking at an issue by bringing together multiple stakeholders and interested parties to share information and find collaborative solutions to issues (Catalan, 2018). The research never explicitly stated that the GRCA adheres to a systems approach when governing and managing the basin, and it was never mentioned by participants in interviews nor asked by the researcher, but participants did mention stakeholder engagement and collaboration taking place within the GRB and GRCA. At the same time, the Grand River Management Plan takes a holistic view of the basin suggesting that while stakeholders may participate in pursuit of their own interests, they are nevertheless guided by what might be termed a 'systems sensibility'.

Regarding the pillars of stakeholder participation and including women in water management, both can be improved. Many stakeholders are included in participation, but as those from the general public or CSOs noted in interviews, they would like to be included more and have valued participation. It also does not appear as if there is pressure to include more women in management and decision-making, but this information may simply not be publicly available. Focusing on the social dimensions of water resources and equitable allocation should be improved as well. This can be seen when considering water security in the basin where Indigenous nations do not have water security while the rest of the basin does. One participant in the interviews also mentioned that their farmlands can be flooded with no warning or compensation by the GRCA in order to protect a municipality or large urban area from flooding. From a logical perspective, this is understandable as flooding farmlands would prevent heavy damage elsewhere or loss of human life, but it ignores the financial and economic burden it can put on farmers as their livelihood can easily be destroyed. It also does not account for fertilizers

that can be safely used on agricultural lands but which then enter waterways creating water quality concerns.

The GRCA is transparent in several aspects of their work. They publicly post reports and make their Board of Directors meetings available to the public. This transparency allows their information to be readily available which can help with future developments in the basin. Several participants did state that the governance and management in the GRB could be more transparent, but currently several elements of transparency exist. The transparency of information can assist with ensuring development in the basin is safe and does not occur in water scarce areas, but with the Places to Grow Act forcing development throughout the basin it may not be enough. Municipalities may have to develop outside of their boundaries to adhere to provincial requirements which can create water stress in already stressed areas.

The participants mentioned that the GRCA receives funding from many different sources including raising funds themselves, municipalities and the provincial government. However participants did stress that more is always needed and different levels of government should be providing increased funding. As of right now, the funding for the GRCA is sustained and reliable, but should be improved based on their responsibilities. Based on reviewing the GRCA's 2021 budget, it appears as if they do adhere to full-cost pricing, but this is not explicitly stated. How the GRCA raises funds through charging visitors to conservation authority lands or through having them pay to attend events, shows that they value the basin and the water in it as an economic good.

Finally, when looking at both capacity building in the basin and the use of the best practices and technologies, the GRCA is actively trying to build their capacity and be at the forefront for practices and technology. These are both shown in the history of the basin with many different management and scientific studies being conducted that enhance and improve the ecology, governance or management of the overall basin. Most of the studies funded by the GRCA are available on their website and showcase how since being established they are actively working on increasing their capacity building for future events.

Table 5: GRCA in relation to IWRM Pillars

IWRM Pillar	Does the GRCA meet the pillar?	Examples
Integrated management	Yes	The GRCA lists the following partners on their website including 32 municipalities, 2 Indigenous nations, the provincial government, Conservation Ontario, and other conservation authorities across the province (GRCA, n.d.a).
Systems Approach	Yes	The GRCA has several values, one of which is the value of collaboration. This value states that the basin collaborates with stakeholders on many different issues to bring together multiple ideas and perspectives (GRCA, n.d.b.)
Central Government	Yes, but it is being eroded	The Conservation Authorities Act, R.S.O. 1990, c. C.27 allowed for the creation of the GRCA, and provides information on the different programs which can be delivered under the Act (Conservation Authorities Act, 1990). Several participants stated in interviews that recent changes to the Act have damaged the ability of the GRCA to act on issues and maintain their governance and management capabilities.
Full Stakeholder Participation	No, it needs to be improved	As participants in the research stated, many are engaged in the GRCA or in decision-making, but this can still be improved as several were dissatisfied with their level of engagement.
Women in Management	Undetermined	N/A
Social Dimensions	No	N/A
Transparency	Yes, but can be improved	The GRCA publishes their board meetings live through their website and YouTube page. They also publish a monthly calendar which states when board meetings are, and contact

