Living With The Lakes: Challenges and Opportunities

Annex C
Interests, Policies, and Decision Making: Prospects for Managing the Water Levels Issue in the Great Lakes – St. Lawrence River Basin

LIVING WITH THE LAKES:

CHALLENGES

AND

OPPORTUNITIES

ANNEX C

INTERESTS, POLICIES AND DECISION MAKING: PROSPECTS FOR MANAGING THE WATER LEVELS ISSUE IN THE GREAT LAKES - ST. LAWRENCE RIVER BASIN

PREPARED BY FUNCTIONAL GROUP 3
FOR THE PROJECT MANAGEMENT TEAM

International Joint Commission
Water Levels Reference Study

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PHASE 1 REPORT OUTLINE
IJC FLUCTUATING WATER LEVELS STUDY

MAIN REPORT

ANNEX A - PAST AND FUTURE WATER LEVEL FLUCTUATIONS

ANNEX B - ENVIRONMENTAL FEATURES, PROCESSES AND IMPACTS: AN ECOSYSTEM PERSPECTIVE ON THE GREAT LAKES - ST. LAWRENCE RIVER SYSTEM

ANNEX C - INTERESTS, POLICIES AND DECISION MAKING: PROSPECTS FOR MANAGING THE WATER LEVELS ISSUE IN THE GREAT LAKES - ST. LAWRENCE RIVER BASIN

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Section 7 of this Report is largely based on the working documents prepared by joint U.S. - Canada teams, listed in Appendix 4. The compilation of these documents and the interpretations in this Annex included extensive involvement with representatives of various interests. Sections 5 and 9 draw heavily upon the work of Mike Donahue. Various sections of the Annex benefitted from critiques by individuals outside FG3, notably Reid Kruetzwiser, Bob Roden, Pearl McKeen, Doug Brown, Robert Spargo, Bruce Mitchell, and Ruth Edgett. The compilation of the manuscript was greatly assisted by Madeleine Ward.

We sincerely thank all those who contributed to this Annex. Of course, the document, including its approach, interpretations, conclusions and errors, remains fully the responsibility of the authors. The authors are:

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ANNEX C

INTERESTS, POLICIES & DECISION-MAKING: PROSPECTS FOR MANAGING THE WATER LEVELS ISSUE IN THE GREAT LAKES - ST. LAWRENCE RIVER BASIN

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EXECUTIVE SUMMARY

The broad purpose of the IJC Water Levels Reference Study is to examine the recurring problems posed by fluctuating water levels in the Great Lakes - St. Lawrence River Basin and to assist governments in deciding what might be done to deal with the issue. This report represents a distinct contribution to the achievement of that purpose, by seeking to better understand the social, economic and political dimensions of the issue and the on-going challenge to governments. It focuses on interests' concerns, their views of the problems and solutions, and how these relate to the responsibilities of governments. The intent is to identify the key elements of the political challenge to governments; in particular, the reasons why interests petition governments for action, and what government response, if any, is called for. These concerns and positions of interests are compared to the stated mandates of governments, together with the current knowledge about fluctuating water levels and associated ecological processes. The findings from this approach provide a basis for identifying actions of governments which can address the management issues associated with fluctuating water levels.

Within the Great Lakes - St. Lawrence River Basin there are multiple interests who have made decisions to use the lakes in anticipation of receiving certain benefits. The interests have been categorized into the following classes: riparians (shoreline property owners), environmental groups, electric power, transportation, commercial and industrial companies, recreationists, commercial fishing, and agricultural interests, native nations, and agencies of governments. When interests' expectations about gains and costs associated with their use of the lakes are not met, they often petition governments for action. At other times, interests may perceive that some action by governments can improve or worsen their situation, even if they have not experienced consequences from their decision to use the lakes. As a result, these interests may petition governments to adopt or reject measures that will affect their welfare. Governments become particularly sensitized to the issue when interests petition for action.

The analysis shows that the experiences, factual understanding and values of the interests vary greatly both among and within interest classes. This situation makes it extremely difficult to establish a basis for evaluating the merit of interests' petitions and the appropriateness of government actions. Consequently, the approach taken in this investigation has been to distill existing policy themes or guiding principles of government, and use them to guide the analysis rather than to establish entirely new judgement on government responsibility.

Investigations reveal that discernible and common tendencies in policy exist between the governments of the two countries. The policy themes pertinent to the water levels management issue have been identified as follows:

- Governments seek to promote "informed" decision making by interests.
- Governments seek to promote "responsible" decision making by interests.

- o Governments seek to assure resiliency of interests to adapt to natural hazards.

- o Governments seek to promote the development of the economy, subject to the imperatives of long term environmental protection

- o Governments seek to promote, and expect to have, an "open" planning process, giving multiple interests access to decision making processes.

These policy themes provide the foundation for interpreting the positions of the interests, and for isolating those instances where government action is warranted, based upon policy.

The approach used to interpret the positions of interests in light of the policies and responsibilities of governments has sought to understand the decision process interests go through, either consciously or subconsciously, when choosing to use the lakes and related land resources, and how and when such use results in calls for government action. This study has identified four areas where petitioning relates directly to the established responsibility of federal governments. These are when the interests' position seems to be related to:

- o surprise due to inadequate information,

- o lack of resiliency to natural hazards,

- o benefit enhancement,

- o cost shifting.

The analysis of why the interests take their positions and how their concerns and motivations relate to the policies of governments reveals that many of the interests were "surprised" by some element of the Great Lakes system, such as the levels, the degree of flooding or erosion, or the failure of governments to do something about these things. This "surprise" is relevant to governments because of their commitment to "informed and responsible" decision making. Also a concern to governments is lack of resiliency by interests to the costs of natural hazards, when this lack of resiliency reflects a failure in promoting informed investment decisions or when it threatens an economic sector or creates widespread hardship. Some petitions by interests seem to seek a shifting of costs associated with an investment to others, in particular the environment or the general taxpayer. Government policies discourage cost shifting and seek to protect the environment. Other interests support measures that would enhance their investments. This is something governments might approve of, but not if it requires modification of the physical system at public expense or at cost to the environment.

Investigations found that measures to regulate levels and flows (Type 1) receive the most attention from interests, with support coming strongly from riparian groups and with opposition pronounced in environmental interests. Those not seeking Type 1 measures petition for the status quo or more

localized responses. Generally, there is limited knowledge of, and little widespread support for measures which directly restrict (Type 3) or indirectly influence (Type 4) the uses of land and water. However, there does appear to be general, if unfocused, support for measures enhancing information, particularly about the physical system.

The institutional analysis reveals that the process for making resource use decisions has grown increasingly complex. Fiscal and environmental constraints on governments are more pronounced, and a more active public demands a place in the decision process. Despite governments' commitment to public involvement, such participation is not achieved within the current decision making structures. Much of the disagreement over the issue can be traced to the current institutional arrangements which are not designed to facilitate mutual learning or resolution of disputes. While the governance setting is extremely complex, this complexity does not appear to be the primary institutional problem, which seems to lie more with the traditional technical methods of evaluation. Any decision making process must recognize the dynamic and uncertain nature of the system and work within its' complexities. Some alternative decision making processes are available which work towards consensus building as an approach to deal with conflicts inherent in the water levels issue and decision making.

Recommendations to federal governments have been organized into six broad categories which together make up an action program. The main recommendations are that:

- o Governments confirm/articulate their policies and responsibilities.
- o Governments determine specific information needs about the Great Lakes Basin system and develop appropriate information bases.
- o Governments establish vehicles for, and commit to, the use of communications.
- o Governments make clear that new Type 1 measures are extremely unlikely to be implemented in the foreseeable future.
- o Government commit appropriate resources to the design and development of measure other than regulatory works.
- o Governments establish contingency plans for extreme events.

FOREWORD

The Canadian and United States federal governments sent a Reference (August 1986) to the International Joint Commission to study the recurring problems posed by fluctuating water levels in the Great Lakes - St. Lawrence River Basin and to report on actions which governments might take to manage the issue. The structure established for this Study was a Project Management Team, comprised of five Functional Groups, dealing with such dimensions as hydrology, coastal ecology and resources, social and economic impacts, public participation, and system synthesis. The products of the Study are captured in a series of Annex reports, which correspond to some degree to the Functional groups, and a main report.

This document incorporates the principal products of Functional Group 3 (FG3), Socio-Economic and Environmental Assessment. The initial responsibilities of FG3 included developing a framework to assist in the evaluation of courses of action, designing an inventory of measures, identifying relevant interests, assessing socio-economic and environmental impacts, and considering the policy and institutional context within which decisions are made. Preliminary investigations indicated that conventional approaches to assessing impacts, developed largely for specific projects, were inappropriate for resolving the management dilemmas associated with fluctuating water levels. This report adopts a different approach, in which an understanding of the perspectives and responsibilities of the public and of governments is fundamental.

Governments make decisions about the laws which regulate and constrain individual behaviour and those which determine the raising and spending of revenues. The management of water and related land resources for the Great Lakes - St. Lawrence River Basin requires continuing attention to these governmental roles, as demonstrated by the issues and concerns expressed under the current Water Levels Reference Study. The necessity for joint decisions over the international waters of the Great Lakes complicates the governmental decision challenge. To facilitate decisions where joint action between Canada and the United States is necessary, the Boundary Waters Treaty of 1909 created the International Joint Commission (IJC) and empowered it with specific authorities for facilitating bi-national decision making on water resources. The success of the IJC has been associated with early actions that addressed the potential and merit of lake levels management, and the resulting implementation of such actions. More recent IJC emphasis has been placed upon water quality concerns. However the issues associated with lake levels continue to be assigned to the IJC for review.

After the high water period of 1985-86, the Canadian and United States federal governments requested that the IJC report to them on the problems posed to basin interests by fluctuating lake levels and that it provide an assessment of measures which might be considered for addressing such problems. In this regard, this latest reference is part of a long tradition of bi-national efforts to define a strategy for managing the lakes and human uses of the Basin.

However, in recent decades there have been changes in the manner in which governments make resource management and investment decisions. Such decisions have been opened up to a larger public. As well, criteria used by governments to characterize the nature of water resource problems and to choose appropriate actions have been modified. The current decision making system is now far more complex than was the case at the time of the Boundary Waters Treaty. This complexity is evidenced in an array of resource management policies, numerous governmental institutions which have some authority on lake and shoreline use, and widely expanded opportunities for interests' access to and influence on decision making. Today, more is required than an evaluation of hydrology, engineering, costs and economic development benefits, supplemented by a public information function, in order to establish the extent of the problem, the opportunities for managing the issue, and the merits of specific measures. Evaluation is now done as a process of public (interest) interaction, which must be supported by technical analysis.

The water levels issue demands a new type of management. By themselves, the conventional options of resource management (attempting to control the physical environment to suit human activities) or shoreline management (attempting to control human activities to accommodate the physical environment) are insufficient to address the situation in the Great Lakes Basin. This report adopts a broader, issue management perspective, which focuses upon the concerns of interested parties and relates these to the responsibilities of governments and the decision making process. Resource management and shoreline management represent possible actions within this broader management challenge.

In response to this new planning environment, and reflecting the nature and scope of the water levels issue, this report is structured to identify the impediments and prospects for improved issue management. This involves establishing the context within which interested parties respond to changing conditions and interact with governments. It involves an exploration of the government policies and the institutions through which decisions are reached. It involves gaining an understanding of how the interests view the problem and why they adopt certain perspectives. This analysis leads to a synopsis of the responsibilities of individuals, organizations and governments, and provides specific directions for government action to help manage the water levels issue.

SECTION 1

INTRODUCTION

The broad purpose of the IJC Water Levels Study is to assist governments in deciding what might be done about the problems associated with fluctuating water levels in the Great Lakes - St. Lawrence River Basin. It is readily apparent that the issue is complex and multi-faceted. The challenge to the Study, and hence to the governments of Canada and the United States, is not simply that water levels fluctuate or that certain individuals or businesses suffer certain consequences. The issue also involves different perceptions of the facts, political pressures by interests, suspicions over the decision process, disagreements over appropriate courses of actions, and varying appreciation of the options open to governments.

The issuing of the Water Levels Reference, one of several in the past decade, is evidence of the difficulty federal governments have in addressing the issue. Much of this difficulty relates to the complexity of the problem, involving as it does a broad geographic scope, interdependencies of hydrology, ecology and human activity, a wide range of affected interests, a broad array of potential government responses including structural, non-structural, administrative and legislative options, a mix of institutional responsibilities, differing perceptions and preferences, and changes over time in both environmental conditions and political climate.

This report represents a distinct contribution to the study of the water levels issue. Its aim is to understand better the social, economic and political dimensions of the current situation and the on-going challenge. It focuses on what interests see as the problems and solutions, and how these relate to the responsibilities of governments. The intent is to identify the key elements of the political challenge to governments; in particular, why it is that interests petition governments for action, and what governmental response, if any, is called for. These concerns and positions of interests are compared to the stated mandates of governments and the current knowledge about fluctuating levels and associated ecological processes. The findings from this approach provide a basis for identifying actions of governments which are possible and needed to address the management issues associated with fluctuating water levels.

The report is based upon information gathered from numerous sources. Working groups on each interest class conducted surveys, participated in group interviews, and reviewed documents, publications and correspondence by organizations, individuals and past studies. Other inputs to the investigation were achieved through workshops, reviews of policy statements, and critiques of draft sections by scientific experts and representatives of government agencies. The sources of information and supporting documents for this report are outlined more fully in Appendix 3, and a list of individuals who contributed to the exercise is given in Appendix 4.

Section 2 of this report summarizes the context within which the issue has developed and within which it must be managed. This includes a description of

the physical setting, as it is currently understood by the scientific community, and the social, governance and decision making settings.

Section 3 supplies a classification of interests, which include individuals or groups who use Great Lakes water or locations in some way, and who perceive their welfare to be influenced by water levels or policies pertaining thereto. The various classes of interest are described along with a brief note on the manner in which they use or invest in the resources of the Basin.

Section 4 presents a summary of the wide range of measures available to governments. It provides a basic description of the main types of measures which are referred to throughout the report.

Section 5 reviews relevant policy themes of the governments of Canada and the United States. It highlights the mandates and commitments of the federal governments with regard to the Great Lakes water levels. This review serves as a basis for comparing government positions with the views other interests hold about the roles and responsibilities of governments.

