SHARED WATER RESOURCES IN THE GREAT LAKES AND IN THE JORDAN RIVER BASIN: COMPARATIVE MODELS IN INTER-JURISDICTIONAL WATER MANAGEMENT

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Abstract

The period from 1909 to 1987 could be characterized as achieving notable successes in the management of the Great Lakes waters. The successes during this interval provide important lessons for shared water resources elsewhere. However, the period from 1987 forward saw more obstacles in restoring and maintaining the waters in the Great Lakes basin. Since 1987, progress toward delisting and restoring beneficial uses in the most degraded locations known as the geographic Areas of Concern (AOCs) (e.g. the St. Clair and Detroit Rivers) has been slow. Cleanup and restoration actions have been completed for only five of the 43 AOCs that were identified in the Great Lakes basin. Meanwhile, in the Jordan River basin, various bilateral agreements were signed to divide and manage the water resources but with little success, with the exception of the successes achieved between Jordan and Israel on the Aqaba Gulf. These successes provide lessons for other parts in the world that are attempting to achieve effective transboundary environmental outcomes. This thesis examines the factors that impede progress in the restoration of the beneficial uses in the St. Clair and Detroit Rivers AOCs and provides recommendations to advance implementation of the restoration process for the two rivers. This thesis also examines the conflict and the agreements over the shared water resources in the Jordan River basin and proposes a model consisting of three elements (political, socio-economic, and scientific) to create sustainable solutions to the water problems and improve management of the shared water resources in the basin based on the historic successes achieved in the Great Lakes region. A comparative analysis of the management of shared

water resources between the two basins provides a series of principles that are applicable to shared water resource management in other parts of the world.

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Glossary

AOC	Area of Concern
ARIJ	Applied Research Institute-Jerusalem
ASEZA	Aqaba Special Economic Zone Authority
BEC	Binational Executive Commission
BPAC	Binational Public Advisory Committee
BWT	Boundary Water Treaty
COA	Canada Ontario Agreement
COAB	Canada Ontario Agreement Board
COE	Corps of Engineers
CS	Combined Sewer Overflow
CWA	Clean Water Act
DFO	Department of Fisheries and Ocean Canada
DRCC	Detroit River Canadian Cleanup
EC	Environment Canada
EPA	United States Environmental Protection Agency
EXACT	Executive Action Team
GEF	Global Environment Facility
GLSLCI	Great Lakes St. Lawrence River Cities Initiative
GLC	Great Lakes Commission
GLFC	Great Lakes Fishery Commission
GLIN	Great Lakes Information Network
GLWQA	Great Lakes Water Quality Agreement
GMB	Ganges-Brahmaputra-Meghna
IBJC	Indo-Bangladesh Joint Commission
IBUs	Impaired Beneficial Uses

ICPDR	International Commission for the Protection of the Danube River
ICPR	International Commission of Protection the Rhine
IJC	International Joint Commission
IMEP	Israel Minister of Environmental Protection
IMFA	Israel Ministry of Foreign Affairs
IWT	Indus Water Treaty
JIWC	Jordanian-Israeli Water Committee
JMWI	Jordan Ministry of Water and Irrigation
JRBC	Jordan River Basin Commission
JSWC	Jordanian-Syrian Water Committee
MCM	Million Cubic Meter
MDEQ	Michigan Department of Environmental Quality
MDCH	Michigan Department of Community Health
MOU	Memorandum of Understanding
MRC	Mekong River Commission
NATO	North Atlantic Treaty Organization
NOAA	National Oceanic and Atmospheric Administration
ODNR	Ohio Department of Natural Resources
OMA	Ontario Michigan Agreement
OMOE	Ontario Ministry of the Environment
OMNR	Ontario Ministry of Natural Resources
PACs	Public Advisory Committees
PCBs	Polychlorinated biphenyls

PIC	Permanent Institution Commission
PWA	Palestinian Water Authority
RAPs	Remedial Action Plans
RSMPP	Red Sea Marine Peace Park
RSDSC	Red Sea Dead Sea Canal
SAB	Science Advisory Board
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
USAID	US Agency for International Development
USGAO	United States General Accounting Office
WFD	Water Framework Directive
WIMS	Waste Information and management System
WQB	Water Quality Board
WRMC	Water Resources Management Committee

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Chapter One: Introduction

1.1 Background on the water agreements in the Jordan River and the Great Lakes Basins

The water resources in the Jordan River basin are shared among five peoples: Jordanians, Syrians, Israelis, Palestinians, and Lebanese. Since the middle of the last century, many proposals concerning the Jordan River basin were put forth to apportion and manage the water resources among the riparian states but with no success (Lowi, 1995). The most important of these proposals was the one submitted by the Johnston Plan in 1955. The Johnston Plan was drawn up by Eric Johnston who was appointed by President Eisenhower as the U. S. Special Ambassador in 1953. The main provisions of this Plan included: 1) giving each state sole authority to decide where and how to use its share of the water; 2) assigning the largest share of the basin water to Jordan, followed by Israel, then to Syria, and the least amount to Lebanon (Table 5) (Wolf, 1994); 3) treating Lake Tiberias as a regional storage facility for all the riparians (Haddadin, 2000).

As a consequence of this failure, management and development of the water resources in the Jordan basin have been implemented on a unilateral basis. Israel built its water carrier and by 1964 its work on the carrier was completed with an initial capacity of one million cubic meters per day (MCM/day) (Libiszewski, 1995). Jordan went ahead with the construction of the East Ghor Canal to divert the water of the Yarmouk River into the Jordan valley and Syria began building dams on the tributaries of the Yarmouk River (Lowi, 1995; Wolf, 1994).

Thirty years after the refusal of the Johnston Plan, Jordan and Syria entered into agreement in 1987 to build a dam at the border to store winter floodwaters of the Yarmouk River. According to the Agreement of 1987 the dam would be able to store a gross capacity of 110 million cubic meters (MCM) annually and 18,800 kWh of power would be generated (JMWI, 2007; 2009). However, because of the Syrians depletion of the Yarmouk's surface and groundwater, the water retained in the Dam since its construction in 2006 is only 18 MCM as compared to the required 110 MCM (Namrouqa, 2009).

Four years after signing the Water Agreement between Jordan and Syria, in 1991, the Arab states in the Jordan River basin entered into direct negotiations with Israel to settle their disputes over territories that were occupied in 1967 and as well as over water. At the Madrid Conference for Peace in the Middle East in 1991, water became one of the complex issues confronting Arab and Israeli negotiators (Wolf, 1995).

After years of negotiations, Israel and the Palestinian Authority signed the Oslo Interim Agreement in 1993 which, for the first time, included an Israeli acknowledgement of Palestinians water rights to the West Bank's groundwater (Hosh & Issac, 1996). The Oslo Agreement provided for the establishment of an Israeli-Palestinian Joint Water Committee (JWC) consisting of an equal number of Israeli and Palestinian representatives for the purpose of overseeing the management of all of the West Bank's water and sewage resources and systems (Selby, 2007). The Oslo Agreement also provided for the establishment of the Palestinian Water Authority (PWA) to represent the Palestinian Authority in the JWC (Aliewi & Assaf, 2007; Clive, 2003; Issac, 1998; Tagar

et al., 2004). Following the Oslo Interim Agreement, two others agreements were signed by the Israelis and the Palestinians, the Camp David Agreement of 2001 and the Road Map Agreement of 2006. The Agreement of 2001 called for additional water quantities to be allocated to the Palestinians whereas the Agreement of 2006 called for solving the Palestinians water problems through regional cooperation (Aliewi & Assaf, 2007). Despite the signing of these agreements, sustainable solution to the water problems between the Israelis and the Palestinians has been unresolved and the problems between the two sides continue (Aliewi & Assaf, 2007; ARIJ, 1996; Issac, 1998; Scheumann & Schiffler, 1998).

In 1994, Jordan and Israel signed an agreement to settle their disputes over water. This agreement, which was part of the Peace Treaty, contained six articles with the purpose of achieving a comprehensive and lasting settlement of all the water conflicts between Jordan and Israel. Under the Agreement of 1994, a Joint Water Committee comprised of three members from each country was established for the purpose of the implementation of Agreement articles (IMFA, 2008). Also, Jordan and Israel entered into agreement to protect and manage the shared marine resources of the Gulf of Aqaba (IMEP, 2008).

Since 1994, the Water Agreement between Jordan and Israel achieved many successes and it was considered the only Agreement in the basin that achieved settlement to the water issues between the two states (Haddadin, 2002). However, it is a bilateral agreement instead of the multilateral agreement that is needed to regulate the rights and

responsibilities of each state in the basin in terms of water sharing and environmental protection (Scott et al., 2003).

Protection of the marine environment of the Gulf of Aqaba was among the issues that were addressed by the Peace Treaty of 1994 (World Bank, 1996). In 1996, the joint environmental cooperation on the Aqaba Gulf became effective when an Agreement on Special Arrangements for Aqaba, Jordan and Eilat, Israel was signed. The 1996 Agreement called for the establishment of a binational marine park called the Red Sea Marine Peace Park (RSMPP) on the Upper Gulf; joint cooperation in combating pollution from ships; data exchange related to environmental monitoring and control measures taken by each party; and the establishment of a joint committee to assist in the implementation of the Agreement.

Since 1996, the successes of the projects that have addressed the protection of the marine environment of the Aqaba Gulf have been beyond expectations (The World Bank, 2002). These outcomes included the establishment of the Gulf of Aqaba Environmental Action Plan (GAEAP) and the establishment of a binational Red Sea Marine Peace Park (RSMPP).

In the Great Lake basin, the water agreements signed are considered as the most comprehensive ones in terms of their coverage of various water-related issues, such as the establishment of water rights, clarification of duties and obligations, establishment of water quality management programs and standards (Giordano, 2002), and establishment of rules and principles that govern the work of the International Joint Commission. The first water treaty signed, the Boundary Water Treaty (BWT), was in North America and

dates back to 1909. The BWT established the principles that govern the use and diversion of the boundary waters and also established mechanisms to help and resolve any water disputes that might arise along the boundary between Canada and the United States (IJC, 2009). Lemarquand (1986) argued that the political will of Canada and the United States to work together to seek common solutions to the shared water problems was the main driver for signing the BWT. According to Lemarquand (1986), "Canada and the United States have similar attitudes about environmental values, resource use, and their interests are generally complementary in the pursuit of objectives such as a clean environment, public health, and economic growth". Thus, they cooperated through scientific and technical exchanges, to develop a policy to promote common objectives (Lemarquand, 1986). According to the BWT of 1909, "the parties are desirous to prevent disputes regarding the use of boundary waters and to settle all questions involving the rights, obligations, or interests of either in relation to the other or to the inhabitants of the other along their common frontier" (IJC, 1997).

Under the BWT, the International Joint Commission (IJC) was established with a mandate to prevent and resolve disputes along Canada-U.S. boundary waters including the Great Lakes (IJC, 2000; Lemarquand, 1993; Saddler, 1986). In accordance with Article VII of the BWT, the IJC is composed of six commissioners, three from each side, appointed by the president of the United States and three appointed by the Governor in Council of Canada (IJC, 2009). Under the BWT, the IJC has three functions: First, the IJC acts as a quasi- judicial body to consider applications for approval to build and operate certain works in boundary water and in rivers that flow across the boundary

(Lemarquand, 1993). In its quasi-judicial function, the BWT gives the IJC the authority to approve or disapprove applications for the use, obstruction or diversion of boundary waters on either side of the border that would affect the natural level or flow on the other side (Lemarquand, 1993). The second function of the IJC is an investigation. In its investigation function, the IJC examines and provides recommendations on transboundary issues at a request of both countries in what is called a reference (Saddler, 1993). The third function of the IJC is an arbitration function.

Although the focus of the BWT was related to water quantity, reference to water quality issues was also incorporated in the agreement. Article IV of the BWT states that "the boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other" (IJC, 2009). Over time, with growing public concern regarding water pollution in lakes Erie and Ontario, the IJC received, in 1964, a reference from the two governments to investigate pollution in the two lakes and in the international section of the St. Lawrence River (Boots & Muldoon, 2005). In response to the reference of 1964, the IJC established an International Lake Erie Water Pollution Board and an International Lake Ontario- St. Lawrence River Water Pollution Board to undertake studies (IJC, 2000). Based on its board's studies, the IJC recommended that the two governments take urgent actions to improve water quality in the basin including programs that would control phosphorus inputs into Lakes Erie and Ontario (IJC, 2009).

Based on the IJC's recommendations, Canada and the United States recognized the need for specific arrangements to deal with the water quality issues in the Great Lakes

region (IJC, 2009; Rabe, 1997). In 1972, the first Great Lakes Water Quality Agreement (GLWQA) was signed. The Agreement of 1972 expressed the commitment of each country to restore and enhance the water quality in the Great Lakes (EC, 2005). It called for curbing eutrophication through achieving reductions in phosphorous loadings to the lakes (Krantzberg et al., 2006). It also provided for a number of general and specific objectives to achieve them and called for reviewing the agreement at the end of five years (IJC, 2006). The responsibility for implementing the Agreement of 1972 fell upon the United States Environmental Protection Agency (EPA) and the Canada Ontario Agreement Board (COAB)[1] (Botts & Muldoon, 2005).

Under the GLWQA of 1972, the IJC was given a central role in achieving the objectives of the Agreement (IJC, 2000). This role included: 1) collecting, analyzing, and disseminating information supplied by the federal, state, and provincial governments on water quality and on the objectives and recommendations to those governments on water quality problems; and 2) assisting in the coordination of the joint efforts to control pollution of boundary waters (Lemarquand, 1993).

To assist the IJC in fulfilling its responsibilities under the agreement, the Great Lakes Water Quality Board (WQB) and the Science Advisory Board (SAB) were established (Canada & United States, 1972). The WQB consisted of officials from the

[1] The Canada Ontario Agreement Board (COAB) was the output of the Canada-Ontario Agreement (COA) regarding the Great Lakes Water Quality (COA) (Botts & Muldoon, 2005). The COA was first signed in 1971, in advance of the 1972 GLWQA. It created a framework to implement Canada's commitments under the GLWQA by allocating responsibilities between the Canadian and Ontario governments to restore, protect and conserve the Great Lakes ecosystem (Botts & Muldoon, 2005).

federal governments, the eight Great Lakes States, and the provinces of Ontario and Quebec. Under the agreement of 1972, the chief objective of the WQB was to make recommendations to the IJC on the progress of programs under the agreement. The Science Advisory Board consisted of experts in a variety of fields, divided evenly between Canada and the United States (IJC, 2000). The chief objective from its establishment was to act as principal scientific advisor to the IJC with respect to the current and anticipated problems to Great Lakes water quality (IJC, 2006). The GLWQA of 1972 also provided for the establishment the Great Lakes Regional Office in Windsor, Ontario to provide administrative support for the Great Lakes WQB and SAB (Canada & United States, 1972).

To fulfill its responsibilities, the IJC began to report annually to the two governments on progress toward achievement of the goals of the Agreement of 1972 (Lemarquand, 1993). In turn, the two governments began constructing and upgrading municipal sewage treatment plants in the Great Lakes basin, and consequently the total discharge of nutrients into Lake Superior, Lake Erie, and Lake Ontario has been noticeably reduced (Botts & Muldoon, 2005; IJC, 2009; Krantzberg et al., 2006).

As progress was underway toward the phosphorus reduction objective, research disclosed the pervasiveness of certain persistent organic chemicals in the Great Lakes ecosystem (Botts & Muldoon, 2005). In 1976, the IJC noted that, while total phosphorous loadings had decreased, new challenges faced the Great Lakes due to the toxic contaminants that reached the lakes from many sources, including direct discharges, the atmosphere, and by leaching through groundwater (Botts & Muldoon, 2005). As the

deadline for the first five-year review approached, in 1977, the two governments found that amendments to the 1972 Agreement were necessary and they started the preparation for negotiating a more comprehensive one (Botts & Muldoon, 2005). In 1978, the new GLWQA was signed to reaffirm commitment of the two governments in restoring and protecting the water quality of the Great Lakes (EPA, 2009). Through the Agreement of 1978, the two governments adopted a policy that the discharge of any or all persistent toxic substances be virtually eliminated in the Great Lakes and international section of the St. Lawrence River (IJC, 2006).

The most significant change in the 1978 Agreement was the adoption of the *ecosystem approach* to restore and maintain the water quality of the Great Lakes (Canada & United States, 1978). According to the GLWQA of 1978, the *ecosystem approach* refers to "the interacting components of air, land, water and living organisms, including humans, within the drainage basin of the Great Lakes and the international section of the St. Lawrence River" (IJC, 1994). In 1987, the GLWQA of 1978 was amended by Protocol to strengthen and renew the bilateral commitments to further an ecosystem approach to Great Lakes management and to virtually eliminate the discharge of persistent toxic substances (Canada & United States, 1987). The Protocol called for developing and implementing Remedial Action Plans (RAPs) to clean up the most seriously degraded locations, the Areas of Concern (AOCs), in the Great Lakes basin (Canada & United States, 1987).

The AOCs were defined as "specific geographic areas that fail to meet the general or specific objectives of the GLWQA where such failure has caused or is likely to cause

impairment of beneficial use or of the area's ability to support aquatic life" (Canada & United States, 1987). The impairment of beneficial use was defined as "a change in the chemical, physical or biological integrity of the Great Lakes System sufficient to cause any of the following: restrictions on fish and wildlife consumption; tainting of fish and wildlife flavor; degradation of fish wildlife populations; fish tumors or other deformities; bird or animal deformities or reproduction problems; degradation of benthos; restrictions on dredging activities; eutrophication or undesirable algae; restrictions on drinking water consumption, or taste and odor problems; beach closings; degradation of aesthetics; added costs to agriculture or industry; degradation of phytoplankton and zooplankton populations; and loss of fish and wildlife habitat" (Botts & Muldoon, 2005; IJC, 1994). Forty two Areas of Concern were identified in the Great Lakes basin, with an additional added in 1991 (Botts & Muldoon). There were 26 sites in the U.S. (e.g. the Rouge River and the Waukegan Harbour), 12 sites in Canada (e.g. the Hamilton Harbour and Bay of Quinte), and 5 binational sites shared between the U.S. and Canada (e.g. the St. Clair and the Detroit Rivers) (Botts & Muldoon, 2005; Great Lakes Commission, 2002; Sproule-Jones, 2002).

Under the Protocol of 1987, the RAP process has three stages. The first stage is definition of the problems, sources, and causes of impairments of beneficial uses. The second stage includes selection of appropriate remedial measures and identification of agencies or organizations responsible for implementing selected remedial measures. The third stage is surveillance and monitoring processes to track the effectiveness of remedial measures, leading to eventual confirmation of restoration of beneficial uses (Canada &

United States, 1987). The Protocol of 1987 provided for biennial reports on progress in developing and implementing the RAPs and in restoring the beneficial uses (IJC, 1994). Under the Protocol of 1987, the IJC was given the responsibility to review and comment on the adequacy of each stage of the RAP process for each AOC (Botts & Muldoon, 2005). The language used in this dissertation, such as Beneficial Uses Impairments (BUIs) and delisting criteria, are derived from the Great Lakes Water Agreement Annex 2 of 1987.

Since signing the Protocol of 1987, progress toward delisting and restoring beneficial uses in the Areas of Concern has been slow (Botts & Muldoon, 2005; IJC, 2006). Cleanup and restoration actions have been completed for only five of the 43 AOCs and none of them have been binational (IJC, 2006).

Several IJC's reports pointed to the causes that have stymied the effectiveness of RAPs in general. Lack of leadership, decline of the governments' support to the RAPs, and lack of accountability represent some of the main constraints to progress in implementation of the RAPs (IJC, 1997; IJC, 2003). This thesis delves deeper to determine what other factors might impede progress in the restoration of the beneficial uses in the AOCs with the intent to provide recommendations to advance implementation of the restoration process for the St. Clair and Detroit Rivers.

1.2 Central thesis questions

This thesis examines the transboundary cooperation between Jordan and Israel on the Aqaba Gulf and evaluates the factors that have helped in achieving the goals of the joint environmental projects. The purpose of this analysis is to determine if there are

lessons that can be learned from this cooperation that can be applied to the binational AOCs in the Great Lakes basin in order to move their RAPs forward.

By contrast, since 1987, various bilateral agreements have been signed in the Jordan River basin to divide and manage the water resources but with little success. For example, the Jordan-Syria Water Agreement of 1987 over the Yarmouk River gives Jordan access to less than half of its share of flow from the river. Eighteen years have passed since the Madrid Conference for Peace, and yet the water conflict has not been fully resolved between some parties (e.g. the Israelis and the Palestinians). Many agreements have been signed between the Israelis and the Palestinians since 1993; however, no explicit water rights have been established for each party. This thesis examines the conflict and the agreements over the shared water resources in the Jordan River basin while considering historical cooperation in the Great Lakes region from 1909 to 1987, a period of great success in the Great Lakes region, to determine what would be needed to establish a sustainable solution to the water problems in the region.

The reasons that have motivated me to do this research in the two regions included personnel and professional ones. On a personal level, I am passionate to contribute to resolving water problems in the Jordan basin, the area where I was born and grew up, and I am certain that resolving water problems would be essential step towards achieving peace and stability in the basin. On professional level, my experience in working on many transboundary projects on the Aqaba Gulf has enabled me to identify some important factors that helped in achieving the goals of the transboundary projects on the Gulf and also enabled me to establish the connections that I need to accomplish

my research. I choose the management of shared water resources in the Great Lakes as a model for comparison because it is a global model with a hundred years of experience, and it covers various water-related issues, such as water rights, clarification of duties and obligations, water quality management programs and standards.

Although the political situations in the two basins are different, there is a consensus among the parties that water issues are generally resolved peacefully and through cooperation. Jägerskog (2001) pointed out that despite the tensions between the Israelis and Palestinians, the two sides reaffirmed their commitment to continue their cooperation on water. Also, the facilitations that have been granted to the Palestinian – Israeli joint commission to cross check points during high security periods is an example that shows that water is an urgent issue, and that the parties recognize the imperative for cooperation between the Israelis and the Palestinians.

This thesis develops a conceptual model to form the basis for a policy proposal that can be expected to provide a sustainable solution to the water problems in the Jordan River basin and improve management of the shared water resources in the basin. The model's elements will be based on an examination of the successful period in the Great Lakes regarding managing shared water resources (IJC, 2009; Saunders, 2000). A model, for the purposes of this thesis, consists of an overarching framework and its subsystem components that together form a management system. This form of model is a conceptual framework, not a mathematical construct.