		information is provided if an individual needs the information in another more accessible format.
Equitable allocation of water	No	N/A
Full-Cost Pricing	Yes	The 2021 budget for the GRCA factors in total operating costs, special costs and capital costs into the budget for a total sum of all expenses compared to all necessary funding (GRCA, 2021).
Financing	Yes, but can be improved	The GRCA's 2021 budget has funding coming from four main sources: municipal levees (23 municipalities have levees which support the GRCA), governmental grants, financial reserves, and funding generated from the GRCA's own programs (GRCA, 2021). As participants stated, funding from the provincial government and federal government could be improved. This would fall under the category of governmental grants.
Economic Good	Yes	The GRCA hosts different conservation areas within the watershed of which people pay to enter. One example is Rockwood Conservation Area which requires visitors to pay up to $6.86 per person to use the park (GRCA, n.d.c.). Having visitors pay to use the area makes the watershed an economic good because a cost is associated with its use.
Capacity Building	Yes	Another of the GRCA's values is innovation which focuses on increasing the use of technology and building the conservation authorities' capacity to respond to issues (GRCA, n.d.b). Their desire to adapt to new solutions shows that they are continually improving their capacity.

New Technology and Practices	Yes	To provide flood warnings for individuals in the basin, the GRCA provides hourly updates on river flows, water levels, temperatures, etc (GRCA, n.d.d).

As shown in Table 5, 9 of the 13 IWRM pillars are met by the GRCA. Of those 9, two need to be improved and one is slowly being eroded away. One pillar cannot be determined based on this research, and three pillars have not yet been met. Based on these results, the GRCA is an example of IWRM or of the beginning of IWRM. It uses an integrative approach but has not met all the pillars to be full IWRM. This was a common gap highlighted in the literature review, that complete IWRM has not been present in many basins around the world.

4.10 Effective Watershed Governance (Qn. 2)

Through participant interviews, effective watershed governance was defined as having transparency, stakeholder engagement, collaborative governance, a mutual understanding or common agenda, communication, multi-level governance, accountability, and whether it is holistic. Some other important elements that respondents mentioned were the need for a long-term perspective, public support, watershed principles, a watershed focus, co-management, data sharing, sufficient funding, balance, a clear vision, knowledge of the basin and issues, and good leadership. The quotations below highlight some important elements of watershed governance including the importance of communication and the need to have everyone united around a common goal or vision.

> "And if you want to effectively communicate, you need them to be able to appreciate other people's perspectives. The perception is reality. So if people perceive something a certain way, then that's their reality, and you'll have to try to work with them. At least hopefully everybody is in the mood to come to a common goal and compromise. But it helps if you can listen to what they have to say." – Participant A16

> "It is fragmented. I think the other challenge through water governance is there isn't a clear vision for water governance." – Participant A10

The respondents touched on many key elements regarding watershed governance, and many of them such as multi-level governance, communication, transparency, to name a few, all reside around collaboration with different stakeholders and interested parties.

Collaboration also deeply affects stakeholder engagement which is a key pillar of IWRM. Within the interviews, 14 participants believed that different discourses about water governance fit into a Canadian standard or perspective. They identified that we need to think about differences in perspectives, and how community and local knowledge is needed to govern the basin. With the GRB this would include CSOs, but also makes the inclusion of IK a necessity which would provide a long-term focus for water issues and solutions. Several participants stated that inclusion does depend on the situation and context, while also stating that we don't have full inclusion just yet. This would explain why some individuals feel as if they are left out of parts of the conversation. If it is believed that not everyone is needed in every conversation, then some will always be excluded. This is also not addressed in IWRM. IWRM does state that all stakeholders should be engaged, but questions could be raised regarding if they are needed in every situation or if it could be context specific.