The approach taken to examining the positions of interests is given in Section 6. A framework is developed to interpret why some interests have a particular view of the issue and petition for certain actions, while others lobby for quite different measures or seem relatively indifferent to the issue. This analysis relates to interests' perceptions of physical processes and government responsibilities, and to their investment decisions and risk-taking behaviour.

The framework is employed in Section 7 to interpret the position each of the interests has taken on the water levels issue. For each interest, a description is given of their concerns related to fluctuating water levels, their stated position on the issue, and an interpretation of the interest's view of the problem in light of the responsibilities of governments.

Section 8 addresses future uncertainties regarding future environmental conditions and social, economic and political events. It then discusses their implications for the water levels issue.

This report concentrates on gaining an understanding of the recurring political dilemma associated with changing Great Lakes levels, and examines the implications of this understanding upon the way governments deal with the issue. Section 9 describes the current institutional arrangements and decision processes through which governments implement policy. These arrangements and processes represent the fabric within which interests and governments interact and from which decisions emerge. This section brings the analysis full circle in that what began with a challenge to decision making is concluded with an examination of the decision making process and it's implications for actions of governments. It is clear that "actions" of governments in this issue go well beyond specific "measures", and include both broad policies and the institutional arrangements for decision making.

The significant conclusions and recommendations for government action are presented in Chapter 10.

This report represents a departure from conventional approaches to the analysis of social and economic aspects of resource use projects. The distinctive nature of the water levels issue, particularly its scope and scale, demanded a different, but nonetheless systematic methodology. The analysis undertaken for this report yields some novel and valuable insights into the issue, and offers some definitive suggestions to governments for managing the issue over the immediate and long term.

SECTION 2

MANAGEMENT CONTEXT

2.1 INTRODUCTION

To identify the impediments to and prospects for improved issue management, a series of management realities salient to the lake levels issue must be established. The Great Lakes are a huge and dynamic system within which there are a variety of physical conditions (e.g. shoreline composition; local bathymetry and topography; extent and type of development; range and frequency of levels, winds, storms and ice extent). The Great Lakes - St. Lawrence River Basin also represents an intensively used resource, shared by a variety of interests. Differences among these interests have significant implications for issue management. The numerous government organizations having authority within the Basin also greatly influence how the issue is managed. Likewise, decision making procedures which have developed over the years are crucial to the management of the water levels issue.

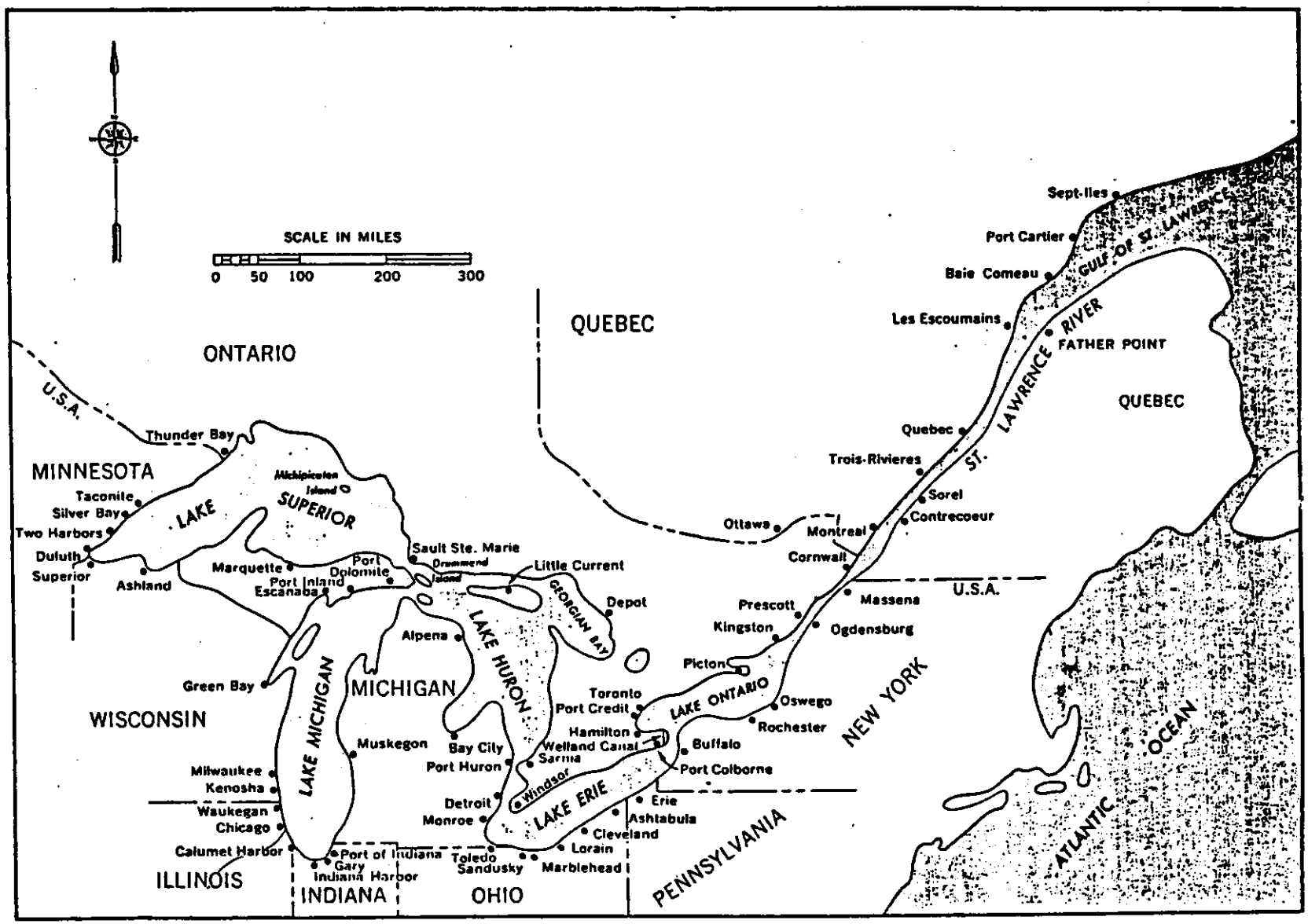
This section outlines the physical, social, governance, and decision making factors which comprise the management context of the Basin. Discussions of the physical setting serve to present the current scientific understanding of the hydrologic and ecologic attributes of the Great Lakes - St. Lawrence River Basin which may have significant implication for issue management. This current knowledge about the physical and ecological system comes from other functional groups in this Study, in particular FG1 and FG2. It is essential that these current understandings be recognized before proceeding with the rest of this report. Indeed, much of what follows can only be understood by recognizing the current understanding of the physical and ecological systems. The social, governance and decision making settings, described subsequently, help to set the stage for later discussions concerning the problems and opportunities for more effective management of the water levels issue.

2.2 PHYSICAL SETTING

The Great Lakes and St. Lawrence River form the largest chain of freshwater reservoirs in the world. Consisting of Lake Superior, Michigan, Huron, Erie and Ontario each lakes drains into the next and out to the ocean through the St. Lawrence River (see Figure C-2-1). The magnitude and dynamic nature of the system has important implications for its use and management.

Water Levels

Functional Group 1 has concluded that fluctuations of water levels, both seasonal and long term, are primarily a natural process, and human influence on these fluctuations is minimal. Human factors affecting water supplies to the lakes, in the form of increasing consumptive uses, management of existing diversions, and land use modifications have altered lake levels only by modest amounts when compared with natural conditions. Seen in this light,



GREAT LAKES—ST. LAWRENCE NAVIGATION SYSTEM

Figure C-2-1: Great Lakes - St. Lawrence Navigation System

these human effects upon the Great Lakes system may be said to have generally insignificant influences on fluctuations in levels.

The following points support this conclusion:

- The effects of land use changes on levels and flows are hard to quantify, but at present are estimated to be minimal. As the population of the Great Lakes - St. Lawrence River Basin increases, so too does the amount of urbanization. The resulting deforestation and laying of pavement leads to increased runoff. The effects on runoff to the Great Lakes are difficult to quantify. Preliminary analysis shows that significant changes in runoff can occur with urbanization, but its net effect on water levels is unclear. Similar problems with estimating the influence on runoff and water supplies exist with regard to the effect of forest and agricultural land use changes.

- The effects of shoreline structures, infill, etc., on levels and flows are minimal. These structures include bridge supports in the connecting channels, dikes in the St. Clair River and various landfills and other structures in the Niagara River. While bridge supports can cause small, local backwater effects, they do not significantly affect water levels or outflows. The same is true of landfills and other structures. The largest impact of these structures was found to be on the Niagara River, and yet it only amounted to a minimal increase in the level of Lake Erie.

- The effects of consumptive use on levels and flows is minimal. The rates of withdrawal and consumptive use of water within the Great Lakes - St. Lawrence River Basin watershed are not constant from year to year because of changes in population, manufacturing and other socio-economic factors, as well as changes in climatic variability. Latest (1985) estimates for consumptive use for the U.S. and Canadian portions of the Basin are 3,400 cubic feet per second (cfs) and 900 cfs respectively. Projected U.S. consumptive use for the year 2000 would be in the range of 5100-7700 cfs while that for Canada would be about 1400 cfs. These are minimal amounts when compared to the natural flow of water in the connecting channels. For example, the total combined maximum projected for consumptive use (9100 cfs), represents less than 4% of the average outflow of the St. Lawrence River (242,000 cfs) and less than 5% of the average outflow of the Niagara River (205,000 cfs).

- The effect of water level regulation (structures and plan operation on Lakes Superior and Ontario 58D without discretion) on monthly average levels and flows are modest when compared to the natural range that has occurred. Water level variations between 1900-1988 have ranged from about 4 feet on Lake Superior to about 6.25 feet on Lakes Michigan-Huron and Erie and about 6.5 feet on Lake Ontario. These ranges have been modified, respectively, to about 3.5 feet on Lake Superior (a reduction of 0.5 feet) and 6 feet on Lake Ontario (a reduction of 0.5 feet) due to regulation of their outflows into the St. Mary's and St. Lawrence Rivers.

Water Level Regulation: System Effects

It is clear from the analyses of FG1 that, in the absence of diversions into and out of the Basin, controls to dampen fluctuations on the lakes will amplify fluctuations of levels and / or flows upstream and / or downstream. Regulation of the outflows from Lakes Erie and Michigan-Huron is technically possible and could reduce the range of levels on those lakes. For example, with the addition of regulation of Lake Erie outflows, the current range of levels could be reduced. However, any regulatory devices placed in the outlets of any of the presently unregulated middle lakes will in turn, not only increase flow variation in the connecting channels, but will also increase the range of fluctuations in Lake Ontario levels and increase variation in St. Lawrence River flows. To maintain the current Lake Ontario water levels regime under these conditions would require extensive channel modifications in the St. Lawrence River, as well as restructuring of the Lake Ontario regulation plan.

Flooding

Flooding, although not independent of "static" levels, is primarily related to storm activity. A majority of all shoreline flooding is caused by storm events superimposed on high water levels, not only by high water levels. Flooding can also occur at lower water levels if the storm is strong enough. Storms are the catalyst for inundation and flooding events, not just levels. As strong winds during storm conditions blow over the surface of a lake for prolonged periods, water is "pushed" in the direction of the wind, resulting in a rise in water level at that end of the lake (storm surge, or set-up). The December 2, 1985 storm on Lake Erie caused almost an 8 foot rise in water level at Buffalo, New York. This rise, combined with the accompanying 10-15 foot waves that were generated, and the above average water levels that existed, caused extensive flooding along the Lake Erie shoreline. Although levels were almost 3 feet above the long term average at that time, much of the flooding would not have occurred had the storm not occurred. Similarly, in 1986, water levels on Lake Erie went higher than those recorded in 1985, yet there was very little shoreline flooding during the year, because severe storm activity did not occur.

Water level regulation can, therefore, have limited effect in preventing storm induced flooding. To illustrate the point, despite the presence of control structures on Lake Ontario and Lake Superior, these Lakes still suffer flooding along their shorelines during storm activity.

Shoreline Recession (Erosion)

The analyses of FG2 have demonstrated that, long term shoreline recession (erosion) is largely independent of lake level fluctuations. The shores of the Great Lakes are geologically very young and still undergoing substantial change. For many shore types, erosion of the nearshore profile and shoreline bluffs is an important factor in this change. Regardless of the water level, the nearshore profile is exposed to wave action. The total wave energy acting on the profile is dependent on the wave climate, but is independent of the

water level. This action causes downward erosion of the profile. A decline in levels initially results in lakeward movement of the area of active erosion. As the erosion of the profile, continues over time, the water depth over any given point in the profile increases, allowing progressively larger waves to approach the shore and causing a recession of the profile in a landward direction. This process brings the area of erosion back to the beach/bluff, thereby resuming the process of shoreline recession.

A change in water levels regime will undoubtedly have an initial effect on the profile erosion rates. A rise in water levels will lead to an initial increase in erosion rates and a decrease in levels will lead to an initial decrease in erosion rates. However, the profiles will gradually re-adjust and equilibrium rates of erosion will be restored. In fact, the most active erosion areas may adjust the fastest to water level changes, with recession rates returning relatively quickly to the long term average. In those limited areas where nearshore erosion exposes bedrock or more resistant stratigraphy however, a lowering of water levels may reduce long term shore recession rates. In most areas, however, long term erosion is largely independent of fluctuations, and controls on water levels would have little effect on the long term pattern of shoreline erosion and deposition.

Climatic Processes and Predictability

The cumulative climatic processes (precipitation, evaporation, etc.) are the main determinants of fluctuations in levels (See Figure C-2-2). These processes are essentially impossible to predict well in advance. For example, it was not known in the mid 1960s that wetter than average precipitation conditions would prevail over the Great Lakes Basin through the next two decades. Similarly in 1986, it was not known that a drought would occur in 1987-1988. As a result, it is exceedingly difficult to predict specific levels and flows beyond a period of a few months.

The reaction time of the Great Lakes - St. Lawrence River system to these climatic variations is hard to predict as well. For example, it took a number of years for the above average precipitation recorded from the late 1960's to 1985 to be reflected in the water levels of the Great Lakes (water level records were set in 1986). On the other hand, after government expectations that it would take several years for the lakes to return to average levels, the lakes dropped significantly (back to near average conditions) in a period of less than two years in response to seasonal drought conditions that occurred in 1987 and 1988. It is thus virtually impossible to manage levels and flows flawlessly. This would require predictions of conditions over a much longer time period than is possible. Given the natural variations that can occur and the reaction time of the system, this predictive capability will likely never exist for the total system. The problem is perhaps more tractable, but is still difficult, for managing levels at a single lake without consideration of "upstream" or "downstream" consequences. For the system as a whole, these realities of climatic variability and unpredictability severely limit the ability to achieve precise levels targets through regulation.