1.3 Methods of Inquiry

In order to address the central questions that are the focus of this research, methodology included both scholarly literature reviews and in depth interviews with senior officials and experts in both North America and the Middle East. The experience I gained during my work with the Environment Commission, Jordan, on managing and protecting the shared water resources in the Aqaba Gulf, Jordan, from 1997 to 2004 in the capacity as Environmental Monitoring, Inspection and Audit Engineer, was also important and helped me through the course of the research. This experience has provided me with the necessary exposure and knowledge to understand the difficulties facing many projects that dealt with trans-boundary water and environmental issues, particularly in the Middle East.

I began with an intensive review, followed by analysis, of the existing literature, including primary sources such as government documents and reports, secondary sources, including books, journal articles, and internet sources. Principally, these were related to the Great Lakes Water Quality Agreements, Remedial Action Plans, the Water and Environment Agreements of 1987 and 1994 between Jordan and its neighbors, Syria and Israel, and the transboundary environmental agreements between Jordan and Israel on the Aqaba Gulf. Further scholarly analysis followed on interjurisdictional water resource management from around the globe to analyze central elements related to good governance and sustainability of international agreements.

Interviews and site visits

The overall strategy of data collected during the field research was through in-depth, face-to-face interview, phone calls, and emails with senior federal officials representing the U.S. Environmental Protection Agency's (EPA) Office of Water, and Environment Canada. These organizations were selected because they have major responsibilities for Great Lakes cleanup and restoration efforts and account for the majority of funds and human resources expended for Great Lakes programs and specifically the Remedial Action Plans (RAPs).

State and provincial officials from Michigan Department of Natural Resources and Ontario Ministry of the Environment were also interviewed. These organizations were selected because the two selected Areas of Concern are located within their jurisdictions, they are responsible for restoration processes, and have been engaged leaders in the RAPs for more than two decades.

Governmental and nongovernmental organizations including the International Joint Commission (IJC), and the Detroit River Canadian Cleanup (DRCC) were part of the interviews and the sites visits that I undertook in the Great Lakes region. The IJC and the DRCC were selected because they are involved in assessing the restoration activities in the two shared AOCs and have been involved since 1987 and 1998 respectively.

In the Jordan River basin, the site visits and interviews were conducted primarily with current and former high ranking officials from Jordan Ministry of Water and Irrigation (JMWI), Amman, Jordan. The former high ranking officials were selected because they participated directly in the negotiations process which led to sign the water

agreement between Jordan and Israel and they are experts in the hydro-politics of Annex 2 of the water Agreement between Jordan and Israel, Jordan River, and the Yarmouk River. The current high ranking officials were selected because they are members in the Jordanian committee directly responsible for implementing the water agreements between Jordan and Israel and between Jordan and Syria.

In all, I was in contact with 21 individuals, of which 12 agreed to interviews and follow up questions. Given the extensive practical experience of those interviewed from their respective regions, there is a high degree of confidence in the quality of the responses to my questions.

As one of many researchers who have examined the water issues in the Jordan River basin, the interviews were an important source of information for my research. According to Jägerskog (2003), who did his PhD research in the Jordan basin, interviews are important for data collection because the oral information provides an important opportunity to check and deepen the understanding of written texts that exist.

1.4.1 List of Interview Questions for the Great Lakes basin

1. The most significant change in the 1978 Agreement was the use of the term Great Lakes Basin Ecosystem approach. In your opinion, how has the ecosystem approach affected achieving the objectives of the GLWQAs and the remediation process in the St. Clair and the Detroit Rivers AOCs? What are the challenges that face the implementation of this approach in the St. Clair and the Detroit River AOCs from management and technical perspectives? Why is hard to implement an ecosystem approach at the scale of the entire Great Lakes?

2. The GLWQAs and the RAPs are not legally enforceable. What types of guarantees do you propose to be included in the RAPs processes to make implementation binding for both countries?
3. Three binational RAPs were undertaken for the St. Clair, Detroit, and St. Marys rivers. Whereas, for both the Niagara and St. Lawrence rivers, two separate RAPs were undertaken. Why do we need binational RAPs for the three shared AOCs? And if it is more complicated to work bi-nationally, what are the benefits of implementation of binational RAPs for the St. Clair and the Detroit River?
4. Local accountability for implementation programs and actions to achieve the goals and objectives of the transboundary agreements between Jordan and Israel on the Aqaba Gulf has played a central part in the success achieved in protecting the shared marine resources. Mechanisms that resulted in accountability are: tracking progress in achieving goals, measuring and monitoring, regular reporting on progress and having independent/external reviews. Do those currently elements exist in the St. Clair RAPs and the Detroit River RAPs and if not how can, in your opinion, those elements be included?
5. Another reason for successful transboundary cooperation between Jordan and Israel on the Aqaba Gulf is the mutual understanding and recognition to the economic values of the shared marine resources. What do you suggest from an economic point of view that should be done in the St. Clair and the Detroit Rivers that could help speed the implementation of the RAPs? Have any studies been undertaken to show the economic benefits gained from restoration of the beneficial uses in the St. Clair and the Detroit Rivers AOCs?
6. In your opinion, how does the structure of the governance in the St. Clair and the Detroit Rivers AOCs affect the progress in achieving the implementation of the binational RAPs? And how can governance structures and processes be strengthened in order to move the binational RAPs in the two shared AOCs forward?

7. In your opinion, how can we get the RAP completed in the two AOCs, the St. Clair and the Detroit Rivers?
8. What is the importance of having quantifiable delisting targets for the BUIs to gain support for completion of the RAPs in the St. Clair and the Detroit Rivers? And, in your opinion, how does the absence of quantifiable delisting targets affect the progress of the RAPs in the two rivers? Is it applicable to delist the St. Clair and the Detroit River even if each side of the border has its own listing/delisting criteria?
9. What would it take to strengthen the IJC from the parties' point of view and from the public's perception? Do you think that we need a new external review body in the Great Lakes? Who would assemble this body and how people could be nominated?

1.4.2 List of Interview Questions for the Jordan River basin

1. Is the Agreement of 1987 between Jordan and Syria legally enforceable? If so, what are the enforcement tools? If not, what are the type of guarantees do you propose to include in the Agreement to make it binding to both countries?
2. One important aspect of binational cooperation is information gathering and sharing between the two countries. Does the current institution of the Jordan-Syria Water Committee (JSWC) provide a reliable source of information that allows for cooperation, building of trust and a shared understanding?
3. How can the JSWC be empowered to effectively mediate resolutions? How effectively has the JSWC been used in the past to solve disputes between the two countries? Can you comment on the current neutrality of the JSWC? How effective is it and how it might better be achieved?
4. Under the Water Agreement of 1994, "Jordan and Israel will cooperate in finding sources for the supply to Jordan of an additional quantity of 50 mcm/yr of water to drinkable standards". Why is it not implemented yet?

Which water resources does the agreement exactly refer to, how they are to be developed and who will bear the costs of additional water resources development?

5. Does the current institution of the Jordanian-Israeli Water Committee (JIWC) provide a reliable source of information that allows for cooperation, building of trust and a shared understanding?
6. What ability does the JIWC have to effectively mediate resolutions? How effectively has the JIWC been used in the past to solve disputes between the two countries?
7. Can you comment on the current neutrality of the JIWC? How effective is it and how it might better be achieved?
8. Under what circumstances, would there be the potential for cooperation on integrated and comprehensive joint management of all regional water resources? Under which conditions it is likely that parties will agree on cooperative solutions and under which will they not?
9. To what do you attribute the success achieved on the Aqaba Gulf in terms of protection of the shared marine resources?

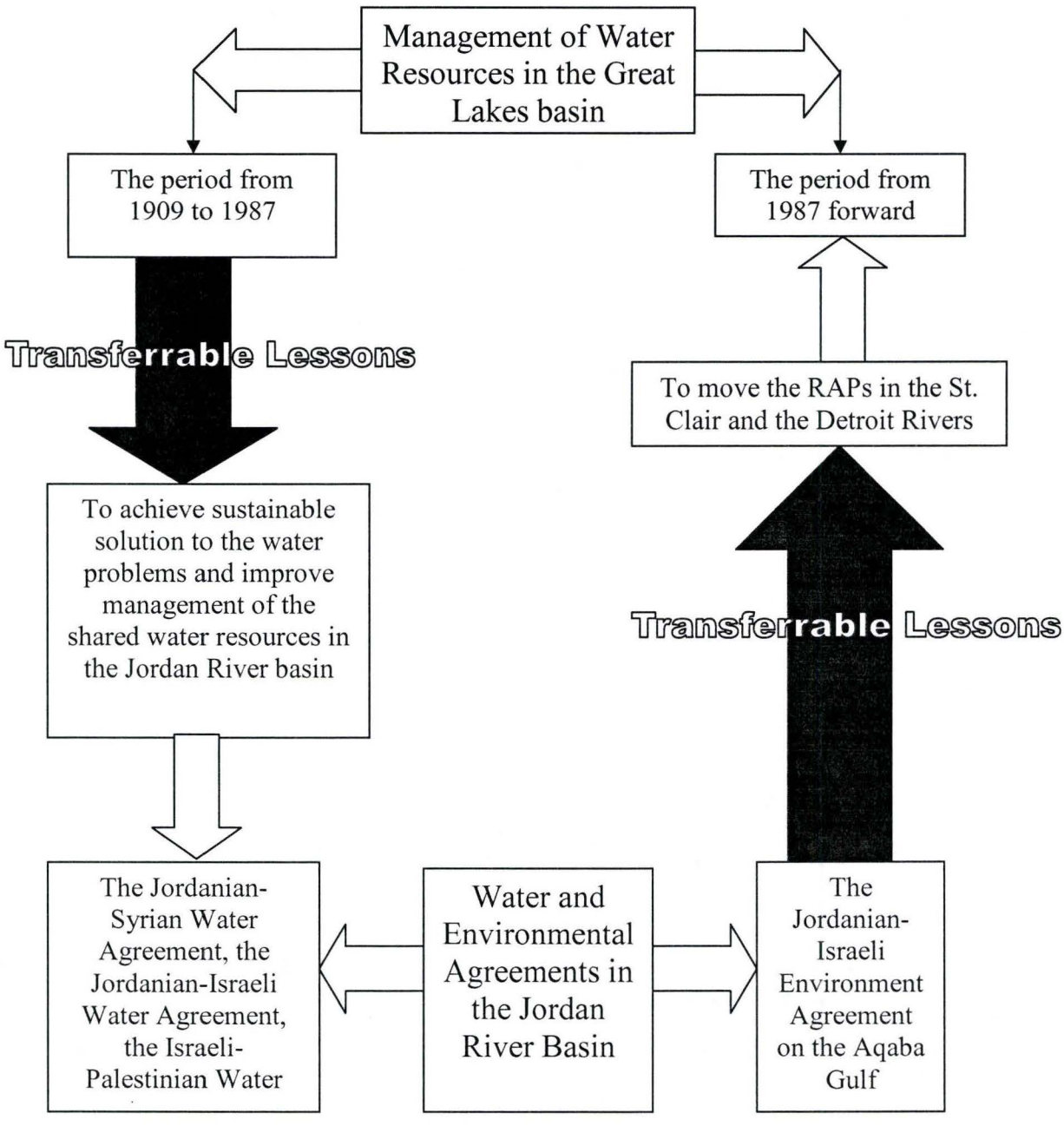

Figure 1: The linkages among regions, and transferable lessons learned among them, as examined in this dissertation.

Chapter Two: Interjurisdictional Management of Shared Water Resources

2.1 Introduction

Natural resources are particularly problematic in border areas as political borders divide up natural systems between two or more nations (Milich & Varady, 1998). Water is one of the resources that contain both the seeds of conflict and cooperation (Spector, 2000). Because water is continuously in motion, issues of control, jurisdiction and sovereignty are much more complicated than when dealing with static land resources (Kliot et al., 2001).

Worldwide, more than 200 basins are shared by two or more countries comprising almost half of the world's land surface (Wolf; 1998; Sadoff & Grey, 2002; Neirini, 2005). Shared by more than 140 sovereign states these basins are governed by approximately 145 international water agreements (Giordano, 2002; Wolf, 1998). In some cases, these agreements were directly accompanied with political and territorial accords; in other cases these agreements were separate from any other political or resource issues between countries (Wolf, 2007). Some of these agreements include all the states in the basin, such as the water agreements on the Danube and the Rhine Rivers, while others are strictly binational and do not include other states in the basin; such is the case with the Nile Water Agreement of 1959 between Egypt and Sudan.

According to Hammer and Wolf (1998), eighty six percent of these agreements are bilateral, more than half of these agreements do not include monitoring provisions, and four-fifths have no enforcement mechanisms. One third of these agreements created a joint water commission to implement the agreements' provisions and to provide a forum

to resolve disputes (Wolf, 1995). Examples of these commissions are the ones created for the Rhine River (ICPR), the Danube River (ICPDR), and for the US-Canada joint waters (IJC) (Wolf, 1995).

The principal focus of about 80 percent of these agreements is on water apportionment and hydropower issues (Hammer & Wolf, 1998). According to Giordano (2002), only 10 percent of all agreements signed prior to 1950 had references to water quality, 35 percent of the agreements signed after 1950 incorporated water quality provisions, and more than 60 percent of the agreements signed in the 1990s had references to water quality.

Various scholars have pointed to the factors that can bring states in a basin to the negotiating table to resolve their water disputes as well as to establish a collaborative framework to protect and manage their shared water resources. According to Brochamnn and Hensel (2009) states will commit to negotiate if they expect to gain more from collective action than from unitary action, or in order to avoid a costly conflict. Elhance (2000) argues that states, even the stronger ones, prefer to negotiate common water issues in order to avoid the costs of war.

2.2 Factors required to bring the riparian states in a basin to the negotiating table to sign and cooperate on protecting and managing the shared water resources

An examination of conflicts and cooperation over shared water resources in many basins reveals that some states were able to overcome their differences and negotiate agreements that endured and accrued benefits to all states in the basin while in other cases, conflicts persist. Examples of cooperation in the Indus, Rhine, Mekong, Nile,

Euphrates and Tigris basins illuminate the factors required to bring the riparian states to the negotiating table to agree and cooperate to protect and manage their shared waters. The positive elements imbedded in these negotiations included involvement by the World Bank and the UNDP as a third party, recognition of the economic benefits gained from cooperation, establishment of transboundary institutions with adequate power, sharing and exchanging data and information, and the establishment of a sound water governance system. The author describes each of these factors in more depth, below.

2.2.1 Involvement of a third party

Some scholars have pointed to the positive outcomes that result from third party involvement in the resolution of water conflicts, especially in basins that have a history of conflict. Zawahri (2009), for example, argues that the involvement of a third party can lead to the signing of treaties regarding international waters and improving the likelihood of the implementation of the agreements' provisions. Biswas et al. (1995) argue that an impartial third party can facilitate negotiations between the concerned co-basin states, especially if it can provide financial support to implement the agreement provisions.

Nishat and Faisal (2000) argue that a third party will be more successful in resolving contentious water issues if the costs of the conflict are too high; negotiation is professionally handled; and the concerned states trust the third party. Nakayama (1997) argues that success or failure of the third party involvement in transboudary water issues depends on willingness of riparian countries to cooperate; involvement of decision makers at the highest level of basin countries; and neutrality of the third party with its capability to provide financial assistance.

Examples from the Indus, Nile, and Mekong basins show the importance of the third party in bringing the adversarial states to the table to negotiate and settle their disputes over shared waters. The involvement of the World Bank in the 1960 Indus Water Treaty (IWT), signed between India and Pakistan, was regarded not only as a remarkable example of successful resolution of a conflict between two sovereign countries but also as a landmark in the role of the World Bank as an international mediator (Nakayama, 1997). The IWT called for dividing the waters in the Indus River basin so that the water of the three eastern rivers should be for the use of India and the waters of the three western rivers should be for the use of Pakistan (Nakayama, 1997).

Biswas et al. (1995) argue that the IWT would not have been reached and sustained without the involvement of the World Bank. According to Lowi (1995) and Kliot et al. (2001), the World Bank induced the upper stream state, India, to cooperate and accept the notion of separating the water of the Indus basin and assisted in funding the massive construction connected to the partition of the Indus waters. Elhance (2000) argues that because of the involvement of the World Bank, the IWT continued to be honored despite the advent of two wars in the Indus basin. However, Elhance (2000) does point out that the third party's success would not have been possible without the political willingness and commitment of the concerned parties.

Zawahri (2009) contends that the World Bank demonstrated a leadership role in enabling the signing of the IWT, as well as in overseeing the implementation of its provisions and the establishment of the permanent Indus Commission (PIC). According

to Wolf and Newton (2007), the World Bank provided crucial staff, funding, and proposals all of which made possible the success of the Indus Water Treaty.

In the Nile basin, the involvement of the World Bank and the UNDP was important in the Sudano-Egyptian talks which culminated in the signing of the Nile Agreement of 1959 (Lowi, 1995). The Agreement of 1959 aimed at regulating the Nile River waters and controlling the river flow into the Mediterranean by constructing the High Aswan Dam (Kliot et al., 2001; Metawie, 2004). The Nile Agreement allocated 18.5 billion cubic meters (BCM) of Nile waters to Sudan and 55.5 BCM to Egypt (Kliot et al., 2001).

The water agreement signed in the Mekong River basin is another example that highlights the importance of the third party, the UNDP in this case, in bringing the riparian states to sign the Mekong Agreement in 1995. Signed by Cambodia, Laos, Thailand, and Vietnam, the Mekong Agreement called for setting the rules for maintaining dry season flows, notification procedures, and a basin development plan (Browder, 2000). The Agreement of 1995 also provided for replacing the interim Mekong Committee with a permanent commission called the Mekong River Commission (MRC). The MRC consists of representatives from the four states and includes three permanent bodies: the Secretariat, the Joint Committee, and the Council (Browder, 2000; Chenoweth et al., 20001). Elhance (2000) argues that the role of the UNDP in the Mekong Agreement was essential to overcome entrenched hostilities and suspicions among the four riparian states in the basin. According to Browder (2000), the involvement of the UNDP included providing logistical, financial, and mediation support to the negotiations

all of which were necessary in order to overcome a legacy of mistrust left from the Vietnam War.

Nakayama (1997) states that the success of the UNDP in the negotiation process for the Mekong Agreement was because the basin countries were unable to solve the problems by themselves and were in need of a third party mediator. The UNDP has offices in each basin country as a good channel of news and views, and donor countries and other international organizations supported the UNDP in its efforts (Nakayama, 1997). Through the course of negotiations of the Mekong Agreement, the UNDP used informal meetings to explore whether the four riparian states were willing to collaborate among them, or not (Nakayama, 1997). In order to make the discussions open and constructive, neutral places were chosen to conduct the meetings and no minutes of the meetings were taken (Nakayama, 1997).

In the Great Lakes basin, the IJC is viewed as a third party because it has an impressive record in preventing and resolving problems on transboundary environmental and water-resource disputes between Canada and the U.S. (Becker et al., 2004). However, the IJC's role in the Great Lakes basin has declined since the signing of the Protocol of 1987. Krantzberg et al. (2007) note that the ability of the IJC to articulate problems was reduced following the Protocol of 1987 because its mandate to review progress toward achieving GLWQA objectives was diminished (Krantzberg et al., 2007). According to Krantzberg et al. (2007), the 1987 Protocol significantly limited the IJC's ability to produce credible information due to removal of many of its coordination functions and its limited ability to acquire the necessary data to review and report on the

Parties' progress in meeting the purpose of the GLWQA. The budget cuts in government that followed the Protocol of 1987 also reduced the IJC's capacity to be an effective fact finder (Krantzberg et al., 2007).

Prior to the 1987 Protocol, the success of the IJC, as a third party, has depended upon the following reasons: 1) impartiality and conflict resolution, 2) joint fact-finding, and 3) promotion of technical cooperation. Since its establishment, the IJC has developed a reputation for impartiality that has earned it respect (Becker et al., 2004; Lemarquand, 1993). The IJC strives to reach decisions based on factual examination and impartial expert opinion rather than on advocacy of national interests (Becker et al., 2004). An example which proves its impartiality in dealing with transbounday issues was the IJC's decision in 1931 with respect to air pollution dispute from a smelter at Trail, British Columbia and its recommendations against the construction of the Garrison Diversion in the United States in 1975 (IJC, 2009).

Promotion of technical cooperation is one of the most important functions of the IJC (Becker et al., 2004). Since its establishment, the IJC has also played a significant role in bringing together people with expertise from both countries to work in the common interests of both governments (Becker et al., 2004). Joint fact-finding is a corner stone of the IJC's practice and it normally takes place through joint investigations and within the IJC's advisory and regulatory boards whose members are drawn equally from both countries (IJC, 1997).

2.2.2 Recognition of the economic benefits gained from cooperation

The economic benefits gained from protecting shared water resources have motivated some states in a basin to sign agreements to collaborate in the management of shared water resources. As Saddler (1986) observes, states will cooperate in protecting and managing their shared water issues when they recognize that unrestricted use of waters leads to depletion and degradation of the commons, with increasingly costly outcomes.

In the Rhine River, the impetus to protect the salmon fish was among the factors that motivated the Rhine riparian states to negotiate several agreements to that end. Production of salmon is an important activity to the Rhine states; it is source of livelihood to the fishermen along the river (ICPR, 2009). The first agreement signed to protect the salmon in the Rhine River and its tributaries from extinction was the Salmon Treaty signed in 1885 by five states in the basin, Switzerland, Germany, the Netherlands, Luxembourg, and France (Frijters & Leentvaar, 2003; Raadgever, 2005). The Salmon Treaty called for efforts to preserve the salmon stock and established the International Salmon Commission (Huisman et al., 2000; Webber, 2000).

Bringing salmon back to the Rhine River was the impetus behind signing the Rhine Action Plan of 1987 (Sadoff & Grey, 2002). Nolkaemper (1996) explains that rehabilitating salmon stocks in the Rhine triggered political and public support for ecosystem recovery of the river (Nolkaemper, 1996). Myint (2001) argues that the reintroduction of the salmon to the river is depending on the achievement of improved water quality and restored hydrological and morphological conditions. Such rehabilitation initiatives require the cooperation of all the Rhine states.