The strengths of the GRB are its transparency, stakeholder engagement that while not full engagement is still strong compared to other basins, collaboration, multiple jurisdictions (which can be both challenging and beneficial), and its watershed scale approach. Based on the strengths identified and the key pillars for effective watershed governance determined in the second objective and supplementary questions, the GRB and its governance structure can be considered an example of effective watershed governance matching the established definition. While the governance of the GRB is effective as it is, it can also be improved. Federal responsibilities must be acknowledged and dealt with particularly surrounding Indigenous access to safe and secure water sources. At the same time, the Act and the provincial government cannot be used to undermine governance or management structures like conservation authorities, and the engagement of those outside the scope of typical government structures must still be encouraged and given spaces to thrive. If these three elements are ignored or not dealt with, then the governance would become ineffective.

The GRB is perceived as having effective watershed governance, while it also fits into the newly determined definition of effective watershed governance. There are still pros and cons of the

basin which allow the basin to be beneficial while also still improving, but decision-makers should also look at other examples of effective watershed governance around the world. Taking the best examples and developing multiple models will provide a greater opportunity for basins to utilize and adapt to a more effective form of watershed governance.

> "In recognizing that change is hard, and especially when you're dealing with institutions and these actual structural features of a water governance landscape, they are hard to change, but it doesn't mean that it's any less meaningful or necessary for the survival of human rights." – Participant A5

Chapter 5: Discussion

Now that the results of the interviews have been analyzed it is important to relate the results back to the literature review to see how the perceptions of water governance and management within the GRB coincide with or depart from the broader pool of theories, cases and practices.

5.1 Collaboration and Engagement

Collaboration is needed in all forms of water governance and can be used to help with the jurisdictional gaps in the above sections. But for it to be successful, it requires a shared vision between all those involved in decision-making to allow for deeper collaboration between parties (Mitchell, 2006; Baird et al., 2019) as more people find similarities between each other and trust between partners is built. Trust decreases potential risk and conflict between organizations and is needed in basin-wide management with multiple stakeholders (Bodin et al., 2020). The less conflict there is, the more likely groups are to work together.

Collaboration works best when it is voluntary, and this occurs when problems being addressed are either very severe or the solutions are feasible and can be relatively easily implemented by stakeholders (Baird et al., 2019). As well, the more organizations engage in collaboration, the more likely they are to continue to do so in the future (Plummer et al., 2017). However, collaboration can still be forced if it is not occuring voluntarily. Actors can be forced to join institutional collaboration or feel that they must join or else their voices will not be heard and their ideas and concerns will be ignored (Baird et al., 2019). Collaboration is required for water governance particularly in basins or areas where deep fragmentation is already occurring. Still caution must be taken to ensure that any collaboration is effective and does not harm the process.

Collaboration also deeply affects stakeholder engagement which is a key pillar of IWRM. Within the interviews, 14 participants believed that different discourses about water governance fit into a Canadian standard or perspective. They identified that we need to think about differences in perspectives, and how community and local knowledge is needed to govern the basin. With the GRB this would include CSOs, but also makes the inclusion of IK a necessity which would provide a long-term focus for water issues and solutions. Several participants stated that inclusion does depend on the situation and context, while also stating that we don’t have full

inclusion just yet. This would explain why some individuals feel as if they are left out of parts of the conversation. If it is believed that not everyone is needed in every conversation, then some will always be excluded. This is also not addressed in IWRM. IWRM does state that all stakeholders should be engaged, but questions could be raised regarding if they are needed in every situation or if it could be context specific.