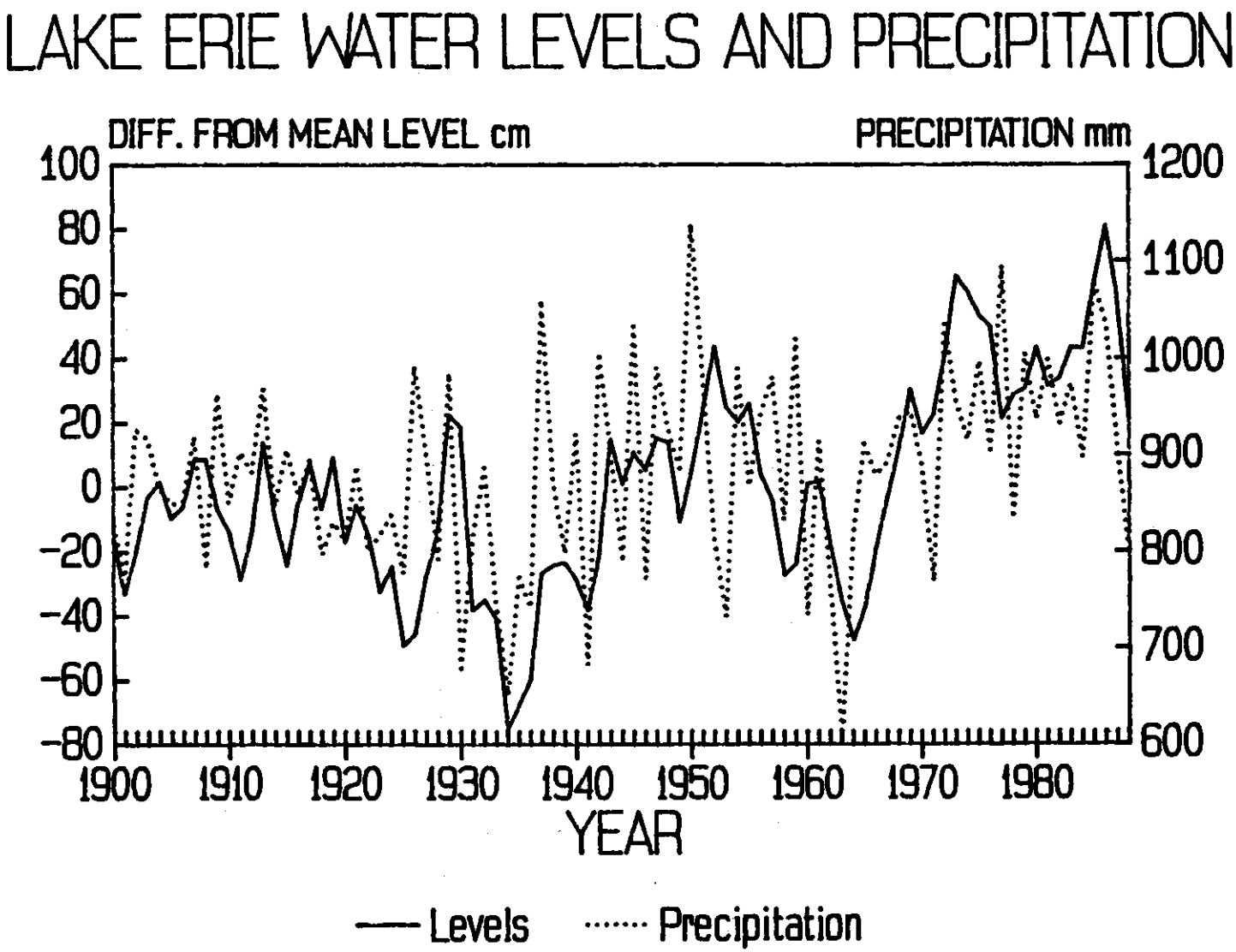


Figure C-2-2: Lake Erie Water Levels and Precipitation

The Historical Record: Predictability or Probability

There is a distinction between predicting specific levels at any future date and estimating the probability that a specific level will occur. Consider the typical weather forecast. In that forecast an analysis of the historical record of meteorological conditions is conducted and compared with existing conditions in order to make a statement about the likelihood it will rain on the given day. Thus a "prediction" is made of a probability of a set of outcomes (rain or no rain). Such probabilistic prediction might be developed for different lake levels. However, of even more importance for long term investment planning is the estimation of the probability distribution of levels over time. With such a distribution in hand the degree of risk for making a decision to capture the services (e.g. build a cottage or a power plant) of the lakes is more readily computed. In this type of "prediction" there is no certainty of specific levels over time, however there can be increased understanding about the possible distribution of levels and their likelihood.

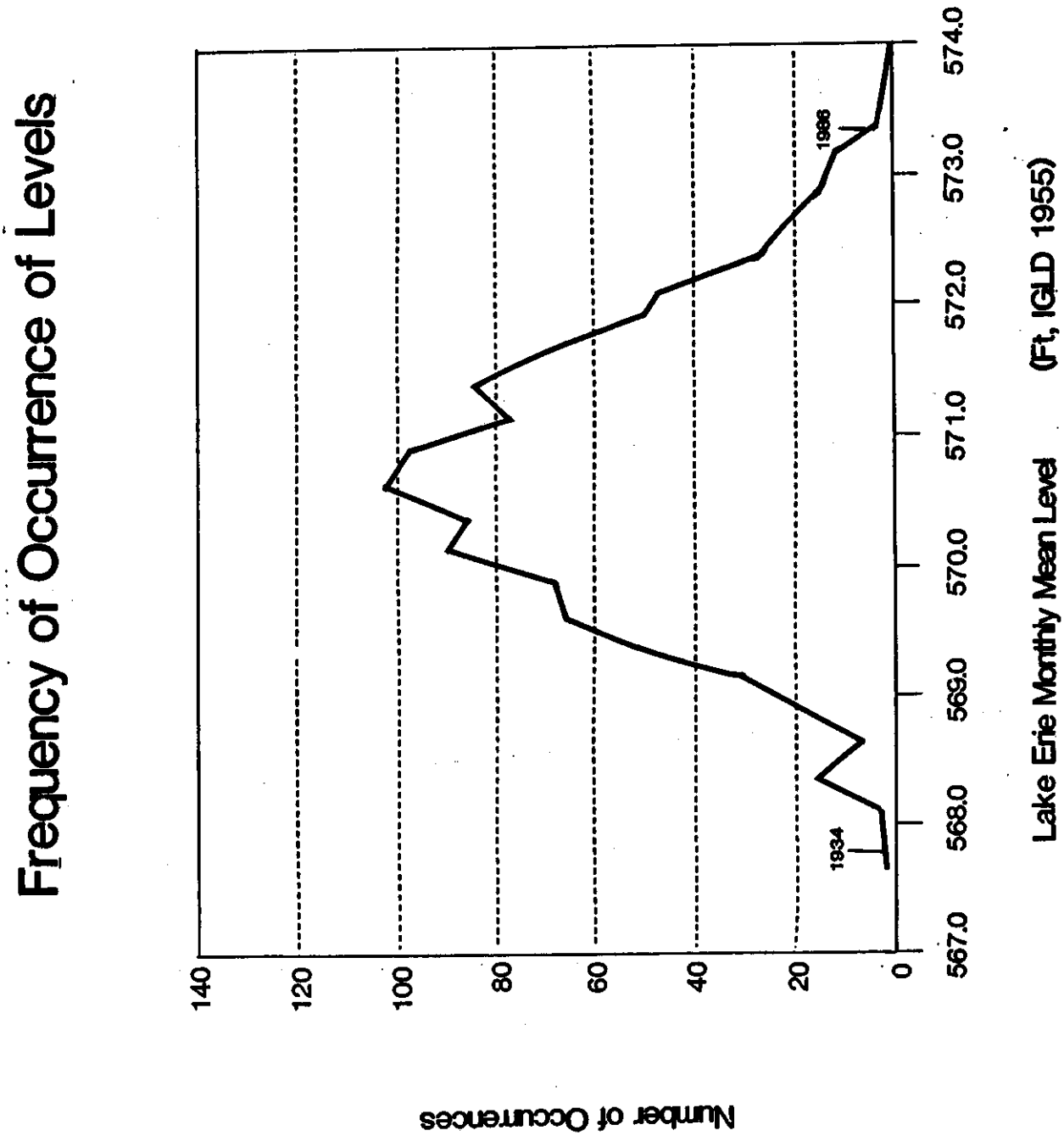
Another problem with regards to predictability is the fact that the majority of predictions made by scientists, engineers, hydrologists, etc., make use of "average" data. For example, the Monthly Water Level Bulletin produced by Environment Canada, reports monthly water level data, and uses these to make predictions of future water levels. In reality, it is quite common that the problematic water level events (i.e. those that cause severe impacts) are of a very short duration, and in some cases can be considered "instantaneous". This type of event will not be captured in data or predictions of average conditions. For example, the December 2, 1985 storm on Lake Erie caused the water level at Buffalo to be approximately 11 feet higher than the long term "average". The December 1985 monthly level is recorded as only about 3 feet above the long term "average", so this short term storm-related local level "escapes" the data. Thus, predicting problematic events is nearly impossible, as these short term events get lost when using "average" data in predictive equations.

Of course, we do not know how representative the 20th Century record of levels (the recorded distribution) (See Figure C-2-3) is of the actual distribution of levels, which may include a wider range of levels and flows and different frequencies. Certainly there is a probability that levels higher than 1985-'86 and lower than 1964 could occur. As a result, it is possible that even without climate change, levels over the next 50 years may differ from the past. If climate change occurs, it may shift the whole probability distribution in undetermined ways.

Wetland Habitat

The report of FG2 shows that coastal wetlands are a critical element of the ecosystem. They serve as important habitat for fish, waterfowl and other wildlife, providing a major source of food and energy to adjacent land and water areas. Wetlands buffer the effects of land based activity on water quality, and in some cases, may protect the shoreline from erosion and

Figure C-2-3: Frequency of Occurrence of Levels



recession. While water level fluctuations are important to terrestrial and aquatic habitats, wetlands are especially dependent on both seasonal and long term water level changes to maintain their productivity, diversity and resiliency. While extremely high water levels can have some short term adverse effects on wetlands, even these conditions are needed over the longer term to periodically renew the plant and animal communities within them.

Aquatic Habitat

The analysis of FG2 also indicates that fluctuations in water levels are generally beneficial to the aquatic ecosystem because they promote biological and habitat diversity and enhance productivity. Within the range of historical low and high water levels in the Great Lakes - St. Lawrence River system, evidence suggests that the aquatic ecosystem is more sensitive to extreme low, in comparison with extreme high levels. However, available evidence indicates that the aquatic ecosystem in the Great Lakes has exhibited considerable resiliency and adaptability to water level changes and fluctuations. Within the aquatic medium, mobile organisms are able to shift their horizontal and vertical distribution in response to water level changes.

2.3 THE SOCIO-ECONOMIC SETTING

The Great Lakes - St. Lawrence River Basin is utilized by a myriad of interests, all having some stake in the fluctuating water levels issue. This further complicates the decision making process which is already constrained by the physical features of the Great Lakes - St. Lawrence system.

The Great Lakes - St. Lawrence River system provides a navigable waterway, water for consumption and transportation access to industry, a power source for electricity, a recreational resource and habitat for several hundred species of bird, fish and reptile along with an assortment of other wildlife. The system's drainage basin is home for some 12 million Canadians and 32 million Americans. Some of the world's largest concentration of industrial capacity are located in the region. Nearly 25 percent of the total Canadian agricultural production and 7 percent of the American production are located in the Basin.

There are many individuals, groups, firms and agencies, both within and outside the Basin, who realize some benefit from location on the shoreline of the Great Lakes - St. Lawrence River and from use of the system's waters. These individuals and groups comprise a variety of interests who not only invest in and benefit from the resource but who are also sensitive in various degrees to fluctuating water levels and other physical and biological processes. These interests consider location benefits in relation to location costs and, based on their own decision criteria, make investments to secure desired services and benefits from the lakes and channels.

Therefore, within the Great Lakes Basin there are multiple interests who have made decisions to use the lakes in anticipation of receiving benefits from that decision. When interests expectation for gains from the use of the lakes are not met, they often petition governments for action. At other times the

interests may perceive that some action by governments can improve or worsen their situation, even if they have not experienced consequences from their decision to use the lakes. As a result these interests may petition governments to adopt or reject measures that will affect their welfare.

For this Study, interests are defined as those individuals or groups whose welfare is affected by use of the Great Lakes - St. Lawrence River, and have or could in the future, take political action to petition governments to take action (even if that action is to do nothing). Interests may be grouped into a number of classes including: riparians (shoreline property owners), environmental, electric power, transportation, commercial/industrial, recreation, commercial fishing, agriculture, native jurisdictions and governments, all of which use the lakes for varying reasons. This classification will be discussed in more detail in subsequent sections of this report.

Similar to natural processes, social structures and concerns are dynamic processes which confound prediction. The types of human activities currently found in the Basin are not static, but may alter dramatically over future decades. The future pattern of economic activity is uncertain, but it is clear that the ways in which the lakes and channels are used can change fundamentally in response to technological, social and economic development.

Social and economic activities undertaken by the interests are influenced by many more factors than fluctuating water levels. All of the interests are greatly affected by developments in technology, commodity demands, energy availability and price, settlement trends, and so on. Furthermore, the social and economic systems within which the interest operate extend far beyond the Great Lakes Basin, hence developments elsewhere can have significant ramifications for interests around the lakes. Thus, interests' concerns over water levels vary not only with physical conditions, but also with other developments in technology, economy and the political environment.