The Rhine Action Plan set the objective that by the year 2000 the ecosystem of the Rhine will have habitat suitable to allow for the return of salmon and other migratory fish (Wieriks & Leidig, 1997). As a result of implementing the Rhine Action Plan, by 2000, the degree of salmon recovery signaled success in ecological improvement in the river (Sadoff & Grey, 2002).

2.2.3 Establishment of transboundary water institutions with adequate power

According to Wolf (1995), one third of water agreements have called for the establishment of a joint water commission to implement the agreements' provisions and to provide a forum for disputes resolution. For example, the Indus Water Agreement between India and Pakistan called for the creation of the Permanent Institution Commission (PIC), to be headed jointly by an Indian and a Pakistani commissioner (Zawahri, 2009). The function of the PIC included management of the distribution of canal waters, exchanging hydrological data and flood warnings, and gathering data on the construction of hydrological infrastructure (Zawahri, 2009).

The Nile Agreement of 1959 also called for the establishment of a joint commission consisting of four members from each country (Metawie, 2004). The commission has its head office in Khartoum; appoints technical and permanent staff, and its budget is funded by the two countries (Metawie, 2004). Since its establishment, the commission has been active in implementing the Agreement provisions as well as working in cooperation with other riparian states in the Nile basin (Metawie, 2004).

To be successful in its work, as Frijters and Leentvaar (2003) argue, any international basin organization should clearly describe the rules of engagement in the

case of a potential conflict or disagreement between members. Such rules should be included explicitly in an agreement. In the Indus basin, the strength of the PIC has been largely attributed to the IWT which provided the PIC with the power to monitor the entire Indus River system and endowed it with substantial conflict resolution mechanisms (Zawahri, 2009). Under Article VIII of the IWT, the Commissioners of the PIC were given the power to conduct inspections and to visit any site through the entire river system (Zawahri, 2009). Since its establishment, the PIC has remained a resilient and effective institution even while diplomatic relationships between the two states deteriorated (Zawahri, 2009). By way of example, during the war initiated in 1965 between India and Pakistan, the members of the PIC continued to implement the treaty and manage the Indus River (Zawahri, 2009).

Compared with the PIC, the transboundary institutions created from the agreements between Turkey, Syria and Iraq over the Euphrates and Tigris Rivers and between India and Bangladesh over the Ganges-Brahmaputra-Meghna (GMB) River have been considered ineffective in the resolution of the common water issues between the parties. Nishat and Faisal (2000) argue that the Ganges Agreement signed in 1996 between India and Bangladesh did not provide the Indo-Bangladesh Joint Commission (IBJC) with sufficient authority to identify and implement effective solutions[2]. As a result, the IBJC failed to deliver timely solutions to contentious issues over common

[2] The Ganges Agreement of 1996 calls for augmenting the flow of the Ganges River in the dry season as well as sharing arrangements for Ganges-Brahmaputra-Meghna River system (GBM) (Nishat and Faisal, 2000).

waters (Nishat & Faisal, 2000). According to these authors, the IBJC is simply a recommending body and suggestions put forward by it are often not accepted.

Like the Ganges Agreement, the Turkey-Syria-Iraq water agreement signed in 1974 over the Euphrates and Tigris Rivers did not provide the joint commission with adequate authority to fulfill its functions, the means to resolve disputes, and the powers for the commissioners to fulfill their responsibilities. Not surprisingly, a permanent situation of conflict exists between the Euphrates and Tigris Rivers riparian states (Zawahri, 2009).

In the Great Lakes basin, the IJC was established as an organization designed to resolve transboundary environmental and water-resource disputes and to avoid conflict that would arise between the U.S. and Canada (Botts & Muldoon, 2005; IJC, 1997). However, the IJC was given limited authority and was not given the responsibility for project implementation (Becker et al., 2004). Although the IJC has some quasi-judicial powers regarding the approval of new development projects affecting transboundary waters which may harm interests located on the other side of the international border, it has essentially advisory and monitoring functions (Becker et al., 2004).

Advocates for a stronger role of the IJC identify weaknesses in a number of areas. First, the IJC depends financially for its functioning on the governments and the commissioners are appointed by their respective governments (Becker et al., 2004). Second, the governments are under no obligation to accept IJC advice or even respond to the IJC on the advice rendered (Lemarquand, 1993). Third, the IJC has no formal relationship with states and provinces on matters within their jurisdictional competence

and no authority to determine that jurisdiction or responsibility (Baim, 1997). Without such authority, the IJC cannot remedy the problems of implementation that go unchecked (Baim, 1997).

To strengthen the IJC, a wide range of reforms has been suggested. Some reforms seek to improve the performance of the Commission through better staffing; terms and duties of the Commissioners; more secure and satisfactory funding from the governments; and allowing the public to participate in the process of selecting Commissioners (Botts & Mulddon, 2005; Jackson & Sloan, 2008; Krantzberg et al., 2007; Lemarquand, 1993). Other types of reforms concentrate on expanding the Commission's jurisdiction and authority in order to carry out its role more effectively.

2.2.4 Sharing and exchanging data and information

Various scholars have pointed to the importance of sharing and exchanging data and information for the successful management of shared water resources. For example, Abrams (2000) and Biswas et al. (1995) consider it as an important measure in that it builds trust among the riparian states, which is a necessary condition for successful transboundary water cooperation. Chenoweth and Feitelson (2001) explain that the exchange of data and information relating to transboundary water resources is the appropriate starting point for more comprehensive cooperation.

Given the importance of data and information exchange, a number of bilateral and multilateral water Agreements have obligated the states to share data with other states in the basin. For example, the Mekong Agreement called for reciprocal transfer of data and information among the four riparian states as an essential prerequisite for planning,

design and operation of water resources development projects in the basin (MRC, 2005). Under the Mekong Agreement, sharing data and information exchange should be based on an efficient, equitable, reciprocal and cost effective manner, and it should be relevant, timely and accurate, and exist in established usable formats for MRC and its member countries (MRC, 2005).

The Indus Water Treaty also called for data and information exchange between India and Pakistan. Under Article VI of the treaty, the two states agreed to regularly exchange data relating to the flow of the rivers and extractions from the reservoirs (The World Bank, 2009). To confirm the accuracy of the exchanged information, the commissioners were given the power by the Agreement to conduct inspections of the entire river system and to visit any site work (Zawahri, 2009).

In the Great Lakes basin, the GLWQA of 1972 and 1978 called for free and open sharing of data. Article VIII of the GLWQA of 1972 stated that "each Party shall make available to the other at its request any data or other information in its control relating to water quality in the Great Lakes System" (Canada & United States, 1972). Also, the two agreements called for providing the IJC with any data or other information relating to water quality and made the IJC responsible for collecting, analyzing, and disseminating water quality data (IJC, 2006). However, the 1987 Protocol transferred major data collection and reporting responsibilities from the WQB, the principal advisor of the IJC, to the governments (IJC, 2006). Also, the Protocol provided that the parties represented by the lead agencies should consult directly with each other instead of the consultation through the IJC (Botts & Muldoon, 2005). To achieve this goal, the parties established a

new institution, the Binational Executive Commission (BEC), to coordinate their work plans for implementation of the agreement and to evaluate progress (Botts & Muldoon, 2005). Additionally, the parties began to have their biennial meetings independent of the IJC under the State of the Lake Ecosystem Conference (SOLEC) (Botts & Muldoon, 2005). The SOLEC agendas are determined solely by the BEC with no input from the IJC (Botts & Muldoon, 2005).

Before signing the Protocol of 1987, Environment Canada and the USEPA were obligated by the GLWQA to provide information to the WQB on progress such as the number of municipal treatment systems that had or had not achieved the level of removal of phosphorous (Botts & Muldoon, 2005). The IJC then used information provided by the WQB in preparing its biennial reports to the governments (IJC, 2006).

2.2.5 Establishment of a good water governance system

Worldwide, there is debate on how to enhance the water basin management in a transborder context and how to increase effectiveness of specific river basin accords (Nikitina et al., 2009). As part of this debate, the issue of making water governance effective has been among the main requirements to achieve effective management of shared waters (AlHwatson et al., 2007; Nikitina et al., 2008; Rogers & Hall, 2003).

Rogers and Hall (2003) define the water governance to be a culmination of the political, social, economic, and administrative systems that are in place to regulate the development and management of water resources and provision of water services at different levels of society. Similarly, the UNDP (2004), water governance encompasses the political, economic and social process and institutions by which governments, civil

society, and the private sector make decisions about how best to use, develop and manage water resources.

On a national level, water governance is more than water legislation, regulations and institutions, though these are important components (UNDP, 2004). It is also the process that promotes public participation, ownership, co-investment, capacity building, and incentives for participation (UNDP, 2004). On a basin level, water governance is critical for resource planning and allocation among riparian states and vital for conflict resolution to defuse upstream-downstream tensions and balance the needs of different groups sharing water resources (UNDP, 2004).

Some international organizations (e.g. UNDP) and scholars consider the current water crisis as a crisis of governance (Plummer & Slamaker, 2007; Rogers & Hall, 2003). Barreira (2006) considers that resolving water governance problems will lead to the achievement of sustainable water resources management and development. Nikitina et al. (2008) also consider that the problems related to water quality and water quantity are rooted in failures to establish good water governance.

The European Commission (EC) considers the governance system as good if it includes: openness, participation, accountability, effectiveness and coherence (Rauschmayer et al., 2009). According to Hirsch (2006), good governance is often understood to constitute the rule of law, effective state institutions, transparency and accountability in the management of public affairs, respect for human rights, and the participation of all citizens in the decisions that affect their lives. The necessary conditions for good governance, according to Rogers and Hall (2003), are: inclusiveness,

accountability, participation, transparency, predictability and responsiveness. According to them, if these conditions do not exist, then a system suffers from poor governance. Poor governance can lead to increased political and social risk, institutional failure and rigidity and deterioration in the capacity to cope with shared problems (Rogers & Hall, 2003).

Sogbi and Fraviga (2007) argue that an effective governance structure can be established if the decision-making process increases the opportunities for public involvement from consultation to environmental impact assessment and co-management. Krantzberg et al. (2007) argue that good governance requires an open and transparent decision-making process, information availability, inclusion of communities, and coherence and integration. An open and transparent process requires that institutions involved in water management should use language accessible and understandable to the public and the process of making decisions should be visible and clear so that each step taken during the formulation of decisions is easily followed (Rogers & Hall, 2003).

Nikitina et al. (2008) emphasize that stakeholders' participation in the Amur River basin agreement between Russia and China was a powerful tool in good water governance because it consolidated institutional capacity for related problem-solving.

Barriera (2006) considers that water governance in Europe is effective because it is premised on openness and transparency, inclusion and communication, and coherence and integration. The basic elements which contributed to effective water governance in European Union member states have been adopted by the Water Framework Directive (WFD) (Barriera, 2006). The WFD represents the primary water policy legislation in the

European Union. It requires member states to establish institutional structures for governing water at the level of each river basin (Rauschmayer, 2009). The WFD obliges the European Union member states to ensure public information and consultation and to encourage active involvement of stakeholders in river basin management (Rauschmayer, 2009). Furthermore, the directive entails monitoring of the participatory governance processes, including an assessment of the extent to which stakeholder input changes the river basin management plan (Rauschmayer, 2009).

In the Great Lakes basin, the governance system is considered complex and identified as one of those areas that need improvements in order to achieve better implementation of the Great Lakes Water Quality Agreements. Responsibility for the water management of the Great Lakes is divided between a large number of organizations, both domestic and international (Valiante, 2008). Domestically, both the US and Canada have a federal system of government, dividing jurisdiction between a federal government, and states and provinces. In the US, the states have primary authority over water resources, but the federal government plays the lead role on water quality standards (Valiante, 2008). In Canada, provinces have primary authority over natural resource development and environmental protection, but the federal government has authority over navigation, fisheries, and international relations.

In both countries, there are also aboriginal communities scattered throughout the basin with some governing authority over the issues of the Great Lakes (Bertram, 2003). Beyond these governments, there are hundreds of municipalities within the basin that

have authority over decisions affecting land use, waste management, sewage treatment and storm water management (Valiante, 2008).

There are also a number of binational organizations with significant roles in restoring and protecting the Great Lakes (Valiante, 2008). The most well-known and most important organizations are the IJC and the Great Lakes Fishery Commission (GLFC) (Valiante, 2008). The GLFC was established in 1955 consisting of eight members, four from each country, and a secretariat staff in Ann Arbor, Michigan (GLFC, 2009). Its mandate relates to the coordination of fisheries research, recommendation of measures to ensure a sustainable fishery, sea lamprey control and implementation of joint fisheries management plans (GLFC, 2009).

According to Jackson and Sloan (2008), the key factors that inhibited the establishment of good water governance structures in the Great Lakes basin are: lack of transparency and clarity of the government's commitments and priorities, inadequate public involvement in policy-making and decision-making, and weakness of coherence and integration. The IJC concluded that the Great Lakes are not managed effectively in part because the governance structure is incoherent, with too many organizations, and no centralized decision-making body (IJC, 2008).

Good governance in the Great Lakes basin means that governments would exhibit effective accountability within and among federal departments and their partners, clear roles and responsibilities, transparency, and the measuring and reporting of results (Jackson & Sloan, 2008). It would also mean that government programs and policies are coherent, in that they are well integrated and coordinated across and within government

departments (Jackson & Sloan, 2008). Good governance means governments are able to demonstrate effectiveness in achieving the objectives and commitments they set for themselves and those objectives are meaningful and overall aims are relevant to the lives and needs of Canadians (Jackson & Sloan, 2008). Finally, it means that the government has in place measures that sustain a national focus on the Great Lakes (Jackson & Sloan, 2008).

Krantzberg et al. (2007) concluded that the current state of governance in the Great Lakes basin could be improved by increasing the accountability and responsibility, sharing of duties and obligations, and inclusion of communities. Promotion of accountability could be achieved if there are regular progress reports and clear lines of bureaucratic responsibility (Krantzberg et al., 2007). The IJC recommended that accountability can be improved if the GLWQA specify the actions to be taken, by whom and when, how reporting back will occur and the consequences of inaction (IJC, 2006).

Ellison (2008) believes that governance in the Great Lakes basin can be strengthened through a better understanding of the appropriate forms of leadership and leadership expectations in multi-jurisdictional organizations: leaders mainly act as facilitators, not directors. Jackson and Sloan (2008) argue that the governance structures in the Great Lakes basin can be strengthened by: 1) engagement of the public in policy and decision making, 2) clarification of responsibilities within the federal government about who is responsible for what, and 3) reporting on the state of the Lakes, the state of action plans and programs, and the state of progress in implementing the Agreement.

Chapter Three: The St. Clair and the Detroit Rivers Areas of Concern and their Remedial Action Plans

3.1 Introduction

The St. Clair and Detroit Rivers serve as connecting channels between Lake Huron and Lake Erie in the Great Lakes basin and comprise part of the boundary between the State of Michigan and the Province of Ontario (Figure 2) (Holtschlag & Koschilk, 2002). The St. Clair River originates from Lake Huron and flows 64 km southerly until discharging into Lake St. Clair at 5150 m^3/s (Holtschlag & Koschik, 2002). Prior to entering Lake St. Clair, the river divides into several channels creating the extensive St. Clair delta (St. Clair River RAP Team, 1991). The Detroit River is the lowest link from the Upper Great Lakes. It receives water from Lake St. Clair and then flows 51 km to Lake Erie (EC, 2008; Holtschlag & Koschik, 2002). The average discharge of the Detroit River into Lake Erie is 5270 m^3/s (Holtschlag & Koschik, 2002).

In 1985, the St. Clair and Detroit Rivers were identified as Areas of Concern (AOCs) in the Great Lakes basin due, in part, to restrictions on fish and wildlife consumption, beach closings, and restrictions on dredging (Suker, 2001). Causes of the problems in the two rivers were cited as municipal and industrial discharges, urban non-point sources, combined sewer overflows and contaminated sediments (Suker, 2001).

In order to restore and protect the beneficial uses in the two rivers, the governments of Canada and the United States decided to undertake binational RAPs in each of the two rivers (St. Clair River RAP Team, 1991). To achieve this common goal, in advance of initiation the development of the RAPs in 1987, the Ontario-Michigan

Letter of Intent on Shared Areas of Concern was signed by the Governor of Michigan and the Premier of Ontario in 1985 (St. Clair River RAP Team, 1991)[3].

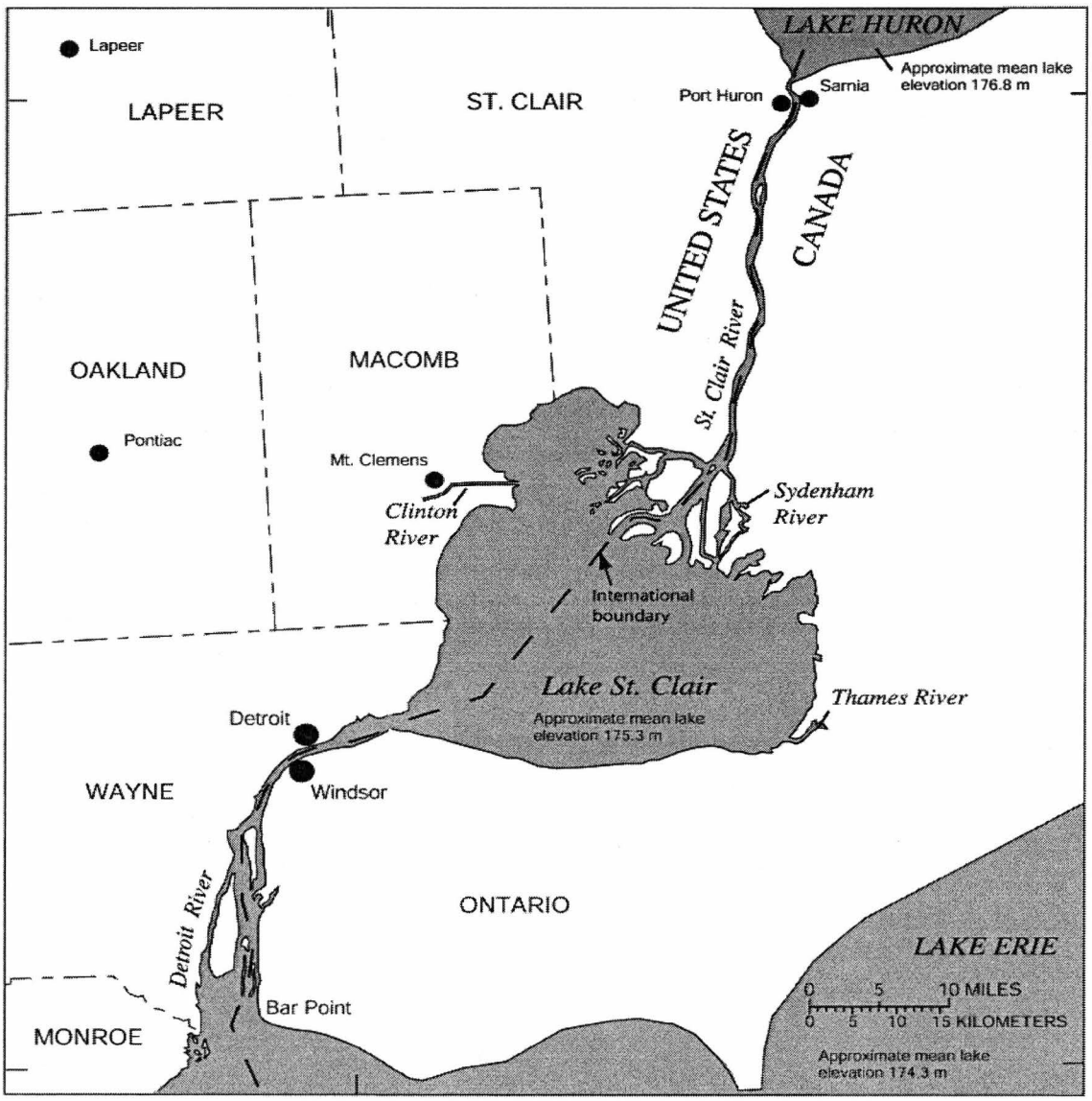

Figure 2: The St. Clair and the Detroit River Map (Source: Holtschlag & Koschik, 2002).

[3] The development of binational RAP of the St Marys River was also included in the Letter of Intent of 1985. However, the focus of this thesis is on the Binational RAPs in the St. Clair and the Detroit Rivers.

The Ontario-Michigan Agreement (OMA) specified that the RAPs in the two rivers would be jointly developed with the overall responsibility for coordinating the implementation of the RAPs resting on two lead agencies; the Ontario Ministry of the Environment (OMOE) on behalf of Canada-Ontario Agreement and the Michigan Department of Natural Resources (MDNR) on behalf of Michigan State (Becker, 1996). The development of binational RAPs for the St. Clair and the Detroit Rivers AOCs occurs along the following stages, as specified in the GLWQA, Annex II:

1) "A definition and detailed description of the environmental problem in the Areas of Concern, including a definition of the beneficial uses that are impaired, the degree of impairment and the geographic extent of such impairment; and a definition of the causes of the use impairment, including a description of all known sources of pollutants involved and an evaluation of other possible sources;

2) An evaluation of remedial measures in place; an evaluation of alternative additional measures to restore beneficial uses; a selection of additional remedial measures to restore beneficial uses and a schedule for their implementation; and an identification of the persons or agencies responsible for implementation of remedial measures;

3) A process for evaluating remedial measure implementation and effectiveness; and description of surveillance and monitoring processes to track the effectiveness of remedial measures and the eventual confirmation of the restoration of uses" (IJC, 1994).

With the signing of the 1985 Letter of Intent, a Binational Remedial Action Plan Committee or RAP Team was created for each river to develop the RAPs. The RAP team consisted of agency employees from the Ontario Ministry of the Environment (OMOE), the Michigan Department of Natural Resources (MDNR), the Ontario Ministry of Natural Resources (OMNR), Environment Canada (EC), Department of Fisheries and Oceans Canada (DFO), and the U.S. Environmental Protection Agency (EPA) (Suker, 2001). The main responsibility of the RAP team is to produce and oversee the analysis of environmental conditions and their sources, the recommended remedial measures to be implemented to restore beneficial uses in the two Areas of Concern, and the implementation of the remedial measures.