The research and results showed that there is the perception of water security, as long as water security is defined as access to safe and secure drinking water, throughout most of the basin and for all of the participants. Participants had never run out of water and were not concerned with their own personal water security in the immediate future. However, as the participants and background literature noted, water security does not exist for Six Nations of the Grand River and often Indigenous peoples on reserve lack access to safe drinking water (O'Gorman, 2021; Out in the Open, 2018; Kerins, 2020). This contrasts with the perception of the participants themselves as having water security.

Water security is also related to collaboration. The GRCA's Water Management Action Plan from 2014-2018 stated that collaboration was needed to achieve water security (GRCA, 2019). While the federal government shoulders responsibility for water security in some areas of the basin, Six Nations of the Grand River must also be involved in the collaboration process. This relates to IWRM where collaboration amongst all stakeholders is one of the pillars for achieving IWRM in a basin (GWP SAS, 2018; as cited in Meran et al., 2021). The collaboration can allow IWRM to help achieve water security because other issues like water quality and quantity concerns can be addressed through IWRM (Wang et al., 2019; Bakker, 2012). A case study of three basins throughout Latin America (one each in Peru, Colombia and Brazil) all found that once IWRM was able to be implemented with the assistance of other frameworks, water security within the basins improved (Bezerra et al., 2022). IWRM was one of the tools which helped with achieving overall water security.

However, there is a prominent perception in the basin that Indigenous peoples are left out of conversations, decision-making, and even from having water security which creates a barrier to effective governance in the basin for several reasons. Many participants in the interviews identified Indigenous peoples as being individuals excluded from decision-making processes. One participant did identify that in the 1990s, the GRCA allowed a position within the Board of

Directors to be reserved for an Indigenous representative, but this was refused because it would not allow for collaboration on a nation-to-nation level. The participant was unsure if the topic of Indigenous representation has been broached since. This particular fact about the GRCA was unable to be verified with any literature or background research, but it showcases how the lack of consistent inclusion of Indigenous participants is a barrier to effective governance and limits the solutions to an issue. This aligns with Morris & de Loë who found that during decision-making Indigenous peoples still have more limited engagement and less inclusion than other interested parties (2016). It also raises the issue of fragmented governance in the basin.

The fragmented governance in the basin (while having benefits as some participants identified) does act as a barrier to effective governance. If Six Nations of the Grand River and the Mississaugas of the Credit First Nation will primarily engage with the federal government on a nation to nation level then their engagement in the basin is limited because the federal government does not have a consistent stake in the GRB. It creates a barrier to achieving water security for Indigenous peoples because access to safe and secure drinking water is a federal responsibility (Shrubsole et al., 2017; Bakker & Cook, 2011; Mitchell, 2016). The federal government must therefore be pushed to act to ensure water security exists for everyone in the basin, and it is only the federal government which can act because responsibilities are often not ceded to other jurisdictions (Mitchell, 2017; Hueglin, 2021). Even if the Indigneous nations were willing to engage with another level of government, action would not be allowed to occur due to the fragmented jurisdictions acting in the basin. The fragmentation is greatly affecting the effectiveness of the GRB's governance structure.

5.2 Perceptions on Future and Current Issues

In the interviews, the participants identified current and future perceived issues in the GRB which align with the literature and past research in the basin. Particularly, they relate to the history of the GRB, GRCA, and past issues of concern. The original issues being addressed by the GRCA were: "water quality, flooding, water supply, environmental protection and conservation and tourism/recreation and floodplain zoning" (as cited in Plummer et al., 2005). As is stated, water quality and water quantity are two themes identified by participants that also align with several of the original issues of concern.These issues have either not been adequately

addressed over the years, or more likely, they are ongoing issues which have multiple causes which are constantly being resolved or adapted.