2.4 THE GOVERNANCE SETTING

The Great Lakes - St. Lawrence River system is a shared, multi-purpose resource intensively used and managed at every level of government from the local to international arena. Within the Basin there are eight states and two Canadian provinces all having some degree of vested interest in the shoreline. Well over a dozen federal agencies - U.S. and Canadian - have a mandated interest in the Basin resources (Donahue, 1989). Furthermore, the shoreline is scattered with municipalities and townships, counties and districts, regional and local agencies, all having some authority, mandate or jurisdiction associated with Great Lake water levels. Similar levels of government vary greatly in size of population, geographic area, and the length of shoreline their boundaries encompass. Consequently, they do not have equal resources upon which to draw, and the level and intensity of the issue of fluctuating water levels may vary greatly between and within governments.

The decision about what, if anything, will be done about fluctuating lake levels, begins from a base of current policies and programs at various levels

of government. In effect, these current policies and programs represent the current "position" of governments regarding fluctuating water levels and measures for addressing the issue. These define the nature and scope of governments' responsibilities. A critical aspect of policy making is that it is dynamic. Government positions can be modified by new information and in response to the petitioning by interests, but most typically, policy can be characterized by inertia and only incremental change, quite often evolving without any formal statement.

The success of any policy depends on governments ability to achieve its goals. Thus, if policies are viewed as an output of governments, the organizational (or institutional) arrangements that shape, interpret, and administer such policies become a critical determinant of those policies' impact and effectiveness. "Institutions can determine the success or failure of a given policy, and even the very existence of that policy" (Donahue, 1987). The institutional setting within the Basin is very complex. There are literally thousands of organizational authorities and procedures interwoven within the Basin, all supposedly representing the public interest. Arrangements between levels of government are matched by multi-unit agreements between bodies at the same level of government. In addition, private nonprofit organizations, coalitions of business organizations and international corporations all attempt to influence responses to the issue of fluctuating lake levels. There may be some question, therefore, as to whether the appropriate mechanisms for the implementation of policies are in place.

2.5 THE DECISION MAKING SETTING

It is within the policy and institutional context outlined above that decisions are made in the Basin. However, there appears to be widespread dissatisfaction with several features of current decision making practices. This can be partly attributed to the growing complexity of decision making processes, both within and outside the realm of governments.

The decision process requires identifying the actions which governments might take, providing some evaluation of those actions on which to base a decision, and then implementing those chosen. Different interests have different preferences for actions or measures. Different levels and agencies of governments also have different views on which types of measures are appropriate. Knowledge of what measures are available, and what they do, is incomplete and uneven. In addition, the decision making arrangements seem to operate in such a manner that stated policies of government, such as informing stakeholders, are not adequately being achieved.

In the U.S. and Canada, the responsibility for water resource management is entrusted to a veritable galaxy of public and private decision makers. Given this situation, it is not uncommon for conflicts to arise over uses and what should be done to deal with the water levels issue. It is equally unusual to find effective mechanisms and decision making criteria for the resolution of disagreements. Greater public sensitivity to potential environmental, social and health risks, developments in technology and information, and the media explosion have all contributed to tremendously intensified differences between

natural resource users. As well, different levels of governments have become increasingly interdependent (e.g. via-cost sharing, up-front financing), and have experienced a reduced ability to unilaterally make decisions, increasing the need for intergovernmental coordination and thus the potential for intergovernmental conflict.

In this increasingly complex decision making setting, a simple benefit cost ratio as a basis for making decisions is no longer adequate. Past IJC water level studies have been criticized for the use of a rather "narrow view" of economics (B/C ratio) as the bottom line for recommendation on measures. There have been criticisms for ignoring a range of other criteria including social, health, security and others. The economic analyses in some past reports have been criticized for not recognizing or building into the solutions the possibility and/or cost of remedial or compensatory measures to offset losses. Environmental interests have complained that they have never been adequately represented, and that natural resource criteria have not been included in evaluations. Consequently, environmental interests argue that habitat needs and impacts have not been fully considered in the decision making process. An overriding concern of past studies has also been the lack of public involvement (Clamen, 1988).

The concerns expressed above over past economic analyses, environmental assessments, lack of public involvement, and external judgements indicate a few of the problems associated with past decision making regarding the Great Lakes' water levels issue. There is great concern over the traditional technical "black box" methods of evaluation and there is considerable argument over whether it is preferable to "manage the levels" or "manage the people". There is clearly both a desire and a need from interests and governments for an improved decision making process, and an improved capacity to manage the issue over the long term. This has basic implications for the way this report has been structured.

2.6 IMPLICATIONS FOR THIS REPORT

For interests and agencies of government involved in the water levels issue a key concern relates to what might be done to alleviate the adverse consequences brought about by fluctuating levels. The question must be raised as to what is to be considered an adverse consequence. For example, should an eroding shoreline be considered an adverse consequence even if it contributes to the accretion of a beach elsewhere along the shore? Should the inundation of a lowland that floods residences, but also flushes a wetland, be considered adverse or beneficial? Is the exposure of rocks a negative effect and the exposure of a beach a beneficial one? What may be adverse or detrimental for one interest, may be beneficial for another. The term "adverse consequence" is subject to varied interpretation and its use engenders confusion. The use of the term also invites the important question "adverse for whom?" To say that a measure will or will not alleviate adverse consequences requires that the technical capabilities of the measure be assessed, but also that an external judgement be made about the welfare of the interest. Thus, evaluation of this type, which requires determining the existence of adverse consequences by measuring them against some external standard is not only

difficult to achieve, but also may not be helpful in resolving the water levels issue.

An alternative for this Study is not to question whether there are adverse consequences or not, but rather to identify the interests who perceive their welfare is affected by lake levels or measures, and to understand the positions they take regarding the responsibility of government to "do something". In taking positions, interests have different views of the policies of government which circumscribe the scope of government action. A central challenge for this Study is to find out what responsibilities governments assume, why certain interests petition governments for specific types of action, and how these concerns relate to the policies of government. This should provide a basis for identifying differences in understanding about responsibilities and physical processes, and differences in values and philosophies. The approach is intended to highlight opportunities for resolving or reducing these disagreements and for enhancing the effective management of the water levels issue.

SECTION 3

THE INTERESTS

Fluctuating lake levels become an issue for governments when individuals perceive that their welfare is or will be affected by lake level conditions, and seek government action. Currently, there are millions of Canadians and Americans who use and relate to the lakes in some way. Any identifiable group or individual who perceives their welfare to be influenced by lake levels, or by policies and measures to address lake level fluctuations is defined as an interest.

There are many different individuals and groups both within and outside the Basin, who see themselves being affected by fluctuating lake levels. In this Study, interests are limited to those groups which are represented in some way, and who have taken or could take political action to influence the choice of measures regarding lake levels. For the purpose of this Study, interests have been categorized into 10 broad classes, based upon their use of the lakes.

The classification of interests is derived by grouping the activities which use similar services and which have similar sensitivities to lake levels and to measures addressing lake levels. The derived classification seeks to identify distinctive, significant, identifiable, relatively homogeneous, policy-relevant interests. Activities or interest groups in each class share some important characteristics, such as the lake services they use, their sensitivities to lake levels and measures, and their institutional organization.

The uses of the lakes and their associated resources represent services which are employed in different ways by the interests. The services include habitat for fish and wildlife populations, a medium for transportation, a good for human consumption, a coolant, a consumable product for industrial and commercial purposes, a medium for receiving wastes, a source of power, and services associated with shoreline location and access for aesthetic and recreational activity.

Although a 10-class system is used, there is often considerable variability within classes and distinct sub-classes may exist. Furthermore, some individuals may fall into more than one interest class.

- **Riparian:** Riparian is a term which means relating to or living on the banks of a river, lake or any other water body. Consequently, riparian can refer to almost all interest groups using and relating to the lakes. In this Study, riparians refer specifically to individuals who own residences (either seasonal or permanent) on the shoreline (excluding farmers and Native jurisdictions). This group is also referred to as residential shoreline owners.

- **Environmental Interests:** This interest receives a service from the knowledge that particular Great Lakes ecosystems exist. The class

is represented primarily by naturalist and conservation groups, as well as government agencies with a mandate for preserving the environment.

- **Electric Power:** Power interests can be found throughout the Basin, and include companies involved in all forms of electrical generation that depend on water as an integral part of the power production process. Thus, the interest includes coal and nuclear power plants, as well as hydro electric plants which use the levels and flows as a source of potential energy.

- **Transportation:** The transportation interest consists of two major sub-classes: 1) ocean going and lake carrier shipping companies, often represented by shipping associations, and 2) ports, often represented by port associations. Associated with the lake transportation interests are other organizations within the regional transportation infrastructure, including truck and rail enterprises.

- **Commercial and Industrial:** This interest class includes commercial and industrial enterprises located on the shoreline. These interests consist of number of diverse businesses and industries which use the lakes in a variety of ways. Industrial interests use Great Lakes services as an input into a production process (e.g. water supply, waste disposal) and indirectly for movement of production inputs and final products. Commercial interests mainly sell access to the lakes and provide services to lake users. Marinas, hotels, resorts, and restaurants are examples of commercial interests.

- **Recreation:** This interest includes individuals, some of whom are represented by specialized associations, who use the lakes and shoreline for recreational activities, but do not own shoreline property. Recreationists depend on the services around the lake (e.g. public beaches, wetlands, marinas and other boating facilities) to serve their needs. Some of the major recreational activities in the Basin include boating, sports fishing, hunting, bird watching, camping, swimming, windsurfing, hiking, picnicking and scenic drives along the shoreline.

- **Commercial Fishing:** Commercial fishing interests use the Great Lakes habitat and shore access services to earn income and sustain a lifestyle from the catching, processing and sale of fish products.

- **Agriculture:** This interest benefits from the services of shore location, namely soil fertility and moderate climate. This interest class includes individuals involved in farming and agricultural production.

- **Native Nations:** This interest includes Native populations whose reservations are located on the shores of the Great Lakes - St. Lawrence River. The benefits derived from shoreline location by Native peoples include subsistence, habitat, residential and commercial location, aesthetics, recreation and cultural heritage.

- **Governments:** This interest include all levels of government: local, regional, state, provincial and federal, whose public properties and infrastructures are or may be affected by fluctuating lake levels or measures.

SECTION 4

MEASURES

4.1 CLASSIFICATION AND TYPES OF MEASURES

A measure has been defined as any method, plan or strategy initiated by a level(s) of government to address the issue of lake level fluctuations, whether actual or potential, tried or untried, in isolation or in combination, and including the decision to do nothing. For this Study "measures" do not include changes in policies or institutions which certainly represent options to governments, but which are addressed elsewhere in this report. Measures may be defined by three elements. The first element is the specific type of action intended to affect the land and water resource and/or the human use of the land and water resource. The second element is the manner in which the socio-economic cost burden for an action is distributed (i.e. who pays?). And the third element refers to the implementing authority (i.e. who is responsible for executing and enforcing the action?).

There are five broad types of actions which governments could take to address the fluctuating water levels issue on the Great Lakes. The types are differentiated according to actions and responsibilities of governments, not on how the actions may be manifest on the water or land resources or their human use. A sixth category considers combinations of any of these five types.

Type 1: Regulation and Diversions

Direct government expenditure in engineering mechanisms which can alter Great Lake water supplies, water levels and flows.

These are actions governments could take to modify water level fluctuations on the Great Lakes. For example, changes could be made in the operation of regulation structures on Lakes Ontario and Superior, or new regulation structures could be built for the unregulated lakes. Existing diversions into and out of the Great Lakes Basin could be operated to change lake level conditions. In addition, new diversions could be constructed to bring more water into, or out of, the Great Lakes - St. Lawrence River Basin.

Type 2: Direct Government Investment for Adaption and Protection.

Direct government investment to modify effects of water and coastal processes on local land and water use, but where the action does not influence levels and flows.

This would include public funding of methods that would help interests better adapt to or be protected from water level changes, flooding and natural shore processes (e.g. erosion). Examples of these kinds of methods could include: construction of major shore protection works for stretches of shoreline; acquisition of, or relocation of structures out of, severely threatened hazard

land; flood proofing of buildings in flood hazard zones; dredging; and retrofitting of harbour structures (docks, piers, etc.).

Type 3: Direct Restrictions on Land and Water Use

Actions whereby governments regulate and restrict how the public uses the land and water of the Great Lakes Basin.

These government actions include regulations to restrict human use of the water in the lakes and channels, and the land surrounding them. Regulations could cover such things as the amount and types of construction that takes place in areas prone to flooding and erosion; ship navigation procedures; water conservation programs; set back and zoning requirements; etc.

Type 4: Programs to Indirectly Influence Use

Public programs and policies to provide information and alter financial incentives which are intended to indirectly influence the ways in which interests make decisions about the use of the land and water.

This type of action comprises measures to alert shoreline interests to the risk that is inherent in their individual decisions about land or water use, or to provide encouragement or discouragement to certain shoreline or water uses. These programs are designed, not to prohibit a certain land or water use, as do Restrictions (Type 3), but instead, make more tangible the risks associated with an individual's decision. These indirect methods can include expenditure policies by governments, tax programs or communication programs (e.g. subsidies for protective works or water conservation devices; disaster aid; insurance programs; tax credits for flood protection; hazard mapping and information and education programs).

Type 5: Emergency Response

Actions by governments to emergency situations. These are short term measures to ease immediate problems.

These actions would be taken during times of severe storms or extremely high or extremely low water levels, so that either the consequences of these extreme events could be reduced (e.g. advance warning, sandbagging and diking protection during high levels), or the actual water levels could be altered (e.g. adjustment of existing diversions or control structures).

Type 6: Combinations

Two or more of the above types of actions combined.

4.2 WHO IMPLEMENTS THE MEASURE?

General

Each level of government has laws, regulations, taxation and fiscal spending powers unique to itself. These powers dictate the amount of authority and resources various governments are capable of applying to measures. In the case of the Great Lakes - St. Lawrence River, the water management issue crosses an international boundary which further complicates the question of who should and can take the actions. The measures considered in this report, and in the overall IJC Reference, are those which rely upon initiation and leadership from governments, although some actions could be taken by individuals or groups of individuals. This brief section will not attempt to address the question of implementation by actual application to individual measures, but will attempt to point out the range of possibilities which must be explored in determining who would take the actions.

Implementing Authorities vs. Types Of Measures

Depending on the measure, authority to implement may rest with the Federal level, the State/Provincial level, and/or the local level, which may include counties, cities, towns, and regions. In addition to those implementing authorities, there is at least one international body, the International Joint Commission, and other inter-State and inter-Provincial organizations with some role in measures implementation.