In order to fulfill the commitments to public participation that the parties set out in Annex II of the GLWQA a Binational Public Advisory Committee (BPAC) was created for each of the two rivers comprised of members representing different sectors, such as industry, environmental groups, and aboriginal organizations (Suker, 2001). The main function of the BPAC is to ensure that the general public's views are addressed during development of the RAP (St. Clair River RAP Team, 1991). Four members from the BPAC were elected as delegates to the RAP Team in order to better facilitate communication between the RAP Team and the public (St. Clair River RAP Team, 1991). In 1998, a commitment for the restoration of the shared AOCs was reconfirmed when the four agencies, EC, Michigan Department of Environmental Quality (MDEQ), OMOE, and EPA signed a letter of commitment (DRCC, 2009). This letter identifies roles and responsibilities of the Four Agencies for the three shared AOCs (that is, the St.

Marys, St. Clair and Detroit Rivers), and details commitments and strategies towards delisting the shared AOCs (Environment Canada, 2008). The primary responsibility for the administration of the St. Clair RAP was given to the Canadian Agencies and for the administration of the Detroit River RAP it was given to the U.S. Agencies (Environment Canada, 2008).

Since signing the Letter of Intent of 1985, only three of nine of the beneficial uses for the St. Clair River AOC have been restored, while none of the beneficial uses in the Detroit River AOC have so far been restored (IJC, 2003; EC, 2008; DRCC, 2009). Several IJC reports have pointed to causes that have stymied the effectiveness of RAPs in general. According to those reports, lack of leadership, decline of the governments' support to the RAPs, and the lack of accountability represent the main constraints to progress in implementation of the RAPs (IJC, 1997). This thesis delves deeper into other factors that impede progress in restoration of the beneficial uses in the AOCs and presents some recommendations advance the implementation of the RAPs for the St. Clair and Detroit Rivers.

3.2 Overview of the St. Clair River Remedial Action Plan

The Stage 1 Report of the St. Clair RAP was released in 1991 and provided a definition of the problems, sources and causes of impairments of beneficial uses, and listed nine beneficial uses impairments (Table 1) (St. Clair River RAP Team & St. Clair River BPAC, 1995). According to St. Clair River Stage 1 Report, the boundaries of the St. Clair River AOC include the entire river from the Blue Water Bridge to the southern tip of Seaway Island, west to St. John's Marsh and east to include the north shore of

Mitchell's Bay on Lake St. Clair (St. Clair River RAP Team, 1991). As shown in Figure 3, a number of tributaries flow into the St. Clair River. In Canada, the principal tributary to the St. Clair River is Talfourd Creek; smaller tributaries include Baby, Bowens, Clay, Marshy and Murphy Creek (St. Clair River RAP Team, 1991). In the United States, the principal tributaries to the river are the Black, the Pine, and the Belle Rivers (St. Clair River RAP Team, 1991). Smaller tributaries which drain into the St. Clair River from the American side include Bunce Creek and Marine City Drain (St. Clair River RAP Team, 1991).

Beneficial Use Impairment (BUI)	Causes of BUI
Restrictions on Fish and wildlife consumption	Mercury and PCBs
Degradation of benthos (aquatic bottom dwelling)	Various organic and inorganic chemicals were bio-accumulated in several types of benthic organisms
Restriction on dredging activities	Concentration of cooper, cadmium, chromium, and PCBs exceed OMOE guidelines
Restrictions on drinking water consumption	Chemical spills at water filtration and treatment plants in Michigan and Ontario
Taste and Odor problems	The ethylbenzene exceed the Health and Welfare Canada taste and odor aesthetic objective
Beach closing	Coliform bacteria levels exceed both Ontario and Michigan standards
Degradation of Aesthetics	Floating scum, oil slicks and spills
Added costs to agriculture and industry	Upstream spills and contaminated sediment

Loss of fish and wildlife habitat	Filling, draining, and dredging for industrial, urban, agriculture, and navigational uses

Table 1: Beneficial Uses Impairments in the St. Clair River AOC (Source: St. Clair River RAP Team: 1991).

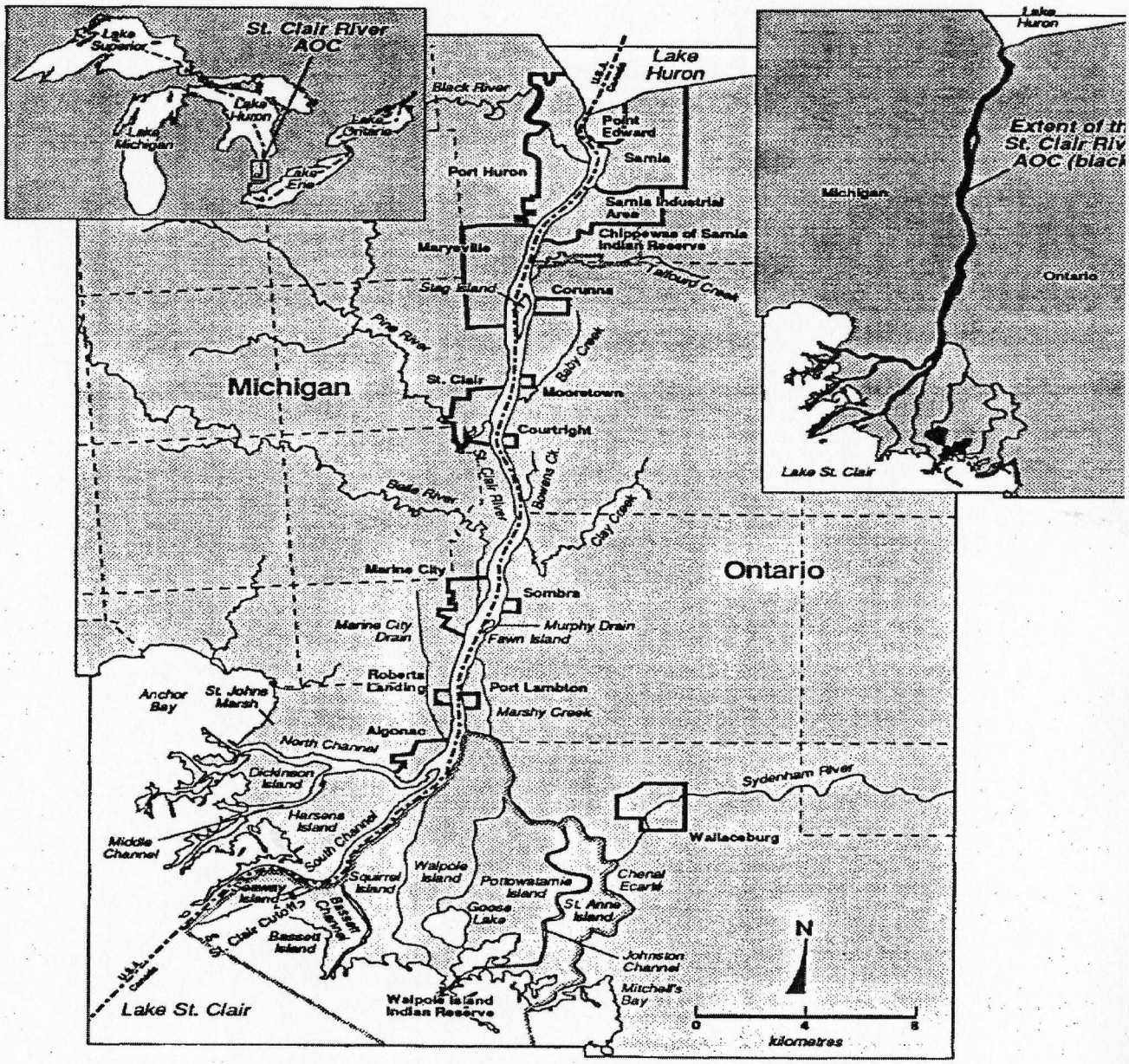

Figure 3: The St. Clair Area of Concern (Source: St. Clair River RAP Team, 1991).

According to the Stage 1 Report, municipal and industrial point sources were identified as significant contributors of metal and organic contaminants to the St. Clair River (St. Clair River RAP Team & St. Clair River BPAC, 1995). There are 56 points sources discharging into the St. Clair River and its tributaries from Michigan and Ontario (St. Clair River RAP Team, 1991). Industrial sources of pollutants to the St. Clair River in Ontario originate primarily from the petroleum, inorganic chemical, and the organic chemical sectors. In Ontario, there are 27 industrial facilities that discharge effluents directly or indirectly into the St. Clair River. In Michigan, there are six major industrial direct dischargers to the St. Clair River (St. Clair River RAP Team & St. Clair River BPAC, 1995).

Urban areas represent a significant non-point source of contaminant loads to the St. Clair River. Loadings from Ontario urban areas generally account for more than 10% of the total contaminant input to the River. Contamination from urban areas is attributed primarily to urban storm water discharges, combined sewer overflows, and septic systems. The cities of Sarnia, Ontario, Port Huron and Marysville, Michigan are the only municipalities within the St. Clair watershed with combined sewer overflows. According to the St. Clair River Stage 2 Report, there are 108 sewer overflows per year in Sarnia, 8 overflows per year in Port Huron, and 12 overflows per year in Marysville Clair that discharge directly into the St. Clair River (St. Clair River RAP Team & St. Clair River BPAC, 1995).

In 1995, the Stage 2 Report of the St. Clair River RAP was released. This report outlined the roles and responsibilities of each agency and facility involved in the RAP

process and their respective actions necessary to achieve specified goals under specified time lines (Geomatics International Incorporation, 1998; Suker, 2001). It established 45 specific actions in order to ultimately restore each of the identified beneficial uses (EC, 2008). These actions addressed:

1) point and non-point pollution sources, sediment, and habitat

2) public education and outreach, and

3) monitoring and research (Mayne, 2006).

Since 1995, many municipalities and industries in the St. Clair River AOC have implemented correctives measures for improving air emissions and water effluent quality, and reducing or eliminating spills (Mayne, 2006). As a result, loadings of persistent toxic substances to the St. Clair River have been reduced (Mayne, 2006). In 1997, improvements in the St. Clair River were documented in the St. Clair River Remedial Action Plan - Stage 1 Update Report (Mayne, 2006). Consequently, it was recommended that the status of three of the nine BUIs be redesignated. The beneficial use impairments of "restrictions on drinking water consumption or taste and odor problems", "added costs to agriculture or industry" and "bird or animal deformities, or reproductive problems" changed from the impaired status to not-impaired (EC, 2008; Mayne, 2006).

3.3 Overview of the Detroit River Remedial Action Plan

The Stage 1 RAP process began in the Detroit River AOC in 1987 and was completed in 1992 (EPA, 2008). The Stage 1 Detroit River RAP defined and provided a detailed description of the several environmental problems affecting the Detroit River

AOC (EPA, 2008). According to the Stage 1 Report, the boundaries of the Detroit River AOC include an area of approximately 2100 km^2, 75% of which is on the U.S. side (Figure 4) (EC, 2008; DRCC, 2009). As shown in Figure (4), there are five tributaries of the Detroit River on the U.S. watershed. These tributaries are: Ecorse Rivers; the Frank and Poet drain, Marsh and Monguagon Creeks, and the Rouge River which is itself a separate AOC and is considered a point-source to the Detroit River (Manny & Kenaga, 1991; EC, 2008). The main tributaries of the Detroit River in the Ontario side are: the Little River, Turkey Creek and Canard River (DRCC, 2009). Eight impaired beneficial uses were identified in the river and the causes of the impairments were linked to combined sewer overflows, contaminated sediments, and discharges from municipal and industrial sources (IJC, 1997). The impairment of beneficial uses included:

Restrictions on fish and wildlife consumption,
Restriction on dredging activities,
Beach closing,
Degradation of benthos,
Fish tumors or other deformities,
Restrictions on drinking water consumption or taste and odor problems,
Degradation of aesthetics, and
Loss of fish and wildlife habitat

In 1996, a draft Stage 2 Report of the Detroit River AOC was released. This report recommended 104 remedial activities including 31 recommendations for the Canadian portion of the Detroit River AOC and 73 recommendations for the U.S. portion of the Detroit River AOC (EC, 2008; EPA, 2008). The draft report also updated the status of beneficial uses impairments and identified the contaminated sediment as a major cause of beneficial use impairments (IJC, 1997; DRCC, 2009). However, due to disagreement

on the central components in the Stage 2 draft report, namely the required environmental interventions, responsibilities and schedules for their completion, members of the BPAC refused to endorse the report and walked out of the BPAC meeting held to discuss the release of the draft report (DRCC, 2009). After the walkout, the RAP process essentially stalled until 1998 when Environment Canada initiated the creation of the Detroit River Canadian Cleanup (DRCC) (Coulter, 2008)[4]. The purpose of the DRCC was to develop and implement Canadian domestic cleanup activities for the river (DRCC, 2009). The Detroit River Remedial Action Council (DRRAC) was established to develop and coordinate the cleanup activities on the U.S. side (Suker, 2001). In 1998, the governments of Canada, United States, and the Province of Ontario and the State of Michigan signed another agreement reaffirming their commitment to cleaning up and delisting the Detroit River AOC. Despite this written commitment, implementation of the RAPs has proceeded separately for each side of the river (DRCC, 2009).

Since the breakdown of the binational nature of this RAP, the US focus has been on sediment cleanup, the cause of many of the BUIs, along with efforts to engage discharges of pollutants principally from municipalities (Coulter, 2008). Cleaning up the contaminated sediment in the Black Lagoon in Trenton, Michigan was the first project chosen to be funded by the Great Lakes Legacy Act (EPA, 2005)[5]. The project began in

[4] The DRCC consisted of four main committees- Implementation Committee (implementers, dischargers, and technical people), Outreach Committee (public involvement and education), Public Advisory Committee (oversight) (DRCC, 2009). The Steering Committee was recently expanded to include the chairs of the other committees as full members (Coulter, 2008).

[5] The Great Legacy Act was passed by the Congress in 2002 with the aim of providing dedicated funding for cleaning up toxic sediments in the U.S. AOCs (Great Lakes Commission, 2007).

2004 and included removal of 115,000 cubic yards of contaminated sediment (EPA, 2005).

On the Canadian side, priorities have concentrated on: 1) Shoreline softening and habitat restoration, 2) Conducting research on fish and wildlife impairments and population status, and 3) Public education and outreach (Coulter, 2008). Sewer system upgrades have been implemented on both sides of the river and this includes separation of combined sewers, upgrades of treatment plants, and CSO control facilities (Coulter 2008, DRCC, 2009).

Currently, each country is working on the development of its own Stage 2 Report. According to the DRCC (2009), The Detroit River Canadian Stage 2 RAP Report will provide a description of the remedial measures required to complete actions necessary to delist the Canadian side of the Detroit River AOC. This report will also provide an updated status of each of the 14 BUIs, revised delisting criteria that set the targets to be achieved for each BU to be considered delisted or not impaired, and a work plan detailing the specific actions required to meet the delisting criteria for each BUI (DRCC, 2009).

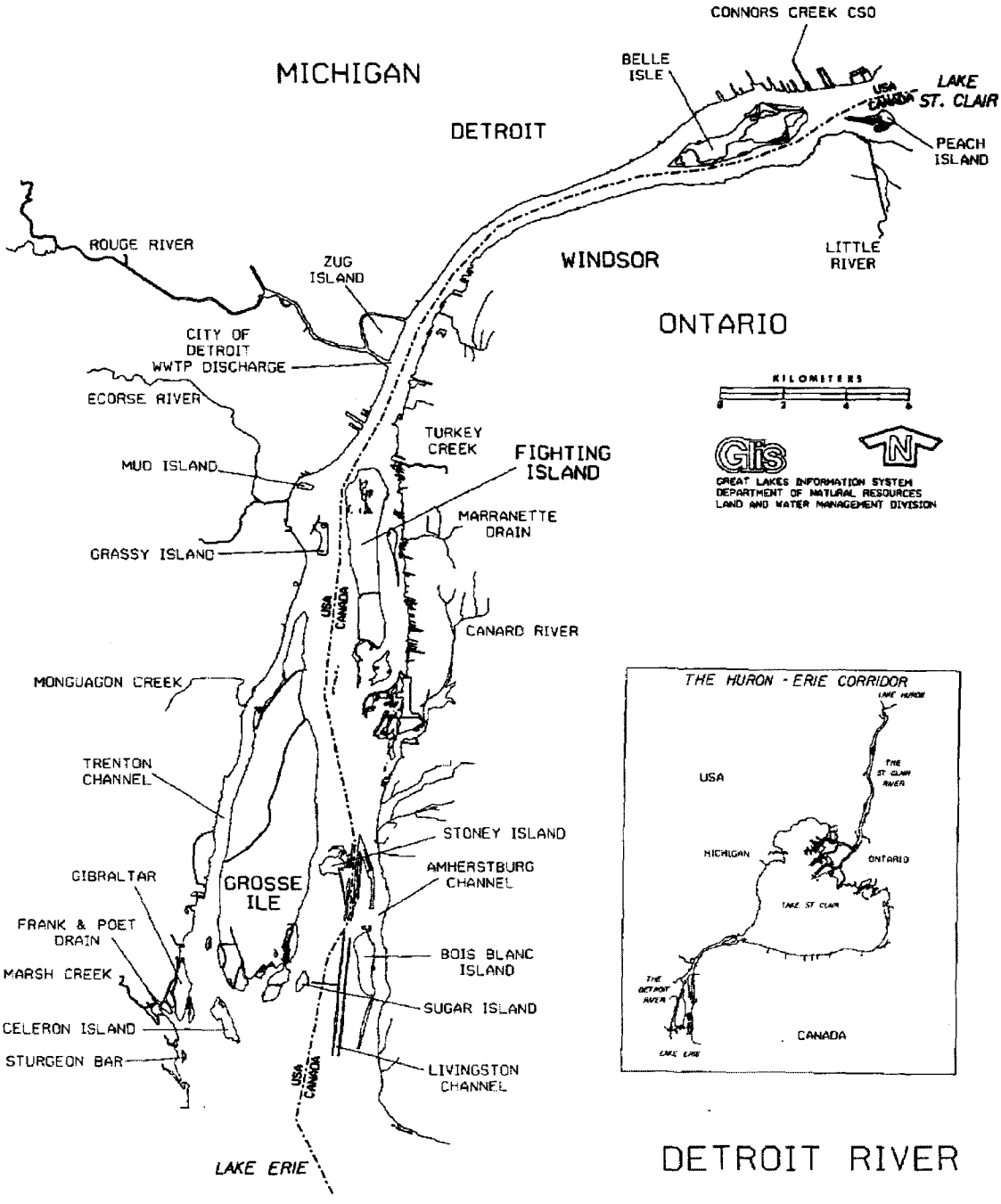

Figure (4): Detroit River AOC (Source: Manny & Kenaga, 1991).

3.4 Factors impeding RAP implementation for the St. Clair and Detroit Rivers

As compared to the successes in the Great Lakes region that accrued prior to 1987, the period from 1987 forward describes a system faced with more obstacles to attain the purpose of restoring and maintaining the waters in the Great Lakes basin. Since signing the Protocol of 1987, progress toward delisting and restoring beneficial uses in the Areas of Concern has been slow (Botts & Muldoon, 2005; IJC, 2006). Cleanup and restoration actions have been completed for only five of the 43 AOCs and none of them have been binational (IJC, 2006)[6]. The overall outcomes of the RAPs for the St. Clair and the Detroit Rivers have been rather modest. Only three of nine of the beneficial uses that were identified in the St. Clair River have been restored, and none of the beneficial uses in the Detroit River AOCs have been restored (DRCC, 2009; EC, 2008; IJC, 2003).

Some factors impeding implementation of the RAPs were identified by the IJC in 2003 and encompassed: lack of accountability; lack of leadership; and decline of the governments support to the RAPs (IJC, 2003).

Based on empirical evidence collected for this dissertation, other significant impediments include: 1) the inability to understand and incorporate the ecosystem approach in developing and implementing remedial action plans; 2) the high costs

[6] The AOCs that were de-listed are: Oswego River AOC, in the State of New York; Collingwood Harbour and Severn Sound are both in the Province of Ontario (IJC, 2006). The two AOCs which are considered to be Areas in Recovery are Spanish Harbour in Ontario and Presque Isle Bay in Pennsylvania (IJC, 2006).

required for remediation; 3) the non-binding nature of the GLWQA and hence, RAPs; 4) the lack of public involvement; and 5) disagreement on common delisting targets.

1. **The inability to understand and incorporate the ecosystem approach in developing and implementing remedial action plans**

The GLWQA of 1987 recommended that the RAP practitioners apply the ecosystem approach as described in the Annex II of the Agreement to restore the beneficial uses in the Great Lakes Areas of Concern (IJC, 1994). Hartig et al. (1998) describe that an ecosystem approach "incorporates the interrelationships among land, air, water, and all living things, including humans, and involves all users groups in comprehensive management". However, applying this approach to the RAPs has made implementation more challenging. Drawing on the findings of Mackenzie (1997) and Jones & Taylor (1999) it is apparent that incorporating the ecosystem approach in the RAPs has led to the following consequences:-

- **Differences in opinion whether the scope of the RAP is water quality in receiving water or ecosystem health within the watershed(s)**

By incorporating the ecosystem approach, RAP implementation has been directed towards watershed-based planning and decision-making. While this is laudable, the strict focus of RAP efforts towards restoration of beneficial uses in the receiving waters diverged, so that efforts to improve the river ecosystem were not specifically designed to advance the RAP towards restoration of beneficial uses in the receiving waters (Coulter,

2008). For example, numerous projects in the St. Clair and the Detroit Rivers watershed were undertaken purportedly under the auspices of RAPs, but they were not specifically aimed at achieving the delisting objectives. This has been the case, for example, with upland tree planting projects on the Canadian side of the Detroit River and planting 21,150 native trees and shrubs, and 18,535 native wildflowers on the Rouge River watershed (Government of Canada, 2006).

According to Coulter (2008), upland tree planting projects on the Canadian side of the Detroit River fulfill Canada's efforts to increase forest cover and interior bird species. However, she argued that "it would be hard to make an argument that planting a woodlot kilometers from a tributary and even more kilometers from the Detroit River moved the RAP forward" (Coulter, 2008). Using AOC resources to restore upland habitat diverts resources from the specific issues that led to listing the AOCs in the first place. If the focus on restoring degraded conditions is lost, environmental rehabilitation and protection in the region will continue, but the RAP itself will not be completed. The RAPs' effort should focus on where the real problems lie, and try to minimize the efforts that will have marginal or cosmetic impacts (Ellison, 2008).