One of the perceived future issues mentioned by the participants is also water quantity (an abundance or lack of) which also relates to the literature. The 2014-2018 Grand River Water Management Action Plan focused one section on ensuring sustainable water supply for the basin long into the future (GRCA, 2019). In 2014, the management of the basin through the GRCA described four pillars of which they would take action against (Water Management Plan Team). These pillars were inadequate water quality, basin flooding, long term water quantity and supply levels, and growing concerns around climate change (Water Management Plan Team, 2014). These pillars were also mentioned by participants as perceived future issues in the basin.

5.3 GRB Governance and Management

The research results showed that the general perception throughout the GRB is that the governance and management structures are both working. One participant did mention that they perceived the management of the GRB to be not working and not optimal because it was outdated. This perception does not match up with the perceived current and future issues identified in the basin, as well as the literature identifying both current and future issues. This may be determined because the research classified each individual issue within one of four themes, and while the themes may be similar, some of the individual issues may be different. There is also the potential that some of the issues identified may be being addressed through different activities, but at slower rates than other activities or projects, which could affect the participants response to the question of if the management structure was working and optimal.

The results also showed that the governance of the GRB is perceived to be effective. Most of the case studies and literature are able to define effective governance by describing what is missing from or what is making a governance structure ineffective. For example, Goinez-Madrigalab et al. found that top-down approaches to governance were ineffective because they often omitted stakeholders and had limited collaboration (2019). Vieira also agreed that effective governance had collaboration and engagement amongst stakeholders, and stated that ineffective governance can lead to failing infrastructure, decreasing services and limited resources (2019). Ineffective governance will also lead to unsustainable resource use and increasing challenges to water

quality (Bezerra et al., 2022). One of the solutions to improving water governance is through the development and implementation of common goals and objectives (Bezerra et al., 2022).

The participants identified several weaknesses in the governance and management of the basin which relate to the overall fragmented governance of the basin. The GRCA is given its power in the basin from the provincial government through the Conservation Authorities Act. The province can alter the role of the GRCA and other Conservation Authorities by changing The Act which was a problem identified by several participants and supported by the background research (GRCA, 2020b). Since the research was conducted more provincial legislation has come out which further harms conservation authorities. Bill 23, the More Homes Built Faster Act, limits conservation authorities by decreasing their ability to participate in discussions surrounding development, opens up Conservation Authority land for development, reduces the number of environmental tests a Conservation Authority can conduct on an ecosystem, and stops them from increasing their fees for using the land (Credit Valley Conservation, 2022). The fragmented governance means that the province can alter the role of the GRCA in the basin which limits its effectiveness to both manage and govern the basin. It then also would add more responsibility to municipalities and smaller stakeholders who often struggle to find the resources to act on their current roles (Norman & Bakker, 2009). Anytime there is a discussion on transferring jurisdictions or responsibilities to different levels of government a similar discussion is had regarding capacity to act on new responsibilities (Dunn, Bakker & Harris, 2014).

The participants in the research also identified their own key pillars of effective watershed governance which aligns with the literature described above. These pillars of effective watershed governance both identified by the participants and in most of the literature, are some or all of the pillars of IWRM described by the UNEP. The research comes to the same conclusion as Watson et al. who also argued that IWRM was present in the GRB (2019). This case study counters that of Lankford and Hepworth who argued that within sub-saharan Africa, IWRM did not promote flexibility in decision-making and was not context specific (2009). The participants continually noted that water governance must be flexible and context-specific in order for any governance structure to be successful.

IWRM does promote the inclusion of all stakeholders in decision-making, but as continually shown Indigenous peoples are perceived as being omitted from conversations within the GRB. It

has been argued that often when IWRM is implemented in a basin, the most marginalized stakeholders in the basin do not necessarily see any improvements to their way of living or engagement in decision-making (Godinez-Madrigal et al., 2019; Merrey et al., 2005). This argument would align with the responses from participants in this research and the literature review identified in chapter 2 and chapter 5.