To undertake actions, governments need two important things: authority and resources. The way a government arrives at their decision may be dictated by an action's scope, location, cost, or it's institutional requirements. The following table shows, in general, what levels of government might, under current authority, be able to initiate the types of measures described above.

Table C-4-1 - Levels of Government to Implement Actions

Action	Levels of Government				
	Fed. U.S.A.	Fed. Canada	State/Provincial	Local/Municipal	IJC
Type 1	x	x	-	-	x
Type 2	x	x	x	x	-
Type 3	x	-	x	x	-
Type 4	x	x	x	x	x
Type 5	x	x	x	x	x
Type 6	x	x	x	x	x

Several levels of government often cooperate to implement actions. One example is the National Flood Insurance Program in the U.S. This program is funded and set up at the federal level, the states may help coordinate the program, and the local governments are responsible for enforcing flood plain

regulations. Similarly in Canada, provinces have principal authority over shoreline management, some of which is delegated to municipal level organizations. Another example deals with the case of emergency actions, whereby the federal governments might request the International Joint Commission to regulate Lakes Superior and Ontario to provide all possible relief to those interests affected by extreme high or low levels and flows.

Although there is need and an opportunity for enhanced cooperation among various levels of government in the implementation of measures, for most types there is generally a poor track record in coordinated implementation and enforcement of certain types of actions. One example is the inconsistency with which many of the non- structural, shoreline management techniques (Types 2, 3, 4) have been implemented and enforced in the past.

4.3 WHO PAYS FOR THE MEASURES?

Costs Involved With The Measures

An important attribute, often the key feature, of a measure is who pays. This cost distribution may be classified into two types of costs:

- Fiscal or government costs, which are expenditures governments must assume;
- Associated costs, which are cash outlays by affected interests in response to a particular action.

- **Fiscal Or Government Costs**

  There are three costs that governments must assume when implementing any action. The first is the initial or capital cost of implementation. The second is the cost associated with operation and maintenance of an action. The third is a compensatory cost. Often governments provide compensation to mitigate negative impacts caused by an action which altered the pre-project environmental state. Such compensation may be in the form of money paid to those affected by an action, or it may involve creating similar conditions at a different location to mitigate effects of the action.

- **Associated Costs**

  A government action may have costs that are associated with the action, but are not part of the government fiscal costs. There are two types of associated costs. The first is a cash cost which is an expenditure required of an interest (e.g. riparian, power, navigation, recreation, etc.) in order to take advantage of an action. For example, if a government offers a subsidized loan program to assist with the construction of shore protection, an interest must first use savings or take out a loan in order to receive the subsidy, thus, there is a cost to the interest to make use of the action.

The second type of cost is an opportunity cost. If an action by a government causes some change in the welfare of an interest, then that interest has assumed an associated cost for that particular action. For example, if governments put load/carrying capacity limitation on shipping interests during low water level periods, shipping companies would sustain some financial losses in relation to the amount they might otherwise have been able to carry. As another example, restriction on shoreline land use can reduce the services a riparian can receive from the land and may affect the enjoyment and market value of that property.

Payment of Costs

Sources of income for government projects vary in type and amount according to the level of government involved. Cost-sharing agreements between governments can be undertaken so that governments with less revenues can benefit from public funds. Cost-sharing is often done in the form of transfer payments from one level of government to another. It can take place among all levels of government, as well as between similar levels of government to allow actions which might not have been possible otherwise.

Governments must secure money for actions through financing, either internally, by using money from the existing tax base, or externally through debt. Debt financing will increase the cost of the action, since interest payments will be required. Consequently, costs of implementation, operation, and maintenance will vary, depending on the way in which the action is financed.

Cost Recovery

Governments have two ways in which to recover the expenditures made to implement an action: through general revenues, whereby the tax paying public bears the expense, or, benefit based cost recovery. This type of cost recovery directs the expense to those who benefit most from the measure. User-fees and direct taxation are examples of benefit based of cost recovery.

Figure C-4-1 illustrates the notion of "who pays" when a government decides to implement an action. Some links emerge when this notion is examined. Compensation is often a government reaction to associated costs to interests and is thus, an added cost of the action. How an action is financed will affect the implementation, operation and maintenance costs. How costs are recovered will, in turn, affect both the cash costs and the opportunity costs to the parties. For example, a user-fee method of cost recovery will increase the cash cost to the interest who benefits from a measure. If a beneficiary is taxed directly, net income is reduced. This constitutes an opportunity cost, since the taxed money cannot be spent on something else.

WHO PAYS?

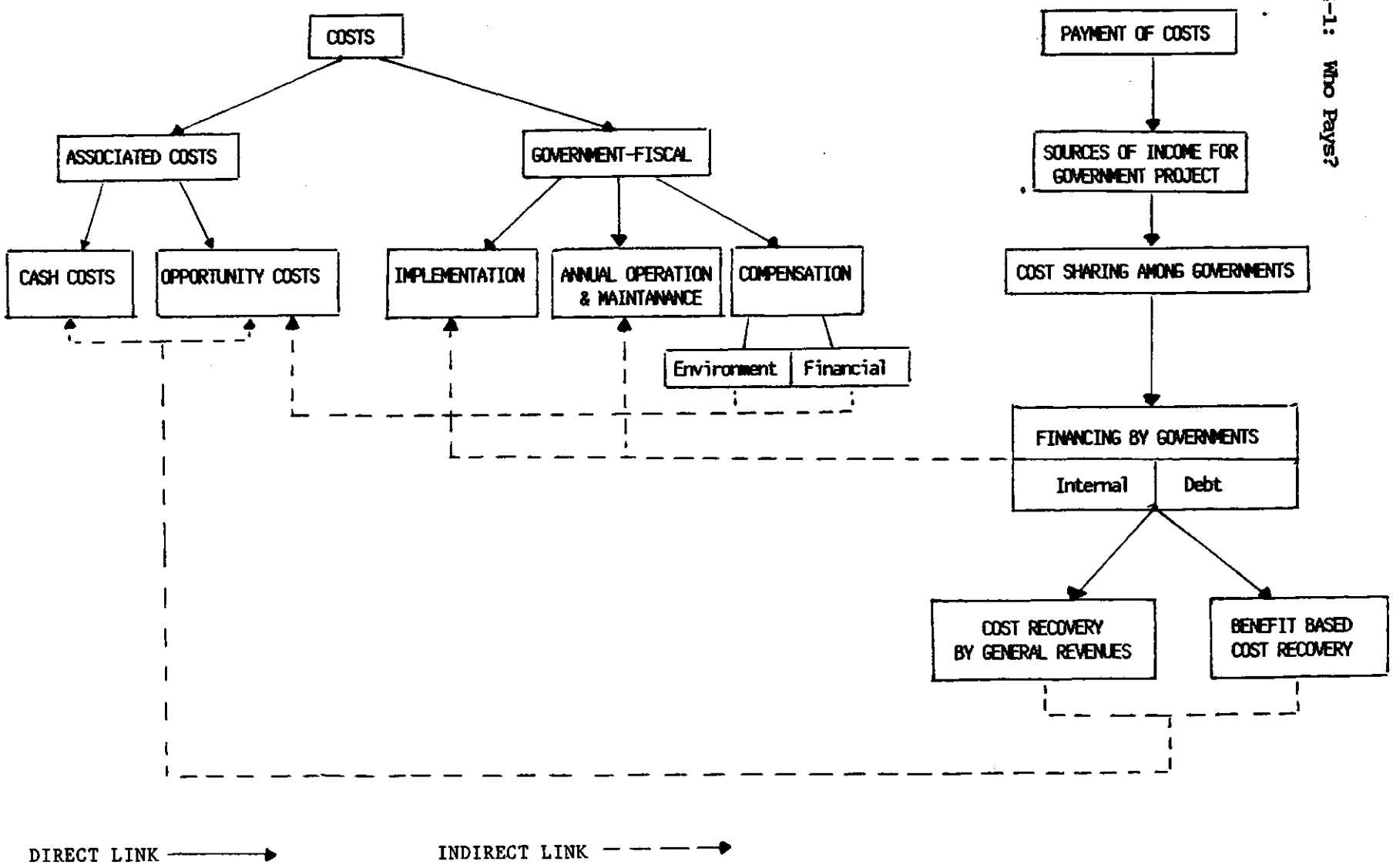


Figure C-4-1: Who Pays?

The cost distribution of any action has the potential for changing the impacts and implications of that action. Thus, the question of "who pays" is an important consideration with any measure and one that can affect interests support for or opposition to measures.

This section has outlined some of the salient attributes of actions initiated by governments. Of course, there are numerous measures, such as shoreline protection, building location relocation, floodproofing, which individuals can initiate without any involvement of government. The financial costs of these actions are borne directly by the individual and so long as they do not require government approval or financing, are not elaborated on in this Study. The focus is on actions which governments can take.

SECTION 5

POLICY THEMES OF GOVERNMENTS RELATED TO THE LAKE LEVELS ISSUE

5.1 INTRODUCTION

This section on levels related policy focuses on the federal levels of government in both nations, although, some state/provincial policies are discussed when pertinent. This section is organized into three parts. First, the general context for policy making is established by describing it's locus of authority. Second, a description is given of general policy themes relevant to defining governments' positions on "problems warranting government attention" and the definition and acceptability of measures. These themes are extracted or synthesized from a review of a wide array of policy statements, and from actions from which policy can be inferred, at various levels of governments in both nations. It is these policies which are explored in the third part of this section. Surprisingly, policies are not easily uncovered. Although some policies are clearly articulated in official statements, many have been established over the years without ever having been formalized in official statements. As well, some statements are very broad, others are presently under development or revision, while still others are simply ambiguous or inconsistent between statement and implementation. All of these factors make interpretation of policy a difficult task.

Nevertheless, this is an important time for the examination of policy. Over the past decade, there has been movement towards fundamental reforms in water policy in Canada and the United States. These are reflected in the Canadian Water Policy statement (1987) and in the passage of the Water Resources Development Act of 1986 in the United States. Other policy reforms have also been developed at the federal levels with regard to environmental protection and hazard management, bearing both directly and indirectly on the lake levels issue (for example, the recent U.S. Upton-Jones Amendment to the Flood Insurance Act and the inclusion of the Great Lakes in the Coastal Barrier Resources Act). Meanwhile, at the other levels of government, policies have also been evolving. This is evidenced in Ontario, for example, by the recent approval of a new flood plain policy, and through efforts to develop new wetland and shoreline management policies. Thus, a review of water policies of the Canadian and United States governments which finds consistency in general themes, as this review does, has important implications for the conclusions of this Study and for the future direction of managing lake level issues. Nonetheless, a note of caution is in order. Because policy affecting lake levels issues is so diverse and found in so many locations, there will be many nuances of interpretation and possible gaps in this discussion. Nevertheless, this study requires a general synthesis of policy themes to better define governments positions on the lake levels issue. The two principal sources used for this section are the Canadian Federal Water Policy (Environment Canada, 1987) and the Digest of Water Resources Policies and Authorities (U.S. Army Corps of Engineers, 1989). Additional sources have been listed in the bibliography including works by M. Donahue (1989) from which portions of this section are based.

In this study, policies are taken to reflect a dominant viewpoint about resources management to serve governments' priorities and goals. They are generally broad statements made by governments and inferred from legislative, executive or judicial actions, which by their nature, are often difficult to interpret. Policies can be used to set constraints on, and provide direction to what governments do or assume responsibility for, as much as for setting goals for governments' programs. Policies define the scope of governmental actions. Governments look to existing policies to guide their approach to resolving management issues.

Policy making is dynamic. It is built upon accommodation among interests, and emerges from an array of executive, legislative and judicial processes. While governments' positions (policies) can be modified by new information or in response to the petitioning by interests in different governmental forums, policy reform is most typically characterized by inertia and incremental change. At any time current policy will contain vestiges of past policy positions. This often creates confusion among interests, including governments. As a result of this confusion, there is rarely precise and unambiguous agreement in any government on policy statements (which at times may also be internally inconsistent), or on the extent to which policy is being faithfully executed. Indeed, policy is defined as much by implementation as by written statement.

However, there are some discernible tendencies in policy, and these common themes can be used to define the "position" of government on the lake levels issue. Rather then attempt to establish entirely new judgement on government responsibility, this study begins by distilling existing policy themes or guiding principles of government and uses them to guide the analysis. These policy themes have been inferred not only from policy statements, but also from actions of governments. This description of the current policy context will also likely be an accurate guide to near term future policy constraints. A comprehension of these broad and consistent policy themes is essential to addressing the water level issue for several reasons:

- Policy themes establish the definition of "problems and opportunities" which warrant governmental concern. With regard to lake levels issues, policy defines those concerns and petitions from interests for which there is a role for government action.

- Policy themes provide a basis for defining attributes of measures relevant to governments, and for identifying measures acceptable to governments. For example, policy establishes principles for the cost distribution of measures among interests and policy determines who has authority to implement measures.

- Policy themes provide a refinement of the definition to "who decides", subject to fundamental general constitutional rules of governance. For example, policy determines the extent to which interests have access to the decision making process and the nature of that process. As another example, policy determines the extent to which the IJC, and federal and non-federal governments are allocated decision making authority and ability.

5.2 LOCUS OF AUTHORITY FOR POLICY MAKING

The Boundary Waters Treaty of 1909 has long been the fundamental reference point for U.S./Canadian transboundary relations. It has been amended only once since its enactment. While it is likely that it's interpretation will vary in the future, neither government has indicated that renegotiation or revision is in order. In fact, according to LeMarquand (1986), the treaty is regarded as "untouchable" as each government believes it would be "virtually impossible" to negotiate any revisions that would be any more favorable for their own interests, given current socio-political and diplomatic conditions.

The International Joint Commission (IJC) is the primary institution charged with fostering binational, coordinated Great Lakes management related to the lake levels issue. Created as a permanent bilateral agency by the Boundary Waters Treaty, the IJC's role is to prevent disputes regarding U.S./Canadian boundary waters, a purpose which is to be served by this Study Reference. The Boundary Waters Treaty also grants the IJC limited quasi-judicial powers. The two federal governments are required to secure IJC approval for all projects expected to affect levels or flows. Further, Title X of the Treaty provides the IJC with an arbitral function. The two governments can agree to refer to the IJC "any questions or matters of difference" arising between them for a binding decision. However, this provision has never been invoked, which suggests a preference by both countries to settle disputes through non-adjudicative means. Indeed, the federal governments are not compelled to make use of IJC Study authority even when it is activated by their request, and governments have not responded to some IJC Study recommendations in the past. It is also worth noting that two regional organizations, while instruments of the Great Lakes states, also provide mechanisms for binational attention to issues of shared concern including the water levels issuer. These are the Council of Great Lakes Governors, and the Great Lakes Commission. However, these organizations are not bound by any formal treaty as is the IJC.