Coulter (2008) argued that "it is very easy to get drawn into a number of very worthwhile activities that would benefit the river, while not necessarily moving the RAP forward, and it is very difficult to avoid that, especially when some non-RAP issues are much more interesting to the public than the restoration of the beneficial uses".

Issues that command public attention include bottled water, water diversions, and climate change, but these are matters outside the capacity of a single RAP to tackle. Issues that are difficult to convey to the public such as contaminated sediment and combined sewer overflows are however central for the RAP to address[7].

- **Conflict among the RAP practitioners in the interpretation of what it means to achieve a particular delisting target**

Some RAP practitioners argue that in order to achieve delisting criteria for a BUI in an AOC, it is necessary to achieve the BUI delisting criteria throughout the entire watershed. Ellison (2008) argued that if there are impairments to the river caused by sources outside the AOC but within the larger watershed those source areas can be recognized and included in the AOC through actions to address the impairments. However, Ellison (2008) points out that if E.coli coming from a tributary is resulting in standards being exceeded in the St. Clair AOC then actions to address the Beach Closing BUI would include the tributary where the source is located to restore receiving water quality. Other practitioners argue that the delisting criteria would have to be met in all reaches of the tributaries. It would be virtually impossible to delist a BUI if we interpret that to mean that each reach and tributary throughout the entire watershed must achieve the objectives identified in the delisting criteria at each location (Briggs, 2008). There is

[7] According to John Gannon (2008), Canadians have largely ignored some RAP issues such as contaminated sediment and instead focused on habitat restoration and other issues in the AOCs where the public could see immediate benefits at relatively low costs.

also conflict among the RAPs practitioners in terms of whether delisting criteria are ecosystem responses (such as E.coli counts) or management actions in the watershed. Briggs (2008) asks if it is necessary to fix all faulty septic systems in the watershed to delist BU in the AOC or whether a 75% buffer on all tributaries will necessary result in environmental responses necessary to delist BUIs. Briggs (2008) argues that while these actions may be worthy and noble, in that they improve the ecosystem health, it is necessary to determine whether they are actually achieving the desired end of restoring the identified beneficial uses.

- **The difficulty, when using the ecosystem approach, in predicting whether the proposed solutions will result in the desired outcomes**

Practitioners in the Detroit River RAP have debated whether sediment cleanup should be prioritized by upstream sites first. The argument for such prioritization was that the presence of contamination upstream would cause re-contamination of any downstream sites should the downstream location be remediated first (Ellison, 2008). With an ecosystem view the logic of the argument is sound, but the management question is whether to delay action on downstream sites until the upstream sites are cleaned (Ellison, 2008). This is what happened with the Black Lagoon Cleanup in Trenton, Michigan. It was a site that was a known problem for a long time and for a number of reasons there was a lot of interest in cleaning it up, but it is in the lower end of the Detroit River (Ellison, 2008). Implementation was partly held up because of the concern that the site would be re-contaminated from upstream sources in the river and there was not a good

enough understanding of contaminated sediment sources, chemistry, and transport in the river to determine if this was true (Ellison, 2008). In the end, the project went forward and the site is currently being monitored to determine if it is being re-contaminated and the nature of the recontamination (Ellison, 2008).

- **The difficulty in determining whether, and to what extent, an impairment in an AOC is a result of local conditions or ecosystem-wide problems**

Researchers generally accept that mercury (mainly from power plants and industry) can be transported long distances in the atmosphere (Mohapatra et al., 2007; DRCC, 2007). Mercury contamination in fish in a specific AOC may therefore be due to sources outside of this area or even outside the Great Lakes basin. If the level of mercury from atmospheric sources alone is high enough to drive the fish consumption advisories in the St. Clair or Detroit Rivers then the RAP itself can do little abate the source (Ellison, 2008). In this case where there are no significant local sources but mercury does exceed consumption advisories in fish in the AOC, the fish consumption advisories could be categorized as impaired, but not due to local sources. Such impairments due to factors outside the AOC should not impinge on the ability to delist an AOC (United States Policy Committee, 2001).

Another example of source-related uncertainty is revealed through a University of Windsor study on the food web in the Detroit River. According to Ellison (2008), two models were run to determine the sources of contaminants in fish. In one model, it was assumed that the water coming from Lake St. Clair was free of PCBs. In this case, the

fish in the Detroit River were contaminated with levels of PCBs high enough to cause fish consumption advisories. This was attributed to contamination sources within the AOC, most likely the Trenton Channel. To reduce PCB levels in fish in the Detroit River would require addressing contaminated sediment in the AOC (Ellison, 2008). However, in another scenario, the model assumed that the water in the Detroit River was free of PCBs, and found that the level of PCBs detected in the water coming from Lake St. Clair were high enough to also drive consumption advisories in fish in the Detroit River. Local action to remove contaminated sediment in the AOC is still appropriate but restoration of fish consumption impairment will require remediation sources of pollution beyond the Detroit River AOC (Ellison, 2008).

2. The high costs required for remediation the AOCs

Although the two governments have a longstanding commitment to cleaning the Great Lakes, from time to time this commitment has waned (Botts & Muldoon, 2005; IJC, 2006). In the U.S., the amount needed to address wastewater infrastructure and sediment improvements necessary to restore beneficial uses was estimated at $7.4 U.S. billion (IJC, 2003). The amount needed for all the Canadian Areas of Concern was estimated at $1.9 billion (IJC, 2003). Expecting governments to address this type of investment is daunting especially considering other societal needs such as health care, education, and market declines (Interview with current official from OMOE, 2008). De Barros (2008) maintains that a long-term strategy with a long term commitment (e.g. 30 yrs.) and a large investment in the Great Lakes needs to be made. A long-term strategy

would have to include a broad partnership base to help in its implementation and cost. More sophisticated communication among senior government officials about the economic value of the Great Lakes is also important in order to keep funding in place for restoration efforts (De Barros, 2008). Recognition of the economic value from Great Lakes restoration could open more willingness to spend/invest. Austin et al. (2007) concluded that investment in protecting and restoring the Great Lakes would generate $50 U.S. billion in long-term benefits.

In 2009, President Obama released his proposed budget for Fiscal Year 2010 which includes a Great Lakes Restoration Initiative (GLIN, 2009). The Initiative will invest $475 U.S. million to confront some of the most serious threats to the region, including invasive species, non-point source pollution and toxic sediments (GLIN, 2009). The Great Lakes Restoration Initiative will be a multiagency effort led by the Environmental Protection Agency (EPA). It will be coordinated by the federal Interagency Great Lakes Task Force, which includes representatives from all of the federal agencies involved in Great Lakes restoration and management activities (Great Lakes Commission, 2009). It is this type of commitment that could put Great Lakes rehabilitation and protection back on track.

3. The non-binding nature of the GLWQA and hence, the RAPs

Experts on the GLWQA point to the non-binding nature of the Agreement as problematic in keeping governments accountable to their promises, and in this case, to RAP implementation. The GLWQA is that it is a good faith document and, therefore,

none of its provisions are legally binding (Gannon, 2008). In 2006, Michigan Department of Environmental Quality (MDEQ) clearly stated that the GLWQA is a non-regulatory agreement between the U.S. and Canada, and the criteria developed under the agreement are non-regulatory in nature (MDEQ, 2006). The states generally view the programs adopted by the Agreement (i.e. the AOCs and the RAPs) as a federal responsibility that should be supported with federal resources (Statewide Public Advisory Council for Michigan's Areas of Concern Program, 2008)[8]. However, there are some enforcement mechanisms that could make the Parties more accountable:

- The public has to remain an active and strong RAP participant, since, according to Beierle and Konisky (1999), public participation in river basin management would generate the community pressure needed to get political support; improve the technical quality of decisions by identifying relevant factual information or discover mistakes; or generate alternative solutions; and resolve conflict and provide opportunities for fostering trust among competing interests.
- The IJC should be more active in urging the governments to live up to its obligations, and in drawing public attention to its failure to do so. The IJC is viewed as the party responsible for tracking the implementation of the RAPs (Becker, 1996). The IJC needs to better understand what is happening in AOCs (De Barros, 2008). With this knowledge, it would be in a better position to make

[8] The Federal Government argued that it had reduced its support for RAPs on the assumption that the states would continue to fund RAP completions (Botts & Muldoon, 2005).

recommendations and offer authoritative advice to the governments on implementation of the GLWQA (De Barros, 2008).

- Integrate RAPs with official municipal plans

  There are no requirements for local levels of government to be engaged in the RAP process (Ellison, 2008). The GLWQA was incorporated into the US federal Clean Water Act (CWA), which provides the legal basis for the Agreement in domestic US law (USGAO, 2002). The CWA sets out the primary role for RAPs to the states (Ellison, 2008). However, the CWA does not lay out any consequences for states that do not fulfill their obligation. There are no requirements in GLWQA, the CWA, or state law or practice to coordinate or integrate RAPs with official municipal plans (Ellison, 2008). In other words, there is nothing compelling municipalities to engage in the RAP and if locals are engaged, they do so voluntarily. In Canada, the lack of municipal involvement in RAP implementation has also limited the progress on the Detroit River RAP (Coulter, 2008). For example, the towns of Essex, Tecumseh, and Kingsville are technically within the Detroit River AOC watershed, but they have not been involved with the RAP (Coulter, 2008). This severely limits the involvement of municipalities in RAP development and implementation, and as a consequence RAP goals and targets were not considered in municipal decision making (Coulter, 2008). Mention here that most of the front line work in keeping beaches open, dealing with sewage and storm water, is the purview of the municipalities that is why their involvement is so necessary.

4. The lack of public involvement

Public involvement has been cited as critically important to RAP implementation for all AOCs in the Great Lakes basin (MacKenzie, 1996; Hartig, 1997). For example, public involvement in Hamilton Harbour and Buffalo River RAPs was cited as one of the strengths of the harbour and the river restoration processes (Beierle & Konisky, 1999; Environment Canada, 2003). According to Hall et al. (2006), public support for restoration processes in Hamilton Harbour enabled politicians to make unpopular decisions, such as increasing water and sewer rates to support infrastructure improvements to the wastewater treatment plant (Hall et al., 2006). Public involvement in Collingwood Harbour RAPs was also commonly cited as one of the main factors that led to dramatic improvements in the environmental quality of the Harbour (Kratnzberg & Houghton, 1996). In addition to its consultative role in establishing goals and beneficial uses for the Harbour, the PAC played a key leadership role in raising public awareness of RAP activities through newsletters, articles in the local press, and presentation and publications for clubs and schools (Krantzberg & Houghton, 1996). As a result of these efforts, the Stage 1 RAP was completed in 1989, the Stage 2 RAP in 1992, and Stage 3 in 1994 (Krantzberg, 2003; EC, 2003).

There have been substantial differences in the involvement of public in the St. Clair and the Detroit River RAPs (Billups et al., 1999). In the Detroit River RAP, there was an attempt to minimize that involvement in several key occasions (Coulter, 2008). When the Detroit River Stage 2 Report was written in 1996, the majority of BPAC members felt that state of Michigan was trying to dominate the process and exclude

public input (Becker, 1996; Coulter, 2008). As a result they abandoned the Detroit River BPAC, so that not only was the Stage 2 document not endorsed by the BPAC but more importantly the binational RAP process was replaced by separate domestic implementation structures (Suker, 2001; DRCC, 2009). Since the establishment of the DRCC in 1998, efforts have been made to raise public awareness of RAP activities through periodic publications, information on the web site, and an electronic newsletter (Coulter, 2008).

In contrast, the BPAC of the St. Clair River AOC has had cross border and broad community representation and has worked binationally in a cooperative manner with government, industry, municipalities and all interested groups (EC, 2008; Mayne, 2006). The BPAC has helped acquire public comments and provide advice to the RAP Team on various aspects of the RAP (St. Clair River RAP Team, 1991). All St. Clair River BPAC members have had an opportunity to share individual views, and all BPAC meetings are open to the general public, thereby providing other concerned citizens chances to address water quality issues (St. Clair River RAP Team, 1991).

To improve public participation in the RAPs, Ellison (2008) argued that the RAPs /PACs should better define what the public needs to do and why. According to Ellison (2008), the PACs need a clearly defined reason or purpose for engaging the public; otherwise the public will lose interest. Without public interest, concern and pressure, politicians will turn their attention to other issues (Gannon, 2008).

5. Disagreement on common delisting targets

Disagreement between Ontario and Michigan over shared delisting targets for the BUIs in the shared AOCs has been cited commonly as one of the factors that have affected RAP implementation in the St. Clair and the Detroit Rivers AOCs. Although the two rivers were listed as single waterways with same listing criteria, the current practice finds that the one country may redesignate a BUI as unimpaired without consent by the other (Briggs, 2008). There have never been any officially approved binational delisting criteria since the draft Detroit River Stage 2 report was written in 1996 (Briggs, 2008). Ontario developed its own delisting criteria in 2005 (Table 2) and Michigan has adopted the statewide delisting criteria developed in 2006 (Table 3).

Michigan criteria are perceived by Canada as too lenient (Coulter, 2008). The Detroit River Canadian Cleanup reports that Michigan fish consumption restrictions are less strict than the Ontario restrictions (DRCC, 2007). From the Canadian point view, the Michigan criteria are statewide and not necessarily applicable for every Michigan AOC. It is not the purpose of this thesis to evaluate the merits of the delisting criteria proposed by Ontario compared to Michigan. It is the purpose to expose that disagreement in delisting criteria has affected a shared vision for the implementation of the RAPs in the shared AOCs, the St. Clair and the Detroit Rivers.

BUI	BUI delisting target
Restrictions on fish and wildlife consumption	When contaminant burdens in sport fish species decline below the strictest action level for all jurisdictions issuing fish consumption advisories for a minimum of three years, with levels demonstrating a downward trend.

Restrictions on dredging activities	When contaminants in sediments do not exceed applicable standards, criteria, or guidelines. As such, there are no restrictions on dredging or disposal activities.
Beach closings	When waters, which are commonly used for total body contact or partial body contact recreation, do not exceed applicable standards, objectives, or guidelines for such use. There are no closures of Detroit River or tributary beaches as a result of water quality impairment for a minimum of two years. Bacteria levels are 100 E.coli per 100 milliliters of water over a one month/five sample average.
Degradation of benthos	Benthic community composition must contain none of the attributes that would characterize a degraded community for at least four years.
Fish tumors and other deformities	When incidence rates of fish tumors or other deformities do not exceed rates at unimpacted control sites for a minimum of three sampling periods spaced two to three years apart, and should demonstrate a downward trend.
Restrictions on drinking water consumption or taste and odor problems	When densities of disease-causing organisms, or concentrations of hazardous or toxic chemicals or radioactive substances in treated drinking water supplies do not exceed applicable human health objectives, standards, or guidelines. When surveys confirm that taste and odor problems are absent.
Degradation of aesthetics	When the waters are devoid of any substance which produces a persistent objectionable deposit, unnatural color or turbidity, or unnatural odor. Oil and petrochemicals should not be present in concentrations that can be detected as a visible film, sheen or discoloration on the water surface, detected by odor, or form deposits along shorelines and bottom sediment.
Loss of fish and wildlife habitat	The amount and quality of physical, chemical, and biological habitat required to meet fish and wildlife management goals has been achieved and protected.

Table 2: Delisting criteria for the Canadian portion of the Detroit River Area of Concern. (Source: DRCC, 2009).

BUI	BUI delisting target
Restrictions on fish and wildlife consumption	When the fish consumption advisories in the AOC are the same or less restrictive than the appropriate control site.

Restrictions on dredging activities	There have been no restrictions on routine commercial or recreational navigational channel dredging by the U.S. Army Corps of Engineers (COE).
Beach closings	When the maximum concentrations of E. coli are acceptable for waters of the state to meet total and partial body contact recreation uses.
Degradation of benthos	When all remedial actions for known contaminated sediment sites with degraded benthos are completed and monitored according to the approved plan for the site.
Fish tumors and other deformities	No reports of fish tumors or deformities due to chemical contaminants which have been verified through observation and analysis by the MDNR or MDEQ for a period of five years.
Restrictions on drinking water consumption or taste and odor problems	When monitoring data for 2 years indicates that public water supplies meet the current and most stringent human health standards, objectives, or guidelines for levels of disease-causing organisms, hazardous or toxic chemicals, or radioactive substances.
Degradation of aesthetics	When monitoring data indicates that water bodies in the AOC do not exhibit persistent, high levels of foam, oil films, floating solids, and suspended solids.
Loss of fish and wildlife habitat	When monitoring shows consistent improvement in quantity or quality of habitat or populations addressed.

Table 3: Guidance for Delisting Michigan's Great Lakes Areas of Concern. (Source: MDEQ, 2008).

3.5 Findings and Recommendations

1. Operationalizing the ecosystem approach requires careful definitions of context and boundaries (i.e. political, regulatory, technical, historical, financial, and cultural) (Ellison, 2008). Given the complexity of problems at the level and scope of the Great Lakes basin, the ecosystem approach's focus should retain on restoration of beneficial uses in receiving waters not in the entire watershed. It is important to remember that the purpose of the GLWQA is to restore and maintain the water quality of the Great Lakes not to restore the Great Lakes basin ecosystem more broadly. Also, the purpose of the RAPs is to restore and protect beneficial uses in the AOCs not to attain that same status throughout all portions of the watersheds.

2. Although it may be more complicated, one side of a binational AOC should not be de-listed until the entire AOC is ready to be de-listed. It is the complete antithesis of an ecosystem approach to divide a river down the middle and declare that one side is degraded while the other is restored. According to Coulter (2008) "it seems to be stretching reality to have people believe that one side is an area of concern while the other is not when it was listed as a whole body of water". Without doubt, there are unique issues to each side of a binational AOC. However, a binational RAP can still address those unique issues collaboratively.

Working on a binational RAP will provide a regular forum at which an underachieving party can be called to account. Further, there are savings in both time and money in sharing work, information, research, and monitoring. According to Ellison (2008), working binationally helps to ensure both sides are satisfied with the actions of

the other in regards to the shared resource and improves coordination and communication which results in better decision making and a reduction on potential conflict.

3. In order to advance RAPs implementation and the restoration of BUs, Ontario and Michigan should agree on common quantifiable delisting targets.

Disagreement between Ontario and Michigan on delisting targets for the various BUIs in the shared AOCs has been frequently cited as one of the factors that has hampered implementation of the St. Clair and the Detroit Rivers RAPs. According to Hartig et al. (1997), agreement on delisting targets provides clear direction for selection of remedial and preventive actions necessary for rehabilitation, and secures broad-based support for necessary actions (Hartig et al., 1997). Briggs (2008) argued that if the target is not quantifiable differing opinions will result.

4. Although the environmental imperative for remediation of the AOCs has been the principal purpose for implementation, the economic benefits from restoration the BUIs also represent strong rationale for cleaning up the AOCs.

The experiences from remediation some AOCs in the Great Lakes basin (e.g. Collingwood and Hamilton Harbours) show that recognition of the economic values from improving the health of Canada's freshwater could provide strong commitment and support for restoring environmental quality in those AOCs. According to Krantzberg (2003), the economic benefits from the environmental health of Collingwood Harbour created a partnership between the PAC and the business community in implementing a myriad of projects and programs.

According to the Great Lakes Commission (2009), the restoration of the Great Lakes will provide an unprecedented opportunity to create jobs, stimulate economic development that will be central to the future of the Great Lakes region. Boating, fishing, hunting and wildlife watching in the Great Lakes region generate over $50 billion in economic activity annually and support hundreds of thousands of jobs (Great Lakes Commission, 2009). Abundant freshwater, recreational amenities and other benefits from the Great Lakes will be vital for attracting new industries and young workers in the future (Great Lakes Commission, 2009).

Austin et al. (2007) have estimated the economic impacts that can be expected from cleaning up the Great Lakes are at least $50 billion. These impacts include: additional tourism, fishing and recreation, benefits to property owners from cleaning up AOCs, reduced water operations costs for municipalities, and benefits from new technology and industries that will be built around an environmentally improved Great Lakes region.

Removing contaminated sediment in the AOCs, alone, will raise coastal property values by $12 billion to $19 billion, will reduce water costs for municipalities by $ 50 to $ 125 million dollars per year, and will lead to direct economic benefits from tourism, fishing, and recreation by $6.5 to 11.8 billion dollars per year (Austin et al., 2007).

According to a study conducted by the University of Illinois and the Northeast-Midwest Institute, residential property values near the Buffalo River could increase by as much as $140 million if contamination in the river is eliminated (Northeast-Midwest Institute, Washington DC, 2006).

Although information regarding the economic benefits from restoration the beneficial uses in the St. Clair and the Detroit Rivers have not been synthesized, the restoration of beneficial uses in the two rivers would clearly have significant economic benefits to local economy (Coulter, 2008). For example, the Detroit River on the Canadian side is the main focus of the communities of Windsor, Amherstburg, and LaSalle. Windsor has done much to make its riverfront an appealing tourist destination, and for the most part, has succeeded in drawing people to the riverfront in recent years (Coulter, 2008). Towns of Amherstburg and LaSalle have both recently realized that the river is a huge asset to their community and have begun to focus more on their waterfronts (Coulter, 2008). However, the unappealing nature of the river along much of the US shoreline hinders the overall reputation of the river, and limits the ability of riverfront communities to draw tourism to the waterfront (Coulter, 2008).