Even with the challenges associated with IWRM in the basin, especially as they relate to the inclusion of Indigenous peoples, IWRM is still present and working as a management structure not a governance structure. Yet, it is this management structure which allows the GRB to be considered effective and directly contributes to its success. Everything the research participants described as being an example of effective watershed governance, is a pillar and component of IWRM. Without IWRM being used as the management structure in the basin, the governance may never have been successful which highlights the importance of combining the management structure with the governance structure in a basin. If the management structure is effective and works well, as it does in this case, then it may not matter what type of governance structure is taking effect in the basin. Whether it's collaborative, multi-level, or another type of structure, as long as the management is successful then the governance will succeed. Over time the management structure can dictate the goals and objectives in the basin, and who is involved in decision-making. The day-to-day actions can affect how the overall organization governs and operates.

Chapter 6: Conclusion

Governance of basins in Canada can be improved and made more effective, and studying the GRB can help with the process. There is a very strong perspective in the literature and amongst interested parties in the basin, that the GRB is governed and managed effectively. However, the GRB does have many of the elements of effective watershed governance, including collaboration, transparency, and stakeholder engagement. The GRB has a separate entity, the GRCA, which acts as a convening power in the basin bringing together multiple stakeholders to solve pressing water issues. To use the words of Rhodes (1996), the GRCA effectively steers the governance ship – balancing formal governance arrangements with stakeholder interests – while allowing stakeholders to row, one hopes, in a common direction (though the water challenges facing Indigenous peoples suggests that there is much more progress to be made). The research suggests that this is emblematic of both effective governance and integrated management. However, there are areas for improvement in both the governance and management of the basin. All basins, even those which function effectively, have governance structures which can be improved.

The most important conclusion which can be drawn from the research is that effective watershed management is fundamental to effective watershed governance. If the management is not working, the organization governing the basin is not funded adequately enough, or if interested parties are left out of conversations and decision-making (to name a few of the day-to-day management activities), then the governance will be greatly affected. The research has also shown that IWRM is an extremely effective form of resource and water management, which closely aligns with the definitions of effective watershed governance. Therefore, if IWRM is being used in a basin, and all (or almost all) 13 pillars of IWRM are being followed, then a basin will have effective watershed governance. This was true of the GRB where IWRM was in place as the management structure and it directly contributed to the success of watershed governance in the basin.

> "I think the GRCA is likely one of the strongest conservation areas in Ontario. Their governance there is second to none. I do believe they oftentimes are identified as, like the poster child, the one that people refer to when they want to get some information, and

they're always there to lend their knowledge and support. I think they're doing a fantastic job." – Participant A9

6.1 Recommendations for Future Research

During interviews, many participants raised various water issues in the GRB which were unable to be discussed in this research. These topics should be subject to future research, including:

1. An analysis of hydrogeology and groundwater studies in the GRB.

Several participants have differing points of view whether groundwater in the basin will be a water quantity issue or not in the future. This should be addressed.

2. Additional research into analyzing the impact of changes to the Conservation Authorities Act.

Changes to the Act that have been implemented must be assessed to determine their impact and if they are beneficial for Conservation Authorities, and particularly the GRCA and the GRB.

3. Analyzing the Places to Grow Act and the More Homes Built Faster Act, and their potential impact on the basin.

It was highlighted by participants that increasing development was a growing concern in light of its likely impact on water issues. While this was mentioned in the research, a further analysis is needed on how sustainable development should occur and where.

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Appendix A

Interview questions:

1. Which stakeholder group do you fit into within the GRW?
    1. Conservation Authority
    2. Government (Municipality)
    3. Government (Provincial)
    4. Indigenous nation
    5. Other
2. What are current water-related issues in the GRW that personally affect you or you personally work on?
3. Do you have water security in the GRW, including access to safe and secure drinking water?
4. What future issues, if any, do you foresee arising? Why would they occur?
5. Is the current management (the GRCA) of the basin working/optimal? Please explain your answer.
6. What limitations and strengths are there of the current management structure in the GRW?
7. How are you currently engaged in management of the GRW?
8. How would you like to be engaged?
9. What would you like to see for future resource management in the basin?
10. Are there any stakeholders who are not included in the management of the GRW?
11. On a scale of 1-10, where would you rank the management of the GRW with 1 being very poor/non-functional, 5 being neutral and 10 being perfect?
12. Is there a framework available that could share the management of the GRW and functioning of the GRCA with other Conservation Authorities or water managers across the country?
13. Would other basins benefit from using the GRCA as a model for water management?