The federal governments have central roles in any Great Lakes management effort. However, as elaborated subsequently, there are differences between the two nations, particularily the comparatively higher authoritative stature of the provinces in the Canadian system as compared with the U.S. federal-state allocation of authority. The strength of the federal presence in the Great Lakes Basin is attributable not only to the nature of the systems of federalism, but also to the fact that the Great Lakes region demands both an inter-jurisdictional and an international management approach. Both federal governments, and their respective agencies, are responsible for administering federal laws and programs, developing and implementing their own policy, providing liaison, financial, and technical assistance to other levels of government, and upholding obligations under international treaties.

The U.S. federal role in Great Lakes management is firmly established under the U.S. Constitution, re-affirmed in a series of major pieces of federal legislation, and reinforced operationally as the prominence of the federal role in Great Lakes management has evolved. Under the U.S. Constitution, the federal government is granted powers over commerce, property, general welfare, war, treaty, and compact consent. Buttressed by statutory and case law, these

various clauses provide the federal government with broad powers in resource management at the interstate and international level.

There have been some historical shifts in the policy of the U.S. government on responsibilities for water resources management. In earlier times water issues were considered a regional or local concern, and hence not under purview of the federal government. Yet, in the 1950's, responsibility for managing water resources had generally shifted away from the states, as water supply, fish and wildlife, recreation, power and navigation development emerged as matters of national concern. More recently, the trend is to reverse responsibility to the states once more, although the final balance of authority continues to be between federal and state governments.

The role of the Canadian federal government in Great Lakes management is different from that of its United States counterpart. Its origin is found in the Constitution Act which allocates legislative powers between the provincial and federal governments of Canada. The Act grants provincial governments jurisdiction over the management and sale of public lands, property and civil rights, and "matters of merely local and private nature within the province."

In a broad sense, the federal government has certain powers which can influence the use and development of water resources. These include the general power to legislate for "peace, order, and good government", as well as regulation of banking, taxation, the public debt, defense and criminal law. The Canadian federal government has four major roles. First, it must manage the resources and activities over which it has direct jurisdiction. This includes its broad responsibility for resources in the northern territories, fisheries, navigation, and international waters. Second, the federal government has a role in protecting the natural environment in Canada generally, while respecting the provinces' constitutional authority. Third, the federal government has a role in research, collecting data and disseminating information. Finally, the federal government must encourage others to preserve and enhance water resources by providing information and guidance, advocating and supporting needed changes, and ensuring equitable resolution of disputes among other jurisdiction in Canada and with the United States (Pearse et al., 1985).

Provinces have clear constitutional authority in the areas of natural resources such as land and forests, intra-provincial commerce, property and civil rights, municipal governments, and matters of a local or private nature. Section 92 of the Constitution Act places under provincial auspices the management and sale of public lands, property and civil rights, and "matters of merely local and private nature within the province." When the resources at issue are of a regional and binational nature, however, jurisdictional questions arise.

Beyond the broad powers vested in the province by the Constitution Act, a series of statutes guide Ontario's involvement in management, of the resource. Substantial statutory authority was made explicit by the 1957 Ontario Water Resources Commission Act which, among other issues, concerns ground and surface water supplies and created the Ontario Water Resources Commission (a predecessor for the Ministry of Environment). Ontario supports thirty-eight

conservation authorities instituted over thirty years ago, under the Conservation Authorities Act, as quasi-independent, quasi-governmental bodies to manage watersheds within their boundaries. In conjunction with the province, the conservation authorities establish land use regulations to control developments in hazardous areas and to regulate the placing or removing of fill.

The municipal level in both Canada and the U.S. has the authority to administer planning policies providing those policies do not interfere or conflict with provincial/state policy. Most often authority is designated to the municipal level by the state or province.

While there are basic differences between the U.S. and Canadian federal system in the division of authority for water resources management, for many of the issues regarding lake levels these differences are less pronounced. Federal responsibility in the area of navigation is common to both nations. Similarly, fisheries management responsibilities can be found in both federal governments. Authority for information programming and international negotiations are also allocated in a common manner. As well, both nations vest primary land use management authority at the state/provincial level.

Perhaps the most significant difference arises less from the constitutional authorities but rather from a policy determination within those constitutional authorities which has expanded the U.S. federal role in commitments to federal financing, and bearing of costs for provision of certain purposes (hazard reduction, recreation) from water projects. In addition, certain regulatory programs relating to habitat protection and water quality tend to be governed more by federal than state authority in the U.S., while in Canada, the authority is shared between federal and provincial levels, although the provinces tend to play a larger role in policy implementation.

5.3 GENERAL POLICY THEMES

From the review of policies several themes critical to the water levels management issue have been identified.

- o Governments seek to promote "informed" decision making by interests.
- o Governments seek to promote "responsible" decision making by interests.
- o Governments seek to assure resiliency of interests to adapt to natural hazards.
- o Governments seek to promote the development of the economy, subject to the imperatives of long term environmental protection
- o Governments seek to promote, and expect to have, an "open" planning process, giving multiple interests access to decision making processes.

At times, pursuit of one policy theme may work to the detriment of achieving another, however, that is the nature of policy implementation. These themes of governments' policy presume initially that decisions made by interests to use the services of the Basin's land and water resources, and to petition governments for action, should be based on the interests' own judgments on benefits and costs, subject to the information they have, and the policies of government which might limit or direct individual choice. By this process governments expect that the various attributes of the Great Lakes system will be well utilized and that overall economic development for the nation will be served. Thus, the perspective of **informed decision making** can adequately describe an important theme of policy. Included within the information governments would like interests to have before making their individual decisions about shore location or water use, and before petitioning governments, is an understanding of (i) the nature of water level fluctuations and shore processes and (ii) the intentions and purposes of government programs and policy which affect interests' investments in the Basin. The current understanding of lake levels and shore processes by the scientific community is summarized in Section 2. The nature of government policies and programs is described in this section. Because governments seek to promote informed decision making, failure of interests to have access to or utilize information is, in part at least, a failure of governments' policy and of programs to execute that policy. To illustrate, Day et al. (1977) in a study of the Ontario Shoreline Property Assistance Program found that only 9% of all respondents were aware of this assistance program. This was attributed to a reluctance by local governments to advertise this program for fear that the municipality might become responsible for a large number of loans should residents abandon their properties.

Responsible decision making means that interests who benefit from a use of the lakes should also bear the brunt of the costs of that use be they economic or otherwise. Governments seek not to have costs redistributed to the environment, to other interests, or to the general taxpayer, unless some overriding public purpose is being served. Policies of responsible decision making are defined in relation to the need for fiscal restraint, economic efficiency and equity of cost burden. The practical result is that U.S. policies of governments reflect a commitment to substantial cost recovery from beneficiaries of water projects, largely Type 1 and Type 2 measures. In recent policy reforms the ability of interests to shift costs for such projects to the general treasury has been significantly reduced. The passage of the Water Resources Development Act of 1986 in the United States provided specific percentages of investment cost for water projects which would be borne by non-federal interests. These cost shares were significant increases over what had been in place up to that time. In Canada, the policy theme of responsible decision making is reflected at the federal level by a reluctance to invest in structural projects intended to alleviate the effects of flooding or erosion. In addition, the federal government has an apparent reluctance to provide aid to those having suffered storm damage on the Great Lakes illustrated by the fact that disaster aid has never been administered in relation to a Great Lakes event.

Another element of this theme of cost responsibility is the desire to design measures which seek to minimize cost redistribution. Attempts in the United States to assure actuarial risk insurance premiums for new development in hazardous area, Canadian stringency in distribution of disaster aid, resistance to funding or financing federal works to control lake shore erosion in both countries, and a commitment to full mitigation of environmental costs in both countries suggest that shifting costs of benefiting from the lakes services to the environment or to the general taxpayer is discouraged by governments. To illustrate the commitment to cost responsibility, note that the Reference for this Study requires consideration of compensation whenever a measure imposes harm on another party.

Of course, the policy theme of responsible decision making is moderated in its application by the pressure of other goals and inertia in making policy changes. To illustrate, cost recovery from water project beneficiaries in the U.S. is often at less then 100%, but it is still substantially above that which was required a few years ago. As another illustration, post disaster aid is limited in the extent that it subsidizes hazardous location choices, but the desire to provide relief for victims of natural disasters often interferes with placing limits on disaster aid. This has been evidence, at least, in the U.S. where disaster aid has been considerable.

Governments seek to assure resiliency of interests to adapt to natural hazards. This policy theme manifests itself in different ways for different interests. In general, governments seek to assure that when inevitable natural disasters do occur interests are able to adapt or recover from the effects. To illustrate, for shoreline residents government policies seek to encourage restrictions on use of shorelines to reduce hazard potential, and in the U.S. governments seek to encourage the purchase of hazard insurance if available. These provide a form of resiliency. As another illustration, for the electric power interest, government policy seeks to assure that generating facilities in the Great Lakes are part of a larger power system with multiple sources of power and a plan for the use of those sources in emergency conditions precipitated by low lake levels.

Governments consider publicly justified resource investments to be those which promote the development of the economy, subject to the imperatives of long term environmental protection. At the first level of application this theme is parallel to the informed and responsible decision making objective. If interests act freely in their own best interest, not shifting costs to others, there is a presumption that national economic and environmental goals are served. However, in pursuing this policy, governments may encourage certain types of investments which they perceive as essential to national or regional economic development, by subsidies or by providing information to promote particular investments. Of course, a subsidy program would contradict the theme of "responsible" decision making. In the process of promoting economic development governments have become increasingly attentive to the desire to make such development consistent with environmental protection goals. In fact the U.S. Principles and Guidelines for Water Project Planning and the Canadian Water Policy statement, and federal affirmation of the "Sustainable Development" principle, make clear that environmental constraints will be considered in promoting economic development goals. As a result, concerns for

environmental protection are often manifested in programs which limit individual decision making, despite the view that decentralized investment decisions by interests best serve national development goals. To illustrate, wetlands protection goals will restrict lakeshore investments and water quality goals will limit thermal discharge of power plants.

This policy theme of aggregate economic development also serves to define some of the limits to governments' roles in the Basin. Certain measures which may produce benefits to interests, while real to the interests, are not considered by governments to be important for national economic development. Policies reflecting this view are the restrictions on consideration of erosion costs or recreation benefits as justification for public investment in water control measures. Conversely, a logic is often applied which argues that governments can make investment which the interest, acting alone, could not efficiently make. In this instance government can act to promote economic development and then recover costs of that act from the beneficiaries.

Governments seek to promote, and expect to have, an "open" planning process, which considers the concerns of many interests as a means of managing interest conflict. This general theme is reflected in a policy commitment to an **open resource planning and decision making process**. The means for public involvement are numerous, including political pressure via elected representatives and government agencies, recourse to the judicial systems, and public inputs via polls, surveys and hearings. While institutions for public involvement in the decision process are not at the core of water resource planning, the authority to participate has been extended to a wide range of interests and representatives of those interests. The larger the geographic and economic scope of a project the greater the number of expected interests who will be involved in and have the ability to influence a decision.

Even at this level of general description the potential for conflict among policy themes is clear. For example, desires to promote responsible decision making may be offset by the desire to subsidize certain activities for more general economic development or environmental goals. At other times, execution of policy themes may be constrained in practice, for example by the presence of less than full cost recovery from beneficiaries of water control projects. What is significant is that these themes are the starting point for governments in considering their role with respect to fluctuating water levels, and the tradeoffs among these policy goals become part of the process of decision making.

As noted at the outset, these general policy themes are derived from an examination and interpretation of policies related to specific aspects of the water level issue and are taken primarily from federal sources (i.e. Canadian Federal Water Policy and the Digest of Water Resources Policies and Authorities). These specific policy areas are described below, and by that description add further specificity to the general policy themes outlined above.

5.4 SPECIFIC POLICY RELATED TO THE WATER LEVEL ISSUE

Shoreline Land Use

Government policy, in this area in both the U.S. and Canada, can be difficult to interpret. To some extent this difficulty arises from the evolving nature of these policies. Past policies, especially in the U.S., have reflected a desire to "reduce" damages from natural hazard. This is evidenced, by the U.S. national response to flood disasters through construction of dams, levees, seawalls, and the like and through the providing of disaster relief to flood victims. In Canada policies to minimize damages of hazards developed following the strike of Hurricane Hazel, in October of 1954, after which the province of Ontario began to actively pursue flood control efforts such as dams, dikes, and acquisition of land. More and more it became recognized by both countries that the reduction of damages to zero is not feasible and is an inefficient use of lands subject to hazard. The origin of the goal of zero damages came largely from the historical U.S. programs for flood control. These programs implicitly subscribed to the now discarded view (never held in Canada) that flood plains will be developed for intensive economic activity and that public investments can be justified when benefits, defined as reduced damages to that economic development, exceed the costs of protection works.

As the modern era of hazard management arrived, a different perspective developed in policies of both nations. This perspective notes that exposure to natural hazards is an inevitable result of certain land use decisions. This perspective also realizes that values of near shore environments where such hazards may arise can derive from natural system processes as well as from economic development. The result in the U.S. is that the objective of hazard management policy has come to be defined as the search for the "optimal" uses of hazard prone lands and near shore environments, while, in Canada, the objective can be interpreted as a search for "minimal" use of hazard prone lands. The range of measures to achieve these goals has extended from protection works to include strategies to modify or restrict the occupancy of these lands. In Canada, there appears to be a greater emphasis on preventing future development of hazard areas. Nevertheless, these changes in policy views are not necessarily reflected in formal policy statements.

Essential to these modern policy perspectives is the question of responsibility for the allocation of hazard prone lands to alternative uses. At the most crudely stated level, the point of contention is whether allocation should be by "individuals responding to market forces" or "government direction". The reality is that the choice is not dichotomous and policy suggests directions and strategies of hazard land management which begin with private determination of land use and then seek programs which will direct this individual use to allocate lands in a some socially optimal manner.