Chapter 4: Conflicts, Agreements, and Prospects for Regional Water Cooperation in the Jordan River basin

4.1 Introduction

The Jordan River basin encompasses the territories of Jordan, Israel, the Occupied West Bank, Syria and Lebanon. It is formed principally by two rivers, the Jordan and the Yarmouk Rivers (Figure 5). The Jordan River is divided into two main parts: the Upper Jordan and the Lower Jordan River. The Upper Jordan River is formed by a confluence of three rivers: the Hasbani, which originates in Lebanon, the Dan, which originates in Israel, and the Banyas, which originates in the Golan Heights, Syria (Amro, 2006). The three rivers converge inside Israel to form the Upper Jordan River (Amro, 2006). From there, the Upper Jordan River flows through northern Israel into Lake Huleh and then continues in a narrow channel before entering Lake Tiberias (Lowi, 1995). The average flow of the Upper Jordan River as it enters Lake Tiberias is 650 MCM/yr (Scott et al., 2003). At its point of exit from Lake Tiberias, approximately ten kilometers south of its exit to the Lake, the Lower Jordan River joins the Yarmouk River (Hambright et al., 2006). This river originates in Syria and flows along the Syrian-Jordanian border until converging into the Jordan River through the Adassiya triangle where it touches the Israeli territory for a few kilometers (Libiszewski, 1995)[9]. After confluence with the Yarmouk River, the Lower Jordan Rive flows through the Jordan valley for approximately 110 kilometers until draining into the Dead Sea at 410 meters below sea

[9] The adassiya Triangle is the area bounded by the Jordan River, the Yarmouk River, and the Lake Tiberias.

level[10]. The historical discharge of the Jordan River into the Dead Sea was about 1400 mcm/yr (Scott et al., 2003). During its course from the point of its confluence with the Yarmouk River until draining into the Dead Sea, the Lower Jordan River forms first the border between Jordan and Israel and then forms the border between Jordan and the West Bank.

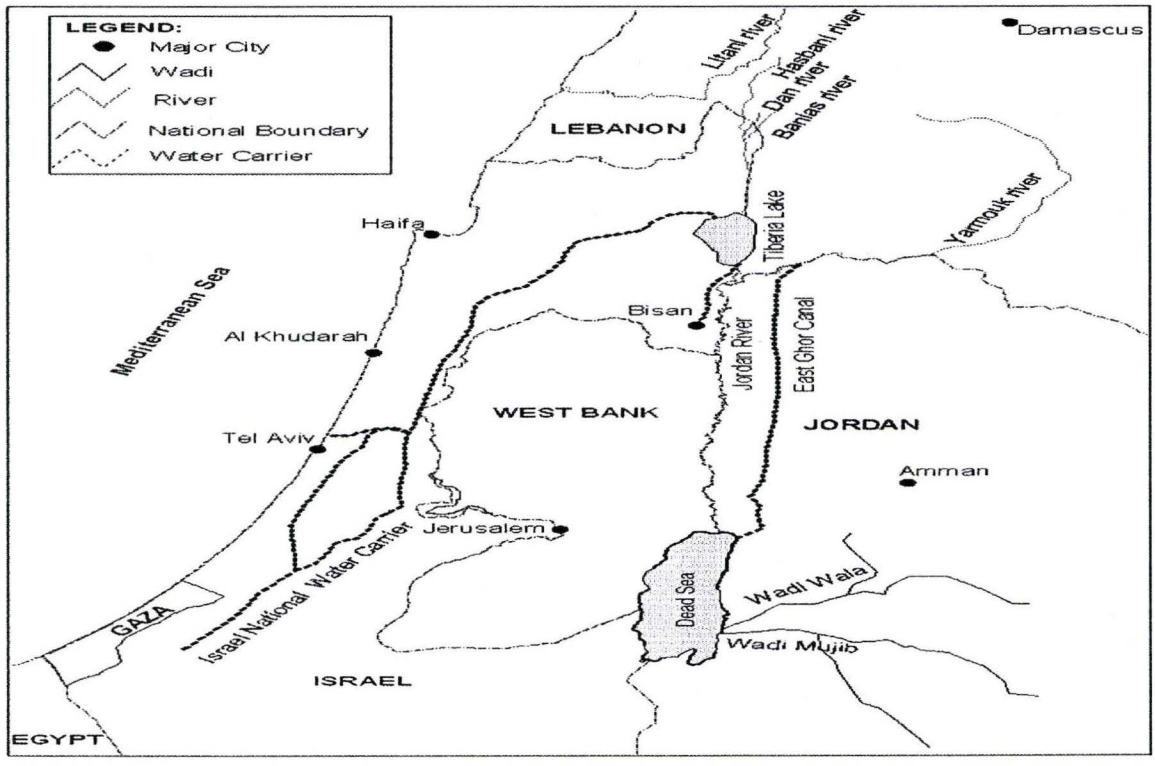

Figure 5: the Jordan River Basin (Source: Mimi & Sawalhi, 2003).

During the initial years following the first Arab-Israeli war of 1948, the Arab states and Israel announced different plans to exploit unilaterally the water resources in

[10] The Jordan Valley encompasses the area that extends from the Lake Tiberias in the North to the Red Sea in the south passing through the Dead Sea.

the Jordan River basin (Biswas, 1994, Wolf, 1995). Israel's plans included the draining of Lake Huleh, diversion of the northern Jordan River, and construction of a carrier to divert water from Lake Tiberias to the Negev desert (Biswas, 1994; Clive, 2003; Lowi, 1995; Wolf, 1995). Jordan's plans focused on utilizing the water of the Yarmouk River by building the Maqarin dam on the Jordanian-Syrian border and diverting the Yarmouk water before it reaches the Jordan River through the East Ghor Canal (Lowi, 1995). The East Ghor Canal, also called the King Abdullah Canal, aimed at serving agriculture water needs in the eastern bank of the Jordan River Valley (Libiszewski, 1995; Murakami & Musiake, 1994).

In order to establish a regional regime for water sharing between Israel and the Arab States, a special envoy to the region, Eric Johnston, was appointed by President Eisenhower in 1953. After two years, Johnston proposed a plan which became known as the Unified Plan. The main provisions of this Plan included: 1) giving each state sole authority to decide where and how to use its share of the water; 2) assigning the largest share of the basin water to Jordan, followed by Israel, then to Syria, and the least amount to Lebanon (Table 4) (Wolf, 1994); 3) treating Lake Tiberias as a regional storage facility for all the riparians (Haddadin, 2000).

	Jordan River	Yarmouk River	Total Volume of Water (Mm^3/yr)	Proportion of each riparian from the total volume
Jordan	343*	377	720	56%
Syria	42	90	132	10%
Israel	375	25	400	31%

Lebanon	35	0	35	3%
Total	795	492	1287	100%

Table 4: Water allocated in MCM/yr for each riparian state in the Jordan River basin according to Johnston's Plan of 1955: (Source: Amro, 2006).
*The Jordan water share from the Jordan River was divided as follows: 100 MCM/yr from the Lower Jordan River, and 243 MCM/yr from the side wadis that feed the river from the Jordanian territories (Elmusa, 1998).

Although the Johnston Plan was accepted technically, it was not ratified by the Arab States for political reasons (Naff & Matson, 1984; Shuval 2000). With the failure of the Johnston's Plan and absence of a formal regional arrangement for sharing the water resources in the basin, the Arab states and Israel decided to proceed with their water projects on a unilateral base (Lowi, 1995; Murakami & Musiake, 1994). Israel built its water carrier and by 1964 its work on the carrier was completed with an initial capacity of one MCM/day (Libiszewski, 1995). Jordan went ahead with the construction of the East Ghor Canal to divert the water of the Yarmouk River into the Jordan valley (Lowi, 1995; Wolf, 1994).

In 1967 war broke out between Israel and the Arabs States. Israel occupied the Golan Heights, the West Bank, and the Gaza Strip. By occupying the Golan Heights, Israel controlled two of the three Jordan River headwaters, the Banias and the Dan Rivers, and extended its control to the northern bank of the Yarmouk River (Lowi, 1995; Wolf, 1995). Following the 1967 War, Jordan focused its attention into achieving two objectives: 1) The construction of a number of dams on the eastern tributaries of the Jordan River; 2) The extension of the King Abdullah Canal to reach the northern tip of the Dead Sea (Lowi, 1995). The Syrian began to build dams on the tributaries of the

Yarmouk River (Wolf, 1994). The Syrian goal for damming was to increase the agricultural potential on that part of the Golan which remained under Syrian control after the war (Libiszewski, 1995). Since 1988, Syria has increased its unilateral development of the upper Yarmouk River by damming many of the wadis, the intermittent streams, feeding the Yarmouk River (Shuval, 2000). Despite the establishment in 1987 of a treaty with Jordan to limit the number of dams on the Syrian side to 26 dams, Syria has increased the number of dams to 42 by the year 2000 with a total storage capacity around 200 Mm^3 (Haddadin, 2006).

4.2 The water and environmental agreements in the Jordan River basin

4.2.1 The Bilateral Water Agreement between Jordan and Syria on the Yarmouk River

The Yarmouk River presents a unique situation. The Yarmouk River borders Syria, Jordan and Israel but has never been the subject of a signed basin agreement between all of the riparian states. Absent direct relations between Israel and Syria separate agreements were concluded between Israel and Jordan on the one hand and between Jordan and Syria on the other (Haddadin, 2002). The sources of the Yarmouk River include a number of tributaries in Jordan and Syria with the majority of these sources located in Syria. The Yarmouk River has permanent baseflow as well as considerable floodflow and according to separate studies, the total flow of the Yarmouk River amounted to an average of 355 MCM/year (JMWI, 2007).

Jordan and Syria entered into an agreement in 1987 to build a dam at the border between the two countries to store winter floodwaters of the Yarmouk River (Scott et al.,

2003). The Agreement of 1987 focuses on establishing Al-Wehdah (the Unity), with details surrounding financing, construction, upstream and downstream water rights and the use of the water stored and the power generated (JMWI, 2007; 2009; Namrouqa, 2009). According to the Agreement of 1987 the dam would be able to store a gross capacity of 110 million cubic meters (MCM) annually and 18,800 kWh of power would be generated (JMWI, 2007; 2009). By the terms of the treaty, the stored water volume would be used for the irrigation of a 31 square kilometer area in the Jordan Valley and to supply 50 MCM a year to the Amman area (JMWI, 2009). Syria would receive part of the water and 75 percent of the total hydroelectric power produced (Biswas, 1994). The 1987 Agreement also provided for the establishment of a Joint Committee to administer its provisions (Schiffler, 1998).

The construction of a dam on the Yarmouk River was seen as indispensable for Jordan for two reasons. First, it provided a solution to Jordan's inability to capture the winter floodwaters of the Yarmouk River (Lowi, 1995). Second, impounding those waters and regulating their distribution would make possible the extension of the irrigated area in the Jordan Valley and thus increase agriculture production (Lowi, 1995). However, because of the Syrians depletion of the Yarmouk's surface and groundwater, the water retained in the Dam since its construction in 2006 is only 18 MCM as compared to the required 110 MCM (Namrouqa, 2009). Since 1987, the Syrians have increased damming on the four recharge springs that feed the river and have increased drilling for groundwater in the Yarmouk River basin for municipal and irrigation purposes (Al-Kloub & Shemmeri, 1996; Haddadin, 2006; JMWI, 2007). This has resulted in a significant reduction of the baseflow in the

lower part of the river along the Jordanian/Syrian border and consequently has considerably reduced the Jordan's share from the river (Haddadin, 2006; JMWI, 2007). According to some estimates, the baseflow of the Yarmouk River dropped to 2 cubic meter per second in 2000, and to 0.9 cubic meter per second in 2008, compared to 5-7 cubic meter per second in the 1950s (Haddadin, 2006; JMWI, 2007; Namrouqa, 2009).

Despite several efforts to regulate the water allocation of the river, Syria has refused to provide Jordan with its water rights from the Yarmouk River (JMWI, 2007). The Syrians have argued that weak rainy seasons have been responsible for reductions in the baseflow of the river (JMWI, 2007). The Jordanians believe that the Syrians' activity on the Yarmouk River basin has led to a decline in the river flow and consequently affected the amount of waters that Al- Wihdeh Dam holds (Namrouqa, 2009).

Among the factors that have complicated the water situation between Jordan and Syria on the Yarmouk River basin are: 1) The absence of a shared database on the Yarmouk basin, 2) The Jordanian-Syrian Water Committee (JSWC) not being able to provide a reliable source of information that allows for cooperation and a shared understanding, and 3) Each member of the JSWC is biased towards its own respective country (Interview with former high ranking official from JMWI, 2007).

4.2.2 The Water Agreement of 1994 between Jordan and Israel

With the opening of the Madrid Conference for Peace in 1991, Jordan and Israel showed a joint will to resolve their water dispute through negotiations (Haddadin, 2002). The negotiations on water between Israel and Jordan were primarily focused on: 1) water allocation from the segments of the Jordan and Yarmouk Rivers that the two countries

share (Elmusa, 1995); 2) the status of some wells drilled and utilized by Israel since 1968 which are located on the Jordanian side of the border (Clive, 2003)[11]; and 3) the Israeli diversion to the salty springs that feed Lake Tiberias to the lower Jordan River.

After three years of negotiations, Jordan and Israel signed in 1994 the Peace Treaty which ended the state of war that had lasted for five decades[12] (Amro, 2006; Lowi, 1995). The Peace Treaty between Jordan and Israel contained 30 articles of agreements, established full diplomatic relations, and promoted broad cooperation in the areas of trade, tourism, and economic development (IMFA, 2008). Annex II of the Treaty is entitled Water and consisted of six articles aimed at achieving a comprehensive and lasting settlement of all the water conflicts between Jordan and Israel (IMFA, 2008). The main Articles of the Water Agreement included:

1. Provisions for water allocation from the segments of the Jordan and the Yarmouk Rivers that the two countries share (Elmusa, 1995).
2. Establishment of a desalination plant on the Lower Jordan River with the aim of supplying Jordan with 10 million cubic meters of about 20 MCM of saline springs that diverted to the Jordan River (Lowi, 1995; Scheumann & Schiffler, 1998).
3. Construction of a weir on the Yarmouk River to divert and store 60 MCM of winter floodwaters of the Yarmouk River in Lake Tiberias for Jordan's benefit.

[11] With the signing of the Water Agreement, these lands returned to Jordan sovereignty in 1994 but the wells were rented to Israel (Wolf, 1995).

[12] The Jordanian-Israeli Peace Treaty was signed one year after the Palestinians signed the Declaration of Principles (DOP) with the Israelis.

4. Establishment of a Joint Water Committee consisting of three members from each country for the purpose of the implementation of the Agreement Articles (IMFA, 2008).

With the signing of the Water Agreement, Israel's share from the Yarmouk River was specified as 25 MCM/yr, consistent with the amount allocated under the Johnston Plan (Haddadin, 2006). Jordan's share from the Jordan and the Yarmouk Rivers was set to be 215 MCM/yr, with 30 MCM from the Lower Jordan River and 195 MCM from the Yarmouk River (Al-Kloub & Shemmeri, 1996)[13]. Since its establishment in 1994, the Joint Water Committee has worked efficiently and helped to enhance building trust between the two governments even during the period when the political conditions were unstable (Interview, with former high ranking official from JMWI, 2007).

Although success has been achieved in implementing some of the Agreement's provisions, work is still required from both Parties to implement other provisions. Fifteen years after the signing of the Peace Treaty of 1994, desalination projects on the Lower Jordan River have yet to be built. The intention to divert 60 MCM from winter floodwaters of the Yarmouk River to Lake Tiberias to benefit Jordan has not materialized (Haddadin, 2006). Table 5 summarizes the water allocated to Jordan, Syria, and Israel from the Jordan and the Yarmouk Rivers according to the Johnston Plan and to the agreements of 1987 and 1994.

[13] Jordan's share of the Lower Jordan River is fixed at a minimum of 30 MCM/yr, where before the treaty, it drew virtually nothing.

Water allocated to Jordan, Syria, and Israel from the Jordan and the Yarmouk Rivers according to the Johnston Plan of 1953 (Mm^3/yr)			Water used by Jordan, Syria, and Israel from the Jordan River basin after refusal of the Johnston Plan and before signing the Agreement of 1987 between Jordan and Syria and before signing the Water Agreement of 1994		Water that should be allocated to Jordan, Syria, and Israel from the Jordan and the Yarmouk Rivers after signing the Water Treaty between Jordan and Israel and after assuming that the provisions of the Agreement of 1987 have been implemented (i.e. Al-Wehda Dam was filled with water)	
	Jordan River	Yarmouk River	Jordan River	Yarmouk River	Jordan River	Yarmouk River
Jordan	343*	377	243	120	273**	305***
Israel	375	25	552	100	522	25
Syria	42	90	0	170	0	160****

Table 5: Summary of the water allocated to Jordan, Syria, and Israel in MCM/yr from the Jordan and the Yarmouk Rivers according to the Johnston Plan and to the agreements of 1987 and 1994.

* The Jordan water share from the Jordan River is divided as follows: 100 MCM/yr from the Lower Jordan River, and 243 MCM/yr from the side wadis that feed the river from the Jordanian territories (Elmusa, 1998).

** Before signing the Agreement of 1994, Jordan received nothing from the Lower Jordan River but after signing the Agreement, Jordan was able to get 30 MCM/yr from the Lower Jordan.

*** 305 MCM/yr include the amounts of water, 75 MCM/yr, that returned to Jordan because of signing the Water Agreement with Israel in 1994 and also include the amounts of water that should be provided to Jordan if Al-Wehda (the Unity) Dam has been filled.

**** 160 MCM/yr represents the approximate storage capacity of 26 dams that were allowed to Syria to build on the tributaries of the Yarmouk River according to Jordan-Syria Agreement of 1987.

4.2.3 The Environment Agreement between Jordan and Israel on the Gulf of Aqaba

Annex IV of the Peace Treaty of 1994 is entitled the Environment Agreement. It includes several areas for Jordan-Israel cooperation, such as environmental regulations and

standards, environmental planning, exchange of data, and emergency response and monitoring (World Bank, 1996). The Environment Agreement gave priority to the bilateral cooperation between Aqaba, Jordan and Eilat, Israel on the Aqaba Gulf (World Bank, 1996).

The approach recognizes geographic, economic, and environmental factors. Geographically, Aqaba, Jordan and Eilat, Israel are the only cities which are situated on the Aqaba Gulf. Jordan's shore reaches 20 km in length, extending to the Saudi border, whereas the Israel's shore extends only a few kilometers, from the city of Eilat to the border with Egypt at Taba (IMFA, 2008). Economically, both cities are important industrial and tourists centers and major ports (Portman, 2007). From an environmental point view, the Gulf of Aqaba is partially enclosed with little mixing with the open ocean and because of that the marine life in the Aqaba Gulf and particularly the coral reefs are vulnerable to pollutants (Downie et al., 1996; Portman, 2007).

Two years after signing the Peace Treaty of 1994, the joint environmental cooperation on the Aqaba Gulf became effective when an Agreement on Special Arrangements for Aqaba and Eilat was signed. The Agreement of 1996 called for broader cooperation between the two countries including environmental cooperation (IMFA, 2008). The World Bank (1996) details that the main environmental provisions included in this Agreement are the establishment of a binational marine park called the Red Sea Marine Peace Park (RSMPP) on the Upper Gulf, joint cooperation in combating pollution from ships, data exchange related to environmental monitoring and control measures taken by each party,

and the establishment of a joint committee to assist in the implementation of the Agreement.

Since 1996, the successes of the projects that have addressed the protection of the marine environment of the Aqaba Gulf have been beyond expectations (The World Bank, 2002). These outcomes included:

1) Establishment of the Gulf of Aqaba Environmental Action Plan (GAEAP)

At the national level, the purpose of the GAEAP was to help Aqaba, Jordan, to build its regulatory and institutional framework in order to protect the environment of the Aqaba Gulf (World Bank, 1996). At a binational level, the purpose of the GAEAP was to develop joint research projects on issues pertaining to coral reef ecology, fisheries management, and pollution impacts from land-based and marine sources (World Bank, 1996). At a regional level, the purpose of the GAEAP was to complement ongoing and planned projects which address broad development impacts on the entire Red Sea region (World Bank, 1996). These projects include the Egypt Red Sea Coastal Zone Management, focusing primarily on tourism impacts; and the Yemen Marine Ecosystem Protection, targeted primarily at environmental monitoring and mitigation of oil-based pollution activities (World Bank, 2002).

The GAEAP continued for about seven years and according to the World Bank, all the GAEAP objectives were met and achieved the outcome of improved environmental management and transboundary cooperation (World Bank, 2002). Regulatory and institutional development occurred at the national level through the establishment of Environmental Planning and Environmental Supervision and Enforcement directorates

within the Environment Commission of Aqaba Special Economic Zone Authority (ASEZA) (World Bank, 2002).

2) Establishment of a binational Red Sea Marine Peace Park (RSMPP) program to preserve the shared coral reefs of the Gulf

Both Jordan and Israel realized the importance of protecting the coral reefs to the economy of Aqaba, Jordan and Eilat, Israel and had previously taken steps on their own to protect the reefs under their jurisdiction (NOAA, 2007). However, due to the harmful impacts that might occur to their shared reefs due to individual development policies in each country, both countries realized that joint management that adopt and implement an ecosystem approach would be necessary to protect the reefs (NOAA, 2007). In 1999, this approach was included in the implementation of the Red Sea Marine Peace Park (RSMPP) program (Crosby et al., 2002).

The RSMPP program consisted of two components. The first component is cooperative research and monitoring. The focus of this component is to undertake comprehensive mapping of the corals reefs within the southern end of the Aqaba Gulf, and development of a framework for long-term monitoring of coral reef ecosystems. The second one is cooperative management and outreach. Under this component three activities have been identified: 1) data sharing and integration; 2) training programs; and 3) public education and outreach activities (Crosby et al., 2002).

The RSMPP program was funded by the US Agency for International Development (USAID) and coordinated by the U.S. National Oceanic and Atmospheric Administration (NOAA) (Crosby et al., 2002). The Marine Science Station in Jordan and Interuniversity

Institute of Eilat in Israel were considered the focal points for the scientific fieldwork of the program.

In its first year of operation, the RSMPP program has developed a consensus on field methodology, established a data management protocol, and developed and implemented public outreach and education activities. In the second and third years of the RSMPP program, many joint meetings and workshops were held in both countries to coordinate the activities and to update the works plans of the program.

Throughout its three years of operation, the RSMPP program has created new instructions to regulate the use of the coastal shores of the adjacent towns of Aqaba, Jordan and Eilat, Israel for ensuring protection of the coral reefs and the marine environment of the Aqaba Gulf. An area of 50 km^2 of the coral reef at Eilat was reserved and protected from Eilat oil port authorities. A public web site for the RSMPP program was initiated, and the education and outreach activities in the two countries were expanded (Crosby et al., 2002).