Supplementary Questions:

1. How do you define effective watershed governance? What needs to be included in governance that is often missing? What are some considerations that must be taken when engaging stakeholders?
2. Where do/Can different discourses about water governance fit into a Canadian standard/perspective?
3. Is there value in how we are currently governing our waterways?
4. Do SDGs complement ongoing governance and sustainability projects?
5. Are these global pathways for sustainability beneficial or working? Is it worthwhile to measure sustainability with SDGs?

Appendix B

Current Water Related Issues listed below.

Issue	Number of Times Mentioned	Theme
Management	1	Management
Management Studies	1	Management
Water Quality	11	Water Quality
Drinking Water	2	Water Quality
Erosion	2	Water Quality
Salt	4	Water Quality
Source Water Protection	2	Water Quality
Agriculture	3	Water Quality
Groundwater	4	Water Quality/Quantity
Lake Erie	3	Water Quality/Quantity
Aggregate Mining	1	Water Quality/Quantity
Water Quantity	5	Water Quantity
Flooding	9	Water Quantity
Drought	5	Water Quantity
Climate Change	2	Water Quantity
Development	5	Water Quantity

Stormwater Management	2	Water Quantity
Water Temperature	1	Water Quantity
Bottled Water	2	Water Quantity
Water Reuse	1	Water Quantity
Water Security	1	Water Quantity
Indigenous Water Issues	2	Other
Funding	1	Other
Covid-19 Related Issues	1	Other
Conservation Authorities Act	1	Other
Grassroots Action	1	Other

Future Water Issues listed below.

Issue	**Number of Times Mentioned**	**Theme**
Management	3	Management
Water Quality	5	Water Quality
Drinking Water	2	Water Quality
Nutrient Loss	1	Water Quality
Pharmaceuticals	2	Water Quality
Source Water Protection	1	Water Quality

Agriculture	3	Water Quality
Groundwater	6	Water Quality/Quantity
Lake Erie	1	Water Quality/Quantity
Aggregate Mining	2	Water Quality/Quantity
Water Quantity	5	Water Quantity
Flooding	7	Water Quantity
Climate Change	6	Water Quantity
Development	8	Water Quantity
Stormwater Management	1	Water Quantity
Bottled Water	1	Water Quantity
Water Security	1	Water Quantity
Indigenous Water Issues	2	Other
Fragmentation	1	Other
Conservation Authorities Act	1	Other

Appendix C

Key Components of Effective Governance	Number of times mentioned
Multi-Level Governance	2
Long Term Perspective	1
Public Support	1
Transparency	6
Stakeholder Engagement	10
Watershed Principles	1
Watershed Governance Template	1
Looking at the Bigger Picture	1
Collaborative Governance	4
Key/Mutual Understanding or Common Agenda	4
Salience	1
Adaptive	1
Accountability	2
Consider the Environment	1
Preserving Water Quality and Quantity	1
Sustainable Water for all Ecosystems	1
Consultative	1

Holistic	2
Watershed Focus	1
Upstream and Downstream Accountability	1
Water Available for Human Needs	1
No Water Waste	1
Communication	2
Comprehensive	1
Integrative	1
Co-Management	1
Data Sharing / Open Data	1
Funding	1
Balance	1
Political, Organizational, Administrative	1
Clear Vision	1
Knowledge	1
Leadership	1
Commitment	1
Integration	1