The trend in federal policy vis-a-vis location in hazard areas is that individuals are expected to be responsible for their own decisions and governments are responsible for providing the necessary information for informed risk taking. Coupled with this view is the attempt to emphasize that risk-costs associated with shoreline location should be borne by the landowner

and not by society at large. In the U.S., the philosophy of the National Flood Insurance Program (NFIP) is to initially offer federally subsidized flood insurance. Communities are expected to regulate development within flood prone areas and, at the same time, new developments in the floodplains are expected to purchase insurance at actuarial rates. Programs and responsibilities for land use management has, for the most part, been handed to the states. Zoning standards and development controls to regulate construction in floodplain areas is a strategy used by at least six Great Lakes states. These states (Indiana, Michigan, Minnesota, New York, Pennsylvania, Wisconsin), all have a requirement to adhere at least to the minimum standard of the NFIP. Many of the states, (Michigan, New York, Pennsylvania, Minnesota and Wisconsin) have shoreline management programs some of which include strict setback requirements for new development on bluffs.

In Canada, federal/provincial activities have been directed toward discouraging development in hazard areas. The Canada/Ontario Flood Damage Reduction Program (FDRP), and the Canada-Quebec agreement relative to the mapping and protecting of floodplains, aim to inform shore property owners of the hazard areas, while seeking to discourage new development in those areas. To illustrate, the FDRP prohibits the placement of future federal or provincial government structures in hazard areas, disallows funds from government sources for new building placed in flood risk areas, removes the availability of disaster aid for any structure placed in a zoned hazard area, and encourages local municipalities to adopt Official Plan Policies and pass zoning bylaws controlling development in the hazard risk area. In Canada authorities over shoreline use lies with the provincial government. The provinces of Ontario and Quebec have flood plain planning programs. The province of Ontario is presently developing a full shoreline management policy to be administered through the Ministry of Natural Resources and implemented through the Conservation Authorities which boarder on the Great Lakes. Likewise, Quebec has adopted a "shore protection policy" which uses zoning by local authorities as a tool to protect the first 10-15 metres of developed shoreline along every significant water body from the effects of erosion.

Part of governments' policy covers post-disaster relief and recovery. The logic behind these policies is that natural phenomena don't always arise as expected. When natural events go beyond conceivable expectations and people are genuinely "surprised" governments must, in the interest of victim relief, provide aid. However, disaster aid programs pose a difficult policy design problem. By their design they permit the shifting of damage costs to the general taxpayer. The programs are justified by a determination that equity requires providing relief and recovery assistance to victims of "acts of God". Governments seek to assure that such programs do not provide incentive to persons to locate in hazard areas and, therefore, shift costs of that location to general taxpayers. But that balance is difficult to achieve in the design of the programs. In Canada, disaster assistance is available through cost-sharing arrangements with the provinces. No cost sharing occurs unless provincial expenditures exceed an amount equal to $1 per capita of the provincial population. Since the inception of the program in 1970, the federal government has paid about $100 million in post-disaster assistance to the provinces (EPC, 1986). However, as noted earlier, no federal assistance has ever been paid for an incident related to Great Lakes water levels.

The U.S. federal government has an active construction program which will make federal investments to provide structural protection works for developments subject to inundation by high waters. The Canadian government, has no such policy commitment to structural protection works at either the federal or the provincial levels. Nevertheless, during the 1970's, Canada and Ontario funded major diking programs to protect agriculture land on Great Lakes and Canada and Quebec shared the costs of dykes to protect urban areas at Montreal.

In both nations policies to implement land use controls are developed and executed at the non-federal government level, although the federal governments do consider it a federal role to develop information which can be used by non-federal interests in establishing land use controls. In both nations there is a federal role in providing varying degrees of financial assistance to those who are damaged from a hazardous location. However, the U.S. programs such as the National Flood Insurance Program provide greater opportunity, than in Canada, for those located in shoreline environments to shift the costs of hazards to others as no similar program exists in Canada.

Despite the apparently more prominent role of U.S. federal government, compared with the Canadian federal role, there are important similarities in policy principles which are particularly relevant to the issue of fluctuating lake levels. Of most significance, both nations consider protection from shoreline erosion to be the responsibility of the individual land owner; there is no federal role unless public facilities are threatened or the damage has been caused by commercial shipping waves. (Even the provincial/state role is relatively minor, for example, through technical advice and low interests loan programs). Both nations feel that the costs of shoreline locations should be the responsibility of the benefiting land owners. In Canada this is apparent through the lack of programs to assist land owners (with the exception of limited disaster aid). In the U.S. responsibility is shifted to the land owner through reduced transfer payments for insurance, limited disaster aid, and high levels of cost recovery for Type 1 and 2 measures. Policies of governments reflect a commitment to inform those who are considering shoreline locations. As a part of this attention to individual decision making both governments have recognized the ecological values of near shore environments and, while seeking to preserve the commitment to individual land use rights, do not wish to compromise the environmental services of near shore environments. This provides a public rationale for prohibiting development in certain shoreline locations.

Water Resource and Power Development

There are national differences in policy with respect to the power sector, but these are modest in the specific issue of water levels and power production. In Canada the power sector is considered part of the social overhead of the economy. A goal of energy self-sufficiency, much of that through hydro power, is a water policy objective. This theme is illustrated by the policy of public ownership of the utilities through provincial (Ontario and Quebec) Crown corporations and by features of provincial and federal tax codes which favour utility capital investment. In the United States power output is considered more a part of the market economy and the power itself as a commodity for

trade as opposed to a part of the social overhead capital. This is illustrated by the willingness to force utilities and their immediate customers to absorb costs for investments which prove unsound. With respect to access to, and development of hydropower, recent U.S. policy, especially in the executive branch, has made it clear that there is to be no direct federal expenditure for power development, without full and up-front reimbursement from the power company.

Yet, upon closer examination there is evidence of joint government and private sector decision making in both nations. In the U.S. electric rates are reviewed by state regulatory bodies, and federal as well as state policies determine the access to and strategies for development of alternative power supplies; for example, through licensing of power plants by the Federal Energy Regulatory Commission. So, as in Canada, U.S. power generation falls under government regulation. Thus in examining the lake levels issue in relation to power, the policies of governments seem to converge. There is a desire in both nations to assure the best power capacity investment strategy over time for national and international markets. There is a real concern, in both countries, that the investment be as well informed as possible in terms of demand and reliability of supply. Thus, in both nations governments attempt to share existing information and develop new information in cooperation with power system planners to assure full consideration of the risks inherent in making capacity investments which depend upon stochastic events such as lake levels and flows.

At the same time there is an increased attention to environmental concerns, and in both nations policy clearly defines a position that power development must not be obtained at unacceptable environmental cost. In developing power sources, governments are expected to assure that power planners consider and incur costs necessary to mitigate environmental damage to water resources associated with power development. This is evidenced in the U.S. through thermal discharge limits in water quality regulations and habitat protection requirements in several environmental statutes, and in Canada through various acts requiring environmental impact assessment where proposed projects might disrupt land or water ecosystems.

Commercial Navigation

Government policies in both countries aim to promote the development of public use of navigable waterways. Governments make investments to provide channels and harbour depths of known and unvarying dimensions for the use of commercial shippers and their customers. In Canada and the U.S. this is considered a responsibility of the federal governments, although the cost recovery from users of the channels and harbors differs between nations. In the U.S. the responsibility for this function falls to the Army Corps of Engineers, subject to various cost recovery rules from project beneficiaries. The Canada Shipping Act and the Department of Transport Act authorize Transport Canada to develop and maintain shipping facilities including channels, canals and ports. The federal government, through Transport Canada, operates the major Canadian commercial shipping ports as well as a few smaller ports serving isolated communities. The Canadian federal government, under the Navigable Water Protection Act, is also responsible for monitoring the construction and

placement of "works" in any navigable waterway in Canada which might obstruct clear navigation. All waterways capable of supporting any type of marine craft, regardless of its mode of propulsion are included. The Canadian St. Lawrence Seaway Authority and it's American counterpart are responsible for the control, construction, maintenance and operation of their respective sides of the Seaway. In developing and maintaining harbors and channels for commercial navigation, governments consider it appropriate policy to share existing information and develop new information in cooperation with shipping interests to assure full consideration of the risks inherent in making capacity investments which depend upon stochastic events such as lake levels and flows.

Commercial Fishing

Governments make investments in providing channels to fishing ports of known and unvarying dimensions. In many instances these harbour entrances are provided jointly with approaches to commercial cargo ports. In the U.S. the maintenance of commercial fishing ports is accomplished by the Corps of Engineers, with some cost recovery. In Canada, Small Craft Harbours (Department of Fisheries and Oceans) is required, under the authority of the Fishing and Recreational Harbours Act to maintain, manage and develop commercial fishing harbour facilities. In the U.S. maintenance of approaches to commercial fishing ports has a lower federal priority than in Canada, but providing information on channel depths and configurations is a role of equal importance in both nations.

In both nations fishery management planning is undertaken with the intention of protecting fishery stocks while maintaining incomes of commercial fisherman. As a part of this fishery management programming, habitat protection is of central importance. In Canada, the federal government has the right to regulate inland fisheries, but the provinces are granted administrative jurisdiction over them. Canadian federal policy has, as its overall objective, a net gain of habitat for Canada's fisheries resources. It's intent is to increase the natural productive capacity of habitats for selected fisheries. Both federal and provincial programs are directed towards the management of fish habitat. The provincial government, in Ontario, through the Ministry of Natural Resources, is also committed to fish stocking and regulations to commercial fishing quotas controlling fish harvests. U.S. policy on habitat protection is a part of general environmental protection goals for wetlands and water quality. It is appropriate to conclude that the primary policy concerns for lake level fluctuations for commercial fishing in both countries will be oriented to habitat effects rather than by access to ports. In this effort common programs for fishery management are sought under the auspices of the Great Lakes Fishery Commission, an international organization.

Water Based Recreation

Both nations have a variety of programs and policies which support outdoor recreation opportunities, for example national parks development. On the specific issue of lake-lands, Parks Canada has an official policy which states that within parks,

"Erosion and recession should be regarded as natural processes and should be allowed to proceed unimpeded unless public safely becomes a factor, unless major facilities are threatened, or unless actions outside the park boundaries result in negative impacts to the park processes." (Parks Canada, 1982).

Policies regarding water based recreation also exist. In both nations water quality programs gain much of their support from the needs of recreational fishing, swimming and boating. Water development programs also consider recreational opportunities. Recreational harbour facilities are maintained by federal governments in the Great Lakes system, although in the U.S. the commitment to recreation harbour maintenance programs has recently been reduced by executive branch budget authority. The Canadian position on support for water based recreation is somewhat unclear. Programs such as Small Craft Harbour's Marina Policy Assistance Program provides for dredging and/or construction of breakwaters in public harbour areas and under the Tourist Wharf Program, the federal government will aid in the construction of wharves and/or launching ramps in an area with an established tourist economy or with tourism potential. Generally, however, water development projects for the purposes of supporting recreational opportunities have low priority in the budget process. The expenditure of funds for recreational development is severely limited in the U.S.. Recreational benefits may not be used in justifying water development plans, although such benefits may be estimated and displayed. In addition, a significant share of the costs of a U.S. federal project which are allocated to recreation must be reimbursed to the federal government by non-federal interests. How these limited considerations of recreation would affect federal positions on lake levels management is not clear; but the general themes of recreation policy do suggest that justification of measures on the basis of their value to recreation may carry limited weight in the budget processes of the two nations.

Environment

Environmental considerations have emerged as a major concerns for water management initiatives. There is reduced willingness to trade off environmental quality for economic development. The Canadian "sustainable development" policy reflects this policy theme. The Canada Water Policy stresses a federal and provincial responsibility for protecting the natural environment in general. The U.S. Principles and Guidelines treat environmental laws as constraints on the quest for economic development. As a general rule, shifting of costs which reduce environmental integrity is sharply restricted, and mitigation requirements for water resources development projects (Type 1 and 2 measures) are quite strict. This is best illustrated by positions on preservation of wetlands by all levels of government, in both nations. The Canadian federal position to conserve and enhance Canada's wetlands is matched by a newly proposed provincial policy, in Ontario, which places wetlands in a restricted zoning category that does not permit alterations to the wetland and gives priority to wetlands over use of adjacent land and construction of public facilities on adjacent land. Wetlands around Lac St. Pierre, in Quebec, have recently become the object of a provincial management plan. In the U.S. wetlands preservation has been a

policy goal of growing importance with current emphasis now focused on development and implementation of a no-net loss policy, which may become the goal for federal regulatory programs and which would constrain public and private developments affecting wetlands.

At the binational level there are several illustrations of agreements on policy goals for Great Lakes management that stress the importance of environmental priorities. While most of these agreements stress issues of concern other than water levels (ie. fisheries, water quality) there is reason to believe that a common position on water levels would stress the importance of environmental protection. This would reflect the policies of the two countries as well as current international agreements.

Diversions

Diversions of water from the Great Lakes Basin are formally opposed in the Canadian Water Policy. The diversion of waters from the basin has also been opposed in an agreement among the governors and premiers of the Great Lakes states and provinces. This agreement has been given U.S. federal government approval via Section 1109 of the Water Resources Development Act of 1986. Ontario has just recently received royal assent of a Water Transfer Control Act. This Act requires the Ministers' review/approval of transfers of water across a provincial drainage basin or out of the province, providing a mechanism for prohibiting diversions. At the federal level a Canadian Water Preservation Bill was recently introduced into the House of Commons by the Minster of the Environment. Although the Bill has since died it does signify an apparent opposition to diversions which, as a matter of policy principle, has important implications for the measures that governments will accept and has particular importance for the design of Type 1 measures.

Information Programming

Information about the lakes, shore processes and the environment is essential for informed individual decision making, for the application of political positions of interests, and for the sound application of policies by governments in specific instances. To achieve these informational goals, governments support research and programs to transfer information to the public and non-federal agencies. However, often the budgets for lake information programming follow the intensity of lake levels conflicts, rising in crisis periods but receding at other times. Also information programming has focused on the development of technical data, and information on policy interpretation and explanation is less wide spread.