In 2003, the two countries recognized that the RSMPP program was an outstanding foundation upon which to build their own Gulf of Aqaba National Monitoring Programs (NMPs) (IMEP, 2008). A Memorandum of Understanding (MOU) was signed aimed at maintaining the core elements of the RSMPP program (IMEP, 2008). The MOU also demonstrated the mutual desire of Jordan and Israel to enhance coordination and cooperation between NMPs to promote the conservation of the marine resources in the Aqaba Gulf (IME, 2003).

4.2.4 The Israeli-Palestinian Water Agreements

The Mountain Aquifer is one of the most significant sources of water shared by the Israelis and the Palestinians (Tagar et al., 2004). While this aquifer represents the primary source of water for the Palestinians, it also contributes to more than 30 % of the total Israel water budget (Clive, 2003; Froukh, 2003; Schlutter, 2005). The Mountain Aquifer, as shown in Figure 6, consists of three sub-aquifers; the Western, the Northeastern, and the Eastern aquifer, which together supply 600-700 MCM/yr (Tagar et al., 2004). The Western Aquifer is the largest shared one among the three aquifers with an average estimated safe yield of about 340-350 MCM/yr (Shuval, 1993; ARIJ, 1996). The second shared aquifer is called the Northeastern Aquifer. This aquifer has an average estimated safe yield of about 130-140 MCM/yr (Shuval, 1993). The third aquifer, which has an average estimated safe yield of about 150 MCM/yr, is called the Eastern Aquifer (Shuval, 1993).

Since the opening of the Israeli-Palestinian peace talks in 1991, the two parties have seen the conflict over the shared aquifers differently. The Palestinians claimed for equitable share of the shared Mountain Aquifer according to the geography and hydrology principles of the Helsinki Rules (Shuval & Dweik, 2007). The Helsinki Rules, codified in 1966 by the International Law Association (ILA), provide general rules governing shared water resources which are generally accepted as part of customary international law (Libiszewski, 1995)[14]. Among the Helsinki Rules is the principle of the equitable utilization and equitable share in the beneficial uses of the water in an international drainage basin (Libiszewski,

[14] According to Kliot et al (2001), International Law arises through explicit and implicit agreements. Explicit agreements are termed treaties or conventions. Implicit agreements are termed custom or general principles. The termed customary international law is more complex and uncertain than formal agreement such as treaties and conventions (Kliot et al, 2001).

1995). This principle deals with the concept of a drainage basin as a unit, and requires the interests of all riparian countries to be taken into account when allocating and using its waters (Libiszewski, 1995). Additionally, the Helsinki Rules spell out different factors which determine if a riparian state possesses a reasonable and equitable share of their water sources (Niehuss, 2005; Schlutter, 2005). Among those factors are: 1) social and economic needs of the basin states 2) the past utilization of the waters, and 3) the availability of other resources (Niehuss, 2005; Schlutter, 2005).

The Israelis argued that their utilization of the shared groundwater is legitimate and justifiable due to the following reasons: 1) Its past and current utilization of the shared groundwater water has been undertaken by the second principle of the Helsinki Rules which recognizes the legitimacy of prior or historic use rights regardless of the sources of the water (Shuval & Dweik, 2007). 2) Restriction of the Palestinians' pumping from the Mountain Aquifer within the West Bank enabled Israel to secure protection of the water quality of its wells at the Mediterranean (Wolf, 1995). 3) The Palestinians rights do not fall under the Helsinki Rules or the International Water Law because: a) The Palestinian Territories do not yet constitute an independent and sovereign state (Niehuss, 2005). b) The Helsinki Rules or the International Water Law deal only with the surface water and do not cover groundwater.

In light of the above claims and counter claims, the negotiations on water were one of the most complex issues that faced the Israelis and Palestinians negotiators since the outset of the Madrid Conference for Peace (Wolf, 1995). After three years of negotiations, the two sides signed the Oslo Interim Agreement in 1993 which, for the first time, included an

Israeli acknowledgement of Palestinian rights to the West Bank's groundwater (Hosh & Issac, 1996). According to Al-Jayyousi and Bergkamp (2008), the Oslo Agreement of 1993 helped in creating a sense of trust between the Israelis and Palestinians and contributed to confidence-building measures between the two sides.

The Oslo Agreement provided for the establishment of an Israeli-Palestinian Joint Water Committee (JWC) consisting of an equal number of Israeli and Palestinian representatives for the purpose of overseeing the management of all of the West Bank's water and sewage resources and systems (Selby, 2007). The Oslo Agreement also provided for the establishment of the Palestinian Water Authority (PWA) to represent the Palestinian Authority in the JWC (Aliewi & Assaf, 2007; Clive, 2003; Issac, 1998; Tagar et al., 2004). Following the Oslo Interim Agreement, two other agreements were signed by the two sides, the Camp David Agreement of 2001 and the Road Map Agreement of 2006. The Agreement of 2001 called for additional water quantities to be allocated to the Palestinians whereas the Agreement of 2006 called for solving the Palestinians water problems through regional cooperation (Aliewi & Assaf, 2007).

After 16 years of negotiations, the Israeli-Palestinian conflict over the shared groundwater of the West Bank has not been settled. Many agreements have been signed between the Israelis and the Palestinians since 1993; however, no explicit water rights have been established for each party (Aliewi & Assaf, 2007; ARIJ, 1996; Issac, 1998; Scheumann & Schiffler, 1998). To illustrate the complex interactions among nations in different regions of the Jordan River basin, Table 6 summarizes the agreements surrounding shared water resource management.

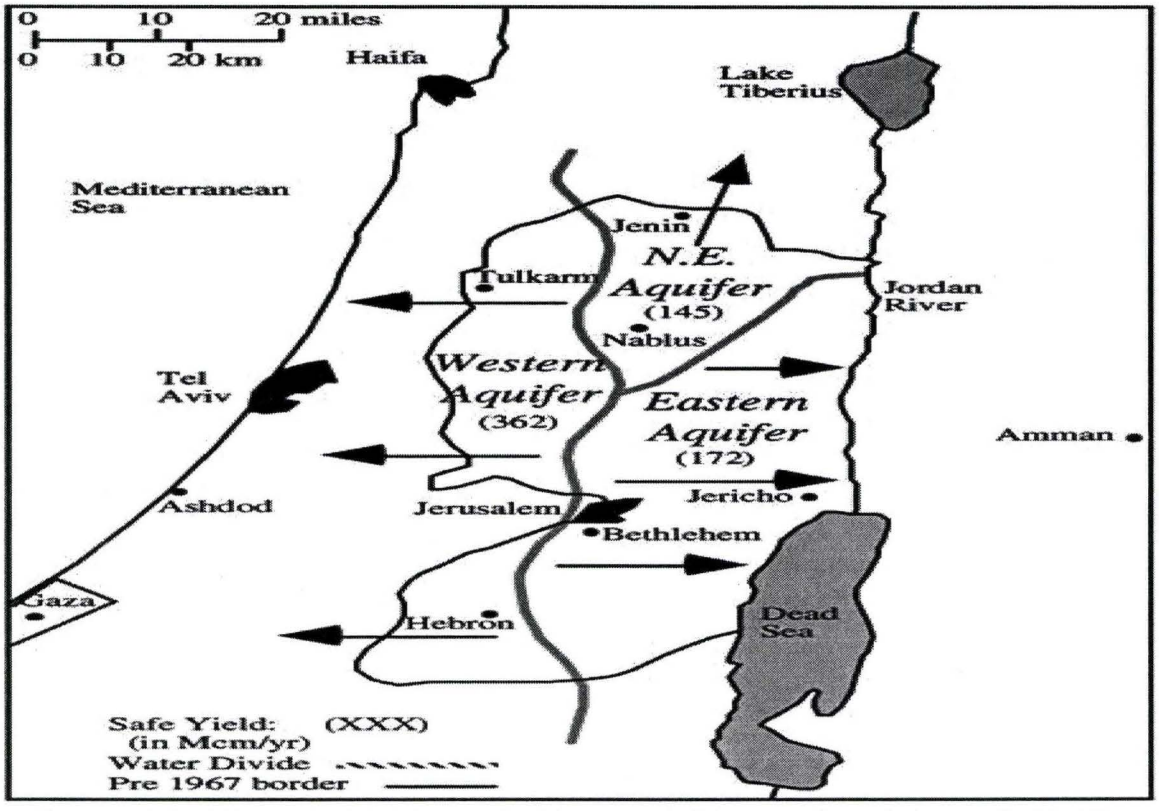

Figure 6: The Mountain Aquifers in the West Bank (Source: Shuval & Dweik, 2007).

	Jordan-Syria Water Agreement	Jordan-Israel Water Agreement	Jordan-Israel Environment Agreement on the Aqaba Gulf	The Israeli-Palestinian Water Agreement
The purpose of the agreement	Store the floodwaters of the Yarmouk River	Achieve a comprehensive and lasting settlement of all the water problems between Jordan and Israel	Protection of the shared marine resources in the Aqaba Gulf	Negotiate the Palestinian water rights from the shared aquifers in the West Bank
The main provisions of the Agreement	1. Establishment of Al-Wehdah (the Unity) Dam at the border between Jordan and Syria with a total capacity of 110 MCM.	1. Sharing the waters of the Lower Jordan and the Yarmouk Rivers 2. Protection of the shared water resources. 3. Establishment of	1. Collaboration between the cities of Aqaba, Jordan and Eilat, Israel in costal zone management and preserving the marine	1. Israel's acknowledge-ment of Palestinian water rights in the shared aquifers.

	2. Syria has the right to dam many of the streams feeding the Yarmouk River located 250 meters above the sea level. 3. Establishment of the Jordanian-Syrian Water Commission (JSWC).	joint desalination projects to supply Jordan with additional water. 4. Establishment of the Jordanian-Israeli Water Commission (JIWC).	environment. 2. Abatement and control of pollution.	2. Supply the Palestinians with additional water from the shared aquifers. 3. Establish-ment of the Israeli-Palestinian Water Commission.
The outputs of the agreement since it has been signed	1. The water retained in Al-Wehda Dam does not exceed18 MCM. 2. The JSWC is not able to provide a reliable source of information that allows for cooperation and a shared understanding. 3. Each member of the JSWC is biased towards its own respective country.	1. Jordan's water share from the Jordan and the Yarmouk Rivers has increased. 2. Israel's water share from the Yarmouk River was fixed at 25 MCM/yr. 3. The JWC has been working efficiently and helped to enhance building trust between the two governments. 4. Joint desalination projects have not been built.	1. Establishment of a binational marine park called the Red Sea Marine Peace Park to protect the shared coral reefs in the Aqaba Gulf. 2. Establishment of the Aqaba-Eilat Coordination Committee.	1. No explicit water rights have been established for each party. 2. The Palestinians has received additional water.

Table 6: Summary of the agreements surrounding shared water resource management in the Jordan River basin.

4.3 Prospects for regional water cooperation in the Jordan River basin

Since the middle of the last century, many proposals were submitted to the region by the Americans with the aim of establishing a regime for water sharing between Israel and the Arab States in the Jordan River basin (Lowi, 1994). The most important of these was the Johnston Plan of 1955. With the opening of the Peace Talks in 1991, water became one of the complex issues confronting Arab and Israeli negotiators (Wolf, 1995). After years of negotiations, Jordan and Israel signed in 1994 the Water Treaty to settle their disputes over water. Israel and the Palestinian Authority also signed the Oslo Interim Agreement in 1993 which included acknowledgement of Palestinian water rights in the West Bank's groundwater by Israel (Hosh & Issac, 1996). Despite the significance of these agreements, no sustainable solution to the water problems in the Jordan basin has been implemented and the problems between the various parties continue unresolved.

There is no doubt that the conflict over water resources in the Jordan River basin is considered the most complex compared with the other basins (Kuffner, 1998). Several factors created this complexity. The water has been interlinked to other core issues of the Arab- Israeli conflict, such as the recognition of Israel and the rights of the Palestinian people. Inequitable distribution of shared water resources remains. Highly exaggerated national security concerns are put forward, and the lack of trust between conflicting parties is apparent (Neirini, 2005; Renger, 1998). Notwithstanding the complexity of these conflicts, many scholars (e.g. Aaron Wolf, Marwan Haddad, and Brigit Schlütter) have argued that settlements to the conflict over territories and water in the Jordan basin could be possible and agreements could be signed between the Israelis and the Palestinians and

the Israelis and the Syrians. These scholars pointed out that solutions to the Israeli-Palestinian conflict would be possible if the shared groundwater in the West Bank is equitably redistributed between the Israelis and the Palestinians and if the Joint Israel-Palestinian Water Committee is empowered by granting it full responsibility over all questions regarding the management of the shared groundwater resources.

For the Israeli-Syrian conflict a solution would be possible if the two sides would agree to an acceptable formula that includes returning the Golan Heights to the Syrians while securing the free water flow from the Jordan River sources into Israel. When the Madrid Talks commenced, Israel and Syria showed their acceptance to the formula of an exchange of the Golan Heights for peace. However, to which boundaries Israel would withdraw, has been under debate between the two sides since 1991. The Syrians have been insisting on Israeli withdrawal from the Golan Heights to the 1967 border (Amro, 2006; Ma'oz, 2006; Wihbey & Berman, 2000). This will mean granting the Syrians access to the areas of the upper Jordan and the Yarmouk Rivers as well as to the eastern and north-eastern section of the Lake of Tiberias (Amro, 2006). The Israelis have been insisting on a withdrawal according to the 1923 border when the whole area was under the British Mandate (Amro, 2006; Wihbey & Berman, 2000). The border of 1923 grants Israel access to the Jordan and the Yarmouk Rivers at three locations (Amro, 2006). Any withdrawal from the Golan Heights on the basis of the 1967 border might give the Syrians the right to demand use of the Lake Tiberias and thereby would leave its control over Lake Tiberias in jeopardy.

In order to reconcile the Israeli security concerns and the Syrian demand on returning the Golan Heights based on the 1967 border, Shuval (2000) proposed a water security zone

to be established along the entire eastern side of the Lake Tiberias. According to Shuval (2000), the water security zone would be a minor portion of Lake Tiberias but would include all the main water sources including the shores of the Jordan River, the Banias, the Hasbani Rivers, El Hama and the shores of Lake Tiberias. The importance of this zone, which would be under international management, inspection and control, is to assure Israel that there will be no direct Syrian access to the Jordan River and Lake Tiberias (Shuval, 2000).

As the proposals for the two conflicts have demonstrated, settlements to the conflict over territories and water in the Jordan basin could be possible and agreements could be signed between the Israelis and the Palestinians and the Israelis and the Syrians. However, to provide sustainable solution to the water problems in the Jordan River basin, an examination of the elements needed to achieve a sustainable model for resolving water issues is needed. The model proposed here consists of three key elements derived from the early successes in the binational management of the Great Lakes. Three key elements proposed herein, encompass political, socio-economics, scientific considerations.

Regarding the political aspects of the proposed model, the rights of each party as a riparian should be fully respected through regional agreement. Accordingly, no state has the right to dominate, misuse, and pollute the shared waters (Haddad & Mizyed, 1996). A regional institution with adequate power to ensure the implementation of signed agreement should be established.

With respect to the socio-economics, factors necessary to accommodate current and future requirements for basin's population, agriculture industries, and other commercial

uses need to be understood. The availability of water resources for the whole region should be continuously assessed and the total per capita water demand should be monitored in all sectors and uses (Haddad & Mizyed, 1996). Alternatives to increase efficiency of water use through conservation measures should be developed and implemented (Haddad & Mizyed, 1996).

Regarding the scientific aspects of the proposed model, common measures to protect the existing water resources, both surface and groundwater, from degradation should be developed through clear and referenced agreements (Haddad & Mizyed, 1996). Sharing and exchanging data and information in terms of precipitation on the basin; rivers water quality; withdrawals from the rivers; groundwater abstraction; and reservoirs storages should be promoted among the riparian states.

To evaluate the soundness of the proposed model for water policy in the Jordan basin, one can examine the model used in the Great Lakes basin which is considered a successful model in managing shared water resources (IJC, 2009; Saunders, 2000).

Regarding the political aspects in the Great Lakes basin, the rights of Canada and the United States in the use of boundary waters were respected through the signing of the Boundary Water Treaty. This Treaty provides principles that the two countries must follow in using the shared waters (IJC, 2009). These principles were established on the basis of equality between the two countries despite the differences in population and power between the two countries. For example, the countries must agree to any project that would change the natural levels or flows of boundary waters (IJC, 2009). The Treaty also states that waters shall not be polluted on either side of the boundary to the injury of health or

property on the other side (IJC, 2009). The Treaty established a joint commission, the IJC, with equal members from each country.

With respect to the socio-economics, although the water supply is higher than the demand in the Great Lakes region, measures have been taken on a regional, national and binational scale to accommodate future requirements for the basin's population, agriculture, and industry. For example, the supply and the demand in the Great Lakes basin and the use of water in the Great Lakes are reported in order to review changes in the potential of the Great Lakes to provide water, and conservation programs and efficient use of Great Lakes waters are implemented.

Regarding the scientific aspects, measures have been taken on a binational scale to protect the quality of the Great Lakes waters. The most important of these are the Great Lakes Water Quality Agreements of 1972 and 1978. The purpose of the GLWQA of 1972 was to improve water quality with a focus on reduction of phosphorous loadings (Botts & Muldoon, 2005). It sets basin wide water quality objectives and included a binational commitment to design, implement and monitor municipal and industrial pollution control programs (IJC, 2006). The GLWQA of 1978 expanded the scope and extent of its 1972 predecessor by broadening the focus from phosphorus reduction to control toxic contaminants, and explicitly introducing the concept of virtual elimination of persistent toxic chemicals (IJC, 2006).

Chapter Five will provide a comparative analysis of the management of shared water resources between the two basins, the Great Lakes and the Jordan River, to reveal lessons that are transferable and informative to shared water resources management in general.

Chapter Five: Management and Protection of Shared Water Resources in the Great Lakes Basin and the Jordan River Basin: A Comparative Analysis

5.1 Introduction

From 1909 to 1987, management of transboundary waters between Canada and the United States was a period of great success in the Great Lakes region and has provided important lessons for shared water resources elsewhere. The period from 1987 forward saw more obstacles in restoring and maintaining the waters in the Great Lakes basin compared with the earlier successes in the Great Lakes region, from the BWT of 1909 to 1987 when the GLWQA of 1972 was amended by the Protocol.

In the Jordan River basin, numerous bilateral agreements were signed to apportion and manage water resources but with little success. By contrast, the success achieved in the transboundary cooperation between Jordan and Israel on the Aqaba Gulf provides lessons for achieving the goals of transboundary environmental collaboration.

5.2 Great Lakes findings and lessons learned that are transferable to the Jordan River basin

Scholarly analysis suggests that the success of the BWT of 1909 and the subsequent agreements that arose from that treaty are based on three elements that could be applied to improve management of the shared water resources in the Jordan River basin. These elements encompass political relevance, socio-economic ramifications, and a focus on science.

5.2.1 The political element

Water and water rights have been important issues in the relationship between Canada and the United States in spite of several controversial issues involving boundary and transboundary water resources dating back to the mid-1800s (Carroll, 1986; IJC, 2009; Saddler, 1993). The first controversial issue to emerge over transboundary waters was related to water apportionment of the St. Mary and Milk Rivers (Lemarquand, 1986; Saddler, 1993). To establish the principles that would govern the use and diversion of the boundary waters negotiations between the two governments began in 1907 (IJC, 2000).

At the beginning of the negotiation of 1907, the two countries saw water resources and boundary water differently. The Canadians saw the boundary water issues in terms of equality and the rights and responsibilities of the two countries (Lemarquand, 1986). Therefore, the Canadians began the negotiations supporting the equality principle that aimed to secure the advantages of geography and the notion of territorial integrity (Lemarquand, 1986). On the other side, the United States looked at boundary water resources issues from the point of view of equity and equitable utilization. As a larger population, the Americans started a position supporting the equity principle in which the rights and the obligations of the individual water user are recognized (Lemarquand, 1986).

After two years, the negotiations culminated in signing, in 1909 in Washington, the Boundary Water Treaty (BWT) (IJC, 2000). The BWT established a number of principles that were to govern relations over all shared waterways. For waters classified as boundary waters, which include the lakes themselves and the connecting channels, each country has an equal right to their use (Valiante, 2008). For waters that exist on one

side of the boundary but flow across that boundary, each country has the exclusive right to their use, subject to an obligation to provide access to legal remedies if injury to health or property occurs in the other country (Valiante, 2008). The Boundary Water Treaty is composed of 14 articles and one of the main products of those articles called for the establishment of the International Joint Commission (IJC). The articles established the rules which govern the IJC's activities. Under the BWT, the IJC was given quasi-judicial, arbitral, and investigative functions (Willoughby, 1981).

Since 1909, the BWT has represented a proven regime for avoiding and resolving disputes that arise between Canada and the United States over the boundary waters and transboundary rivers (IJC, 2000). Also, since its establishment, the IJC has helped in investigating environmental issues of mutual interest along the border in an independent and impartial manner (Government of Canada, 2003). Since its establishment, the IJC has dealt with over 100 cases including applications for approval of specific projects and references with respect to a wide variety of complex water related issues (IJC, 1997). In many of these cases, the IJC's work has freed the two governments from having to deal continually with the problems that might have troubled their diplomatic relations (IJC, 1997). In other cases, the IJC has provided an early warning in respect of issues that might have become sources of environmental concern (IJC, 1997).

Becker et al. (2004) argued that the IJC has helped in promoting a sense of shared goals and impartiality necessary for effective transboundary management (Becker et al., 2004). According to Becker et al. (2004), the IJC has been able to effectively reach its objectives because of its participatory approach which has given the public and the

stakeholders the opportunity to express their views on the various water management issues dealt with by the IJC, and because of its low political profile. Legault (2000) argued that over a period of almost 90 years, the Commission has divided along national lines in only two cases out of 117 and has usually reached unanimous agreement (Legault, 2000). The reason for that, according to Legault (2000), because the IJC acts as a single, unitary body that is intended to work collegially in the common interest of both countries.

Lemarquand (1993) has attributed the strength of the IJC to its impartiality which serves it well in its fact-finding tasks. According to Lemarquand (1993), the IJC provided a means of obtaining agreed upon and trusted technical and social data. According to Krantzberg et al. (2006), the IJC depends mainly on boards or task forces with equal membership from each country and under the Great Lake Water Quality Agreement (GLWQA), membership has been extended to nongovernmental experts, including representatives of environmental organizations and industry (Krantzberg et al., 2003).

Among the major accomplishments of the IJC are the development of indicators that reflect the ecosystem health of the Great Lakes, and public participation which has extended to a broad cross section of members of civil society (Becker et al., 2004; Krantzberg et al., 2006).

In the Jordan River basin, the negotiations on water have been part of the complex issues that faced the Arab and Israelis negotiators since the outset of the Madrid Conference for Peace (Wolf, 1995). Eighteen years have passed since the Madrid Conference, and yet the water conflict has not been fully resolved between some parties

(e.g. the Israelis and the Palestinians). Many agreements have been signed between the Israelis and the Palestinians since 1993; however, no explicit water rights have been established for each party (Aliewi & Assaf, 2007; ARIJ, 1996; Issac, 1998; Scheumann & Schiffler, 1998). Notwithstanding the Jordan-Syria Water Agreement of 1987 on the Yarmouk River, Jordan is only able to access less than half of its share of flow from the river, (Haddadin, 2006). The Joint Commission which was formed to execute the provisions of the Water Agreement of 1987 has not been working efficiently and has not provided a reliable source of information that allows for cooperation and a shared understanding (Interview with former high ranking official from JMWI, 2007).

Based on the lessons learned from the Great Lakes region, the political element of the proposed model for the Jordan basin should include agreement based on the principle of equality in which the rights of each riparian from the shared water are respected regardless of the differences in population and the power between the riparian states. The BWT includes that principle and guarantees equal and similar rights in the use of boundary waters despite the differences in population and the power between Canada and the United States.

A regional water agreement has not been achieved to date, and I speculate this to be due to the absence of a third party. To reach a regional water agreement in the Jordan River basin, the involvement of a third party such Turkey or the United States would be essential. Owing to its close ties to all parties in the basin, Turkey can be a key regional mediator in reaching settlement to the water problems in the basin (Ravid, 2008). The involvement of Americans would also be important because it can help provide the

economic, security, and political guarantees needed for achieving comprehensive settlement to the water problems as well as other political problems in the Jordan basin (Moubayed, 2008).

An important section of this agreement should provide for establishment of a Jordan River Basin Commission (JRBC) consisting of equal members from all the riparian states. This Commission will be responsible for all water related issues in the basin. In order to have a successful operation of this commission, one should examine the IJC which is considered to be a globally successful model with an impressive record of achievements in joint management of shared water resources (Becker et al., 2004). Any IJC weakness can be addressed and improved in the JRBC (Biam, 1997).

The JRBC needs to keep three characteristics derived from the IJC. These characteristics include: impartiality and joint fact-finding, politically low profile, and participatory management approach which involves consultation with stakeholders and the concerned public. The commissioners of the JRB must be free to act in the best interests of the region as a whole and not as arms of each riparian entity (Biam, 1997). Although each commissioner will bring national biases to the negotiating table, the goal must be reached through consensus (Biam, 1997). To ensure that the commissioners can work unrestrained by their government and to lessen the national pressure on the commissioners in the JRB payment of the commissioners and any experts retained by the commission should be made from a joint fund (Biam, 1997). A joint fund would reduce the monetary pressure a state could apply on its commissioners (Biam, 1997). This

payment plan differs from the Boundary Waters Treaty which requires that each country pay its respective commissioners (Biam, 1997).

The role of the JRBC would be multifaceted (Biam, 1997). Like the IJC, the JRBC would be responsible for monitoring the water situation, adjudicating any claims that arise, and acting as a forum for communication among the people of the countries (Biam, 1997). Also, the JRBC would be able to create boards to investigate issues. As a concession to the sovereignty concerns of the member states, the JRBC would be limited, like the IJC, to those issues it is asked to handle (Biam, 1997). As trust builds and the competency of the commissioners is proven, these limits can gradually be removed (Biam, 1997). The JRBC must also have a program for ensuring implementation. The IJC's lack of such a program has been criticized as one of its flaws (Biam, 1997).

Like the IJC, the JRBC should include in its structure the technical legal committees as well as other committees. The functions of the technical committees should include: 1) Establishing common environmental quality and pollution control regulations for both surface water and ground water, 2) Establishing a joint environmental monitoring staff including a joint laboratory for testing of water quality and pollution sources, 3) Long term resources planning, and 4) Oversee the field measurements, data analysis and interpretation, database management and other technical issues.

5.2.2 The socio-economic element

There is no where near the challenge for the parties in the Great Lakes region to meet their social and economic water requirements as compared to the Middle East. The

United States, with only four percent of the world's population, has 5 percent of the world renewable freshwater; whereas Canada, with less than 1 percent of the world's population, has seven percent of the world renewable freshwater (Kaminski, 2004).

However, because less than one percent of the waters of the Great Lakes is renewed annually and significant increases in demand are expected in the Great Lakes States and Provinces (Great Lakes Commission, 2004; IJC, 2000), measures have been taken on national and binational levels to conserve the waters so that the future water needs can be met.

On a national level, these measures included: installation of universal metering, leak detection and repair, adoption of rebate programs for water efficient appliance, and public education and outreach (GLSCI, 2008).

Installation of universal water metering was considered an essential element in conserving waters in the Great Lakes basin because it has lead to a change in behavior by allowing customers to better track their consumption and thereby reduce water use. Installation of universal water metering in Canada has proven to reduce overall residential, industrial and commercial water consumption by 15 to 30 percent (GLSCI, 2008). Detecting and repairing leaks can largely minimize the amount of lost water and reduce the amount of water pumped, saving water and energy (GLSCI, 2008). Leak detection and repair is the most practiced conservation activity in the Great Lakes region (Great Lakes Commission, 2004). Rebate programs have provided incentives to customers to invest in efficient appliances like washing machines and toilets and have helped in saving water and energy in the Great Lakes basin (GLSCI, 2008).

On a binational level, more restrictive measures to improve water conservation and efficient use of the Great Lakes waters were adopted when the Great Lakes Basin Sustainable Water Resources Agreement was signed in 2005 by the Great Lakes governors and premiers (ODNR, 2006; WIMS, 2009). This Agreement includes provisions requiring improved water conservation and efficient use of the Great Lakes (Great Lakes St. Lawrence Regional Body, 2007). This agreement provided for the establishment of the Regional Body consisting of the eight Governors and the Premiers of Ontario and Quebec (Great Lakes St. Lawrence Regional Body, 2007). Among the functions of this Body are: establishing basin wide goals and objectives for water conservation and efficiency; providing recommendation options to the Parties with respect to the development and enhancement of their water management programs; and facilitating scientific and technical interaction and data exchange between the Parties involved (Great Lakes St. Lawrence Regional Body, 2007).

Also, in 2005, the Governors of the eight Great Lakes states signed a binding agreement, known as the Great Lakes Basin Water Resources Compact. The Compact aims at protecting, conserving, and effectively managing the waters in the Great Lakes basin (Council of Great Lakes Governors, 2006). It also provided for the establishment of the Great Lakes St. Lawrence River Basin Water Resources Council consisting of the Governors of the eight states. Among the functions of the Council are preventing significant adverse impacts of withdrawals and losses on the Great Lakes basin's ecosystems and watersheds; and promoting the efficiency of use and reducing losses and waste of water (Council of Great Lakes Governors, 2006).

The region of the Jordan River basin is considered among the poorest regions in the world in terms of water resources and these resources are barely adequate to satisfy current demand (Haddad & Lindner, 2001; Fadel et al., 2001). It was projected that the water demand in the basin would be doubled by 2030 and if future demand is to be met the water resources should be increased (Al-Jayyousi & Shatanawi, 1995; Fadel et al., 2001; Haddad & Lindner, 2001). The baseline freshwater requirement to meet the socio-economic needs of each person in the Jordan basin was estimated to be 125 cubic meters/ year (Elmusa, 1993; Shuval, 2007). According to this baseline, the projected water demand to meet the socio-economic needs in Jordan in 2020 would amount to 1,685 MCM, whereas the amounts of water that would be available in 2020 would be 1,289 MCM (Abdel Khaleq & Dziegielewski, 2006). The projected water demand to meet the socio-economic needs in the Palestinian Territories would amount to 785 MCM by the year 2020 which is about three times the available supply at present (Abu-Zahra, 2001).

There is a strong belief that no single action can remedy the water shortage in the Jordan basin but many actions are needed to increase overall water availability so that the future water needs can be met. Efficient use and conservation water is one of the most reliable and cost-effective solutions to the water shortage problem faced by the region (Attallah et al., 2001). It is a cornerstone of sound water management policy, whether the resource is considered abundant or scarce (Great Lakes Basin Advisory Council, 2009). In the Great Lakes, although water is considered abundant measures to conserve water have been taken to ensure long-term availability of water.

In the Jordan basin, although the states have very limited water resources, a large proportion of the region's water supply is wasted because of the age and inefficiency of water supply (El-Naser, 2007; Issac & Selby, 1996). According to Elnaser (2007), about 56% of the total production of water for municipal uses in Jordan is unaccounted for water (UFW). Unaccounted for water includes leakage, illegal use, unmetered deliveries, and errors in meter reading. Leakage and illegal use is estimated at 37.5% (El-Naser, 2007).

Based on the lessons learned from the Great Lakes region, technical and economic measures should be developed and implemented to reduce consumption and save water. Technically, many of the networks are old and have to be replaced to achieve the highest possible efficiency in water conveyance, distribution, and use (Abdel Khaleq & Dziegielewski, 2006). Broken metering devices must be replaced and errors in meter reading or in the billing process should be corrected (El-Naser, 2007). Also, technology transfer among the riparian states in terms of water saving devices should be encouraged. Some water conservation activities involve costs that must be paid by the public, such as fixing water taps, upgrading irrigation systems, or modifying industrial production lines (Attallah et al., 2001). These costs of water conservation programs must be offset by some incentives (Attallah et al., 2001).

A public awareness and education targeting all water users is needed to achieve long term awareness and change in attitudes of water users (Abdel Khaleq & Dziegielewski, 2006). In the Middle East, water conservation activities and awareness campaigns typically focus solely on domestic users (Attallah et al., 2001).

5.2.3 The scientific element

A historic scientific underpinning provides for binational guidance to develop programs protective of the quality and quantity of the Great Lakes waters. These include the establishment of common general and specific water quality objectives, the development of indicators that reflect the integrity of the lakes, and the establishment of a common base of data and information regarding water withdrawals, diversions, and consumptive uses (Great Lakes Commission, 2005).

In the Jordan River basin, deteriorating water quality is a serious issue in the basin and increasing pollution and salinization threaten to make more and more water resources non-utilizable in the future (Haddad, & Lindner, 2001). The water resources in the basin suffer from considerable environmental degradation resulting from irrigation return flows and the disposal of sewage and treated wastewater from all riparian countries (Scott et al., 2003). However, most of the water agreements signed had no references to water quality. The Jordanian-Syrian Agreement of 1987, for example, only provided that the signatories each within its territory shall take all necessary measures for prevention or minimization of silt accumulation in the Interstate Reservoir (Dombrowsky, 1998).

Furthermore, most of these agreements have not included any provisions for sharing data among the riparian states in terms of precipitation on the basin; rivers water quality information; groundwater abstraction, water level and quality in the basin; allocations and withdrawals from the rivers, and reservoirs storages (Dewiri, 2007).

In the Great Lakes basin, the GLWQA of 1972 set general and specific water quality objectives and mandated programs to meet them (IJC, 2006). It gave priority to point-source pollution from industrial sources and sewage plants (IJC, 2006). In 1978, the

two governments replaced the GLWQA of 1972 Agreement with a new agreement. The GLWQA of 1978 was built upon the foundation established in the earlier Agreement, as well as new information from scientists both in and out of government (IJC, 2006). It shifted the focus from conventional pollutants, such as phosphorus, to toxic and hazardous polluting substances. The GLWQA of 1978 adopted an ecosystem approach and called for a broad range of pollution-reduction programs (IJC, 2006).

In the Great Lakes basin, regional water database was established based on the recommendations of the Great Lakes Charter which was signed by the Governors of eight states and the Premiers of Ontario and Quebec in 1985 (Great Lakes Commission, 2005). The Charter of 1985 focuses on the use, conservation, protection and effective and cooperative management of the water resources of the Great Lakes basin with particular attention to major diversion (IJC, 2000). It called for the development of a uniform, consistent data base of Great Lakes water withdrawals, diversions and consumptive use (the Great Lakes Commission, 2004).

The first step taken toward establishment of the Great Lakes water data base was the establishment of the Water Resources Management Committee (WRMC) consisting of a representative from each Great Lakes state and province (Water Resources Management Committee, 1987). The function of the WRMC included identifying specific common water data needs; development and design of a system for the collection and exchange of comparable water resources management data; recommending institutional arrangements to facilitate the exchange and maintenance of such data; and

development of procedures to implement the prior notice and consultation in terms of water diversion from the lakes (Water Resources Management Committee, 1987).

To assist the WRMC, three subcommittees were formed. One addressed elements comprising a regional data base, the second addressed institutional criteria for storing, maintaining, and exchanging data, and the third addressed procedures for development of prior notice and consultation (Water Resources Management Committee, 1987).

Since 1988, these data have been provided to the repository on an annual basis, and data are compiled and reports provided to assist the jurisdictions in water resources planning and management (Great Lakes Commission, 2005). According to the Great Lakes Commission (2005), establishment of water database in the Great Lakes basin is important for conducting trend analyses, developing uniform and consistent demand forecasting applications and promoting regional water conservation programs.

Based on the lessons learned from the Great Lakes region, a joint regional water database would be important for creating the transparency needed for narrowing the divergent perceptions of the problem and contributing to more rational water resource planning in the Jordan basin (Dombrowsky, 1998). Dweiri (2007) believes that establishment of a joint regional water database would foster a cooperation spirit through data sharing and joint analyses, and generate a better collective understanding of the Jordan system through integrating the entire knowledge fragments into one trusted common database.

The regional water database in the Jordan basin should include precipitation on the basin, water withdrawal from the Yarmouk and the Jordan Rivers, groundwater

abstraction and its water level and quality, and the current uses and projected demand for municipal, industrial, and agriculture use. This information is available for various countries but is not shared among the riparian states, which has been a limiting factor for accurate model predictions of water supply to the basin.

In order to establish a regional water database in the Jordan basin, it is important to establish first a Jordan River Basin Water Resources Management Committee. This Committee should be working under the JRBC and it should be entrusted with:

1. Development of the components and content of the database.
2. Collection of all previous data and an assessment of the consistency and comparability between the different data from the riparian states.
3. Establishment of common environmental quality and pollution control regulations for both surface water and ground water.
4. Establishment of a regional environmental monitoring staff including a regional laboratory for objective testing of water quality and pollution sources.
5. Submission of annual report to the JRBC on the quality and the quantity of the surface and groundwater resources in the basin.
6. Recommend policies to guide the protection and management of the water resources in the basin.

The JRBC will serve as a centralized repository for this data and it will be responsible for maintenance of the data base, retrieval of data for summaries as requested by each riparian state, and for provision of annual reports to the states in the basin. In the

Great Lakes basin, the Great Lakes Commission serves as the centralized regional data base repository based on the recommendations of the Great Lakes Basin Water Resources Management Committee (Water Resources Management Committee, 1987).

5.3 Factors that have contributed to the success achieved between Jordan and Israel on the Gulf of Aqaba and lessons learned that can inform management of the St. Clair and Detroit Rivers AOCs

The bilateral cooperation between Jordan and Israel on protection of the marine environment of the Gulf of Aqaba had been among the issues that were given priority under the Environment Agreement of 1994 (World Bank, 1996). Two years later, the joint environmental cooperation on the Gulf became effective with the signing of a special agreement for Aqaba and Eilat region. Since 1996, the projects that have been addressed by the Agreement have been duly implemented and their outcomes have been beyond expectations (The World Bank, 2002). Among the factors that have contributed to the success achieved in implementing those projects are: 1) The focus of the ecosystem approach was on achieving restoration and protection of the coral reefs of the Gulf, 2) the involvement of an external review body, and 3) the recognition of the economic benefits gained from protection of the shared marine resources. These points are elaborated below, and related to possible Great Lakes applications:

5.3.1 The focus of the ecosystem approach was on achieving restoration and protection of the coral reefs of the Gulf

The ecosystem approach has been adopted in various parts of the world, including the Great Lakes basin, the North Sea, the Gulf of Mexico, the Baltic Sea, and the Aqaba

Gulf (Duda & Sherman, 2002). The lessons learned from the protection of the Gulf's coral reefs suggest that the ecosystem can better achieve the desired outcomes if its focus is directed toward achieving a specific target. In the Aqaba Gulf, the focus of this approach was only on restoration and protection of the Gulf's reefs not on improving the whole ecosystem of the Gulf. This has led to the following consequences: 1) consensus among decision makers on common implementation plans, 2) consensus on common methodologies for conducting field work, and 3) tracking and reporting on progress.

In the Great Lakes, the focus of the ecosystem approach has been beyond the water quality of the lakes and this has been among the factors that have affected the progress in the restoration of the beneficial uses in the shared AOCs.

5.3.2 The Involvement of an external review body

The success achieved in reaching the goals of the joint projects on the Aqaba Gulf reveals that involvement of an external review body is valuable for meeting the objectives of transboundary projects. The joint projects between Jordan and Israel on the Aqaba Gulf were supervised by teams from the World Bank and the USAID who were proactive in detecting and resolving implementation problems (World Bank, 2002; Crosby et al., 2002). According to the World Bank, its missions were well prepared with appropriate terms of reference and its follow-up letters were well organized, focusing on key issues and solutions (World Bank, 2002). Its supervision team consistently provided appropriate advice to the implementing agency and agreed on action plans with the project authorities to improve implementation (World Bank, 2002).

The existence of an external body on the transboundary joint projects on the Gulf has also created a sense of accountability. The officials from Aqaba, Jordan and Eilat, Israel were aware that full implementation of the joint environmental projects should be completed within the closing date of the projects, as well as within the duration of the fund. They carried out their responsibilities in a timely and efficient manner. According to the World Bank (2002), the performance of the Aqaba Government to the Environmental Action Plan project has been satisfactory and its contributions to the project were timely and have exceeded planned contributions.

In the Great Lakes basin, creating a new external review body has been among the proposals to improve commitments by governments and agencies towards cleaning up the AOCs (Krantzberg et al., 2007). However, some RAPs practitioners argue that the IJC is already in place, and it makes more sense to strengthen its role as an overseer of GLWQA implementation and provide it with the necessary resources. The lessons learned regarding a neutral third party in the Aqaba Gulf suggest that the IJC can play a more effective role in the Great Lakes basin if the governments increase the budget given to the IJC and provide timely and meaningful responses to the IJC's findings and recommendations.

5.3.3 Recognizing the economic benefits gained from protection of the shared marine resources (e.g. the coral reefs) in the Gulf

The joint recognition of the economic benefits gained from protection of the shared marine resources has been among the driving forces to gain the governments' support needed to manage and protect the marine resources of the Aqaba Gulf and

especially its coral reefs. The coral reef is a major tourist attraction that makes a significant contribution to the local economy of Aqaba, Jordan, and Eilat, Israel (Downie et al., 1996). Thus, the two countries realized that a successful tourism industry on the Aqaba Gulf depends on the availability of clean, non-polluted water and healthy coral reef ecosystems (Halasah & Ammary, 2007). Portman (2007) noted that the motivation of the two countries to work together on the Aqaba Gulf was because they realized that the opportunities for tourism would be lost if the Gulf became a degraded sink for pollutants.

Recognizing the economic gains that derive from healthy marine resources of the Aqaba Gulf, a number of measures have jointly been taken by Jordan and Israel with the aim of protecting the coral reefs in the Gulf. Establishment of the Red Sea Marine Peace (RSMPP) program is the most important measure that has been taken in this regard.

According to Crosby et al. (2002), the RSMPP called on Jordan and Israel to collaborate in research efforts on coral reefs and marine biology, and to implement comparable policies and regulations designed to protect the coral reefs as a tourist attraction.

The economic value of the protection of the Gulf coral reef was studied in 1996 by a team from Columbia University, USA. This team concluded that an effective reef protection is a worthwhile investment for the region's citizens and reef protection would pay for itself, generating US$ 16 million in net benefits (Downie et al., 1996).

In the Great Lakes, the restoration of beneficial uses in the AOCs would clearly have significant economic benefits. Austin et al. (2007) estimate that the return on investment in protecting and restoring the Great Lakes would result at least in a 200%

return on investment. The lessons learned from the Aqaba Gulf suggest that information regarding the economic benefits from restoration of the beneficial uses in the St. Clair and the Detroit Rivers should be synthesized since the restoration of the beneficial uses in the two rivers would be extremely valuable to the local economy as some RAP practitioners pointed (Briggs, 2008, Coulter, 2008).

5.4 Concluding contributions to the state of knowledge

This thesis examined successes and failures in two shared water basins namely the Laurentian Great Lakes and the Jordan River basin. Through scholarly analysis and in depth interviews, the characteristics of success from each of the basins were identified and applied to the areas of weakness in the other basin.

Success from the Great Lakes prior to 1987 included sound and shared science, socio-economic considerations for the future of the basin, and inclusive political engagement. These attributes were found lacking in the Jordan basin as a whole. There is no data sharing on water quantity or quality among the countries bordering the Jordan basin, no measures have been taken by the parties to ensure the future sustainability of the waters, and there is no single agreement that engages all the parties.

Success in managing and protecting the marine environment of the Aqaba Gulf and particularly the coral reefs demonstrated the appropriate application of the ecosystem approach, the importance of third party with high level of credibility and authority, and the value of recognizing the economic importance of the natural assets. In the Great Lakes, particularly in the last twenty years, these attributes have not been well understood (e.g. the ecosystem approach), have not performed effectively (e.g. the waning moral authority of the IJC), and have not been widely applied (e.g. the economic valuation).

While the slow pace of implementation in the Great Lakes is possible to resolve, for example through a revised Great Water Quality Agreement, the challenges facing the

Jordan River basin will be more difficult to rectify. Ultimately, what is needed for the Jordan River basin is an agreement that includes all of the parties, articulates the rights and responsibilities of the neighbouring countries, ensures open access to the data and information, includes water quality as well as water quantity, and protects the resource in light of future pressures associated with population growth and water scarcity.

It is strongly recommended that these successful aspects of shared water management be transferred between the regions to result in more sustainable solutions for the Great Lakes and the Jordan River basins.

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