The Canadian constitution does not mention research and data collection, but these functions appear to be covered by the "census and statistics" power assigned to the federal government. Federal legislation providing for research with regard to water includes the Canada Water Act, the Fisheries Act, the Environmental Contaminants Act, and the International Boundary Water Treaty Act. International and federal-provincial agreements, such as the Great lakes Water Quality Agreement, often specify requirements for federal research as well. The Canadian Federal Water Policy identifies research and information transfer as a key element and provides a clear indication of the

federal government's responsibility for contributing to improved understanding of natural resources and the environment generally. Of particular note was the information effort made by a federal government with regard to water levels, through the establishment of Environment Canada's Great Lakes Water Level Communication Centre in March of 1986. It provided round-the-clock monitoring of high water level "watches" and "warnings". According to Pearse et al. (1985), Environment Canada alone expends an estimated $6 million annually on public information and related programs from its total budget of $800 million. However, most of this is dedicated to issues other than water levels.

The commitment to information development and dissemination in the U.S. is spread throughout numerous federal and state agencies. Virtually every agency with management responsibility for the lakes has an information development or information transfer program. To illustrate, basic hydrologic information and hazard mapping is done by the Corps of Engineers. However, this is done as a service to, and often in cooperation with, other federal and state agencies. Special purpose research laboratories are also funded to develop basic Great Lakes data and analysis, for example through the National Oceanic and Atmospheric Administration, of the U.S. Department of Commerce. To itemize each information source would be a large task. However, it is important to recognize that the commitment to information programming is widespread; so widespread in fact, that there is potential for engendering confusion among interests on the issue of Great Lakes water levels.

It would not be possible (at least in the U.S.) to tabulate the total amount of research funding received for Great Lakes research by public agencies, universities and private consultants over the past several years. The amount is significant, but is devoted to many topics outside the issue directly concerned with lake levels. In particular, water quality research programs likely receive the largest share of total Great Lakes research funds. However, this funding demonstrates that federal governments' support for Great Lakes studies is significant. This signals the commitment to development of baseline information for governments. At the same time, getting the information to the public and having it understood is of prime concern to governments. This is demonstrated by their specific request for the development of an information program in the Water Levels Reference establishing this Study.

National Sovereignty and Decision Making for Lake Levels Issues

Despite the commitment to the IJC as a bi-national body, sovereignty of national policy is of overriding importance in both nations. The apparent concurrence of basic policy themes between the two nations on the water level issue will make claims of sovereignty less of a problem issue than may have been the case on other past issues. Nonetheless, these policy positions make it less likely that major new formal agreements will be entered into by the two countries, and more likely that statements of agreements through joint communiques or other less formal arrangements will be most likely.

Federal governments are characteristically hesitant to vest significant management authority in international commissions. Implementation of commission findings and recommendations is largely dependent upon how they are

received by governments. This explains the apparent reluctance of the U.S. and Canadian governments to create international commissions (there are only 2 long standing commissions). It may also explain the failure of governments to formally respond to recommendations of past IJC levels studies.

Commitment to Open Planning

There is an expectation of openness and accessibility to the federal policy-making process. Individuals and interest groups with designs on introducing or influencing resource management policy have a number of avenues to do so. In the U.S. members of Congress have long been receptive to legislative initiatives from constituents. Political sensitivities in the executive branch render agencies susceptible to pressures for the emphasis/de-emphasis of given resource management authority. Finally, the judicial system grants citizens and interest groups standing in the courts, an arrangement that has established litigation as an often-used resource policy-making device.

In Canada, the civil service participates in policy development in conjunction with elected officials. Pressures from the public to federal agencies can influence policy development. In recent years, the federal and provincial governments have increasingly sought the views of interest groups and the public at large before making decisions, especially when they have involved natural resource and environmental matters. Ontario's conservation authorities channeled grass-roots interest in flooding and soil erosion problems resulting in numerous studies with regard to public attitudes about hazards such as floods (Pearse et al., 1985). The 1970 Canada Water Act authorized the federal minister to enter into agreements with provincial governments for the purpose of formulating comprehensive water resource management plans,

> "...taking into account views expressed at public hearings and otherwise by persons likely to be affected by implementation of the plans." (Canada Water Act, 1970).

In 1980, Environment Canada adopted a Public Consultation and Information Availability Policy consisting of four parts: Public consultation; regulation making, requiring new regulations and guidelines be made available for public comment at all stages of their formulation; information availability to the public; and contribution to transportation expenses, which helps qualifying groups to attend designated meetings.

In the United States the commitment to public participation in water resource project planning dates to the late 1960s. Since that time the agencies of federal and state governments have experimented with various approaches for public involvement in decision making and continue to define the purposes of public involvement. While the purposes and means of public involvement continue to be developed, specific water management programs and legislative action uniformly call for and require "public participation" and openness of decision making on water resources issues.

Evaluation Requirement for Federal Actions

Prior to the 1960's environmental or social consequences of projects were mostly limited to recreational aspects. Due largely to a rapid increase in popular environmental concern, the environment has since emerged as a key issue to the governments of both the United States and Canada. The result of the public demand for policy change in the U.S. was the passage of the National Environmental Policy Act (NEPA) in 1969. This legislation made environmental protection a major federal responsibility and created the Environmental Impact Statement (EIS) requirement as the principal means of forcing comprehensive environmental planning to be done for new government projects. During this period, U.S. federal water project evaluation guidelines were modified. The Principles and Standards for Planning Water Land Resources (P&S) guided evaluation through to 1983 at which time they were replaced with the Economic and Environmental Principles and Guidelines (P&G), still in place today. The decision rule of the P&G is to maximize national economic development (NED) net benefits subject to environmental constraints or criteria imposed by other regulations. Planners must consider all existing environmental regulations in formulating plans and must meet the requirement for an environmental impact statement (EIS). Any alternative plans that reduce NED benefits in order to address other federal, state, local or international concerns can also be formulated, but must be done so with consideration of four criteria: completeness, effectiveness, efficiency and acceptability. Appropriate mitigation of unavoidable adverse impacts must also be considered within each plan.

A comparable desire in the early 1970's also existed among Canadians at both federal and provincial levels resulting in the establishment of the Environmental Impact Assessment (EIA) procedure. In Canada, a more flexible EIA procedure was chosen than in the U.S.. The Canadian procedure allowed environmental concerns to be balanced against political needs. At the federal level, the Canadian Environmental Assessment and Review Process came into effect in 1974. Adjustments were made in 1977, and the Environmental Assessment and Review Process (EARP) Guidelines were issued in 1984. The process is structured to allow project proponents to conduct "initial environmental evaluation" of their own projects; the initiating department being the decision-making authority. Unlike NEPA in the U.S., the Canadian federal cabinet has retained the power to decide whether individual projects should proceed despite their environmental impact if they are in the national interest. Basically the process is made up of a preliminary self-assessment of potential impacts, a formal assessment by the proponent of impacts, government review, public reaction and comment, and finally a decision. The provinces (Quebec and Ontario) also have their own EIA procedures requiring the preparation of an EIA for all Public Sector projects. Ontario is the only province to date to have passed a specific Environmental Assessment Act (1975), in this regard. However, as with the federal level, discretionary power has been reserved for elected officials and cabinet.

Both countries realize that there are limitations to their procedures. This is evidenced by the frequent changes and adjustments to programs and guidelines. In Canada the federal government again has moved towards improving the process by including social impact assessment; broader environmental

resource issues such as aesthetics; sustained productivity of fish and wildlife resources; and policy questions such as project needs, project alternatives and compensation for non-mitigatable environmental losses (CEARC, 1988). In the U.S., there have been suggestions for combining the strengths of multi-objective planning with benefit-cost analysis to lead to a stronger and more defensible evaluation procedure (Hobbs et al., 1989). These proposals for reform would indicate the commitment by the governments of both nations to the procedure and a desire to improve the process. EIA has changed in Canada from an instrument of potential reform in public decision-making to a planning and procedural requirement in the project approval process. The process in both nations has become an accepted and established evaluation requirement, and in all likelihood will continue to be so.

In conducting the required procedural evaluations, the process of evaluation itself, with its multiple concerns, provides a focus for diffuse interests to influence planning of federal projects. Thus, evaluation processes complement the open planning process. The result and intent of the extensive review requirements are to assure achievement of the policy goal of environmentally compatible economic development wherever federal investments are made. To a more limited extent, the procedures will also apply to other (non-investment) federal and non-federal actions. A result, (perhaps unintended) is that the evaluation requirements coupled with the public involvement process have lengthened the time from the conception of an investment idea to its implementation.

5.5 SUMMARY

Governments do have positions on the nature of the "problem" posed by fluctuating water levels in the Great Lakes Basin, and they do have a perspective on what, if anything, governments should do. Governments' evaluations of actions need not (in fact, should not) start from scratch; rather they should reflect established policy positions which have evolved over time. In making generalizations about positions of governments (i.e. policy), liberties of interpretation are unavoidable and the presence of exceptions must be acknowledged. Indeed, it is the exceptions which demonstrate the main policy themes. Thus, for example, the resistance of governments to expanding post disaster aid (despite its existence) and the increased insistence on cost recovery (in the U.S.) for hazard reduction projects (despite a policy of less then full cost recovery), demonstrate the policy presumption in favour of informed and responsible decision making. Acknowledging these limits on the ability to generalize, there remain key themes of policy which must be recognized in describing the position of governments. In summary, interests uses of the services of the lakes are presumed to be "informed" and "responsible". Governments' responsibility extends to assuring informed and responsible behaviour, but also includes some commitment to assuring resiliency, economic progress, and environmental protection. Finally, when making decisions, governments seek full participation of interests in decision making.

These broad policy themes serve to define the nature and scope of governments' responsibilities in the water level issue. As a consequence, they also provide a basis for appraising petitions by interests for government actions and for evaluating specific measures governments might contemplate. Whether these policy positions of governments are made clear to other interests and whether mechanisms are in place for their implementation are other matters explored in subsequent sections of this report. s report.

SECTION 6

INTERPRETING THE INTERESTS' POSITIONS

6.1 INTRODUCTION

The preceding section has highlighted policy themes of governments (especially federal) relating to fluctuating water levels. As noted, these policy themes represent the current positions of governments with respect to fluctuating water levels and measures. On the other side of the issue are the interests, who also take positions regarding water level fluctuations (and other physical processes) and measures. Underlying the positions taken by interests are their perceptions, concerns, beliefs and preferences about lake level changes and measures, and their implications. Positions are sometimes in conflict within and among interest groups, as well as between interests and governments. Interest groups who hold very strong positions have or may in the future petition governments for action. Whether governments should act on this petitioning depends on their responsibilities.

To help governments better understand what actions to take in response to disagreements and petitions requires that their policies and responsibilities be clarified (Section 5), and that positions of interests be articulated. Furthermore, it is important to relate the positions of interests to the policies and responsibilities of governments. The purpose of this section is to develop a conceptual framework for interpreting interests' positions in light of government policies. This approach is then applied in subsequent sections of the Report to each interest in turn.

The analysis basically seeks to understand the process by which interests go through, either consciously or subconsciously, when choosing to use the lakes and related land resources, and how and when such use results in calls for government action. Interests use the Great Lakes - St. Lawrence River system and related land resources to obtain certain services, such as habitat for fish and wildlife populations, a medium for transportation, a source of power, or access for aesthetic and recreational activity. In making their decisions to use the services of the lakes and channels, interests evaluate is some way the costs and benefits they will incur as a result of their decision. The costs and benefits of their decisions include not only economic costs and benefits, but social, environment and aesthetic considerations as well. Costs and benefits of any decision to use the lakes or locate along the shoreline are evaluated by interests, explicitly or implicitly, on various criteria. Interests' decisions may be influenced by their financial resources, and their values and attitudes towards such things as risk and fairness. Another major factor in interests' decision making is their expectations regarding both the consequences of water level fluctuations and the responsibilities of governments. These expectations are formulated in part using the information the interest has available.

The values, attitudes and expectations an interest has also influence the positions which they take. If an interest holds strong positions about fluctuating water levels and measures, they may petition governments for what they feel is appropriate action to deal with their problems. Such petitioning can arise for any number of reasons. It is when these reasons relate to government responsibilities that governments are obliged to act. It is the established policies of governments which determine whether or not they should take action to deal with interests' petitioning, and which provide direction for the types of action.

6.2 THE BASIS FOR INTERESTS' DECISIONS TO LOCATE AND USE THE LAKES

Interests, individuals or firms, choose to locate on or use the lakes and channels in order to obtain certain services. These services of the Great Lakes and St. Lawrence River are employed in different ways by interests, and include such things as habitat for fish and wildlife populations, a source of power and a consumable product for industrial and commercial purposes. The interest must make an investment (e.g. financial, time) to transform the attributes of the Basin environment into a flow of services. The services create flows of benefits and costs, which, of course, include not only economic benefits and costs, but social and environmental as well. Thus, to capture the benefits or desirable attributes the interest must incur the costs of the investment and the costs arising from the attributes of the Basin location.

Consider some of the attributes of the Basin environment, which may be thought of as inputs to a production process. The lakes and channels display many interconnected physical and biological processes affecting levels, flows, sediment transport, wave action, aquatic life and bird life. As an example of the connection between lake attributes and the investment to capture a service flow, which includes a flow of costs, consider an electric power generating firm. The firm, potentially, can utilize water level changes as water flows from lake to lake. To do so the firm must invest, initially, in generating equipment which transforms the energy of the falling water into electric energy which it hopes to sell at a price above cost. However, there will be additional future costs associated with the levels. For example, lower than expected levels can result in under utilization of the generating facility. As another example, consider the individual who invests in a home on the shore in order to capture the amenities of lake life, beaches, boating and spectacular sunsets. Lake levels, flows and sediment transport can affect the future benefits and costs of owning the home. The environmental interest is somewhat anomalous in that this group need not locate on or near the lakes to receive a flow of services. Their service flow is characterized by a desired state of natural environment.

In undertaking a given activity in the Basin, an individual makes an investment, in one way or another considering explicitly or implicitly the following:

- o the expectation of a flow of benefits from the investment related to the expected services of the lakes and the variability in those services as the levels and flows fluctuate.

- o the expected cost of the investment.

- o the expectation of a flow of costs for the investment. These include costs which are expected to vary with levels and flows, typically damage costs, and the extent to which the interest has an expectation that the government will absorb some share of the costs by such programs as disaster aid or sharing some of the costs for protection works.

- o the willingness to take the risk that the investment will yield the expected flow of benefits and costs.

Of course, there are usually factors other than water levels which will influence the expected benefits and costs for the individual. In making the investment decision individuals may follow any of a number of decision rules for relating the costs of the investment to the expected flow of returns. They may seek to maximize the expected return, or they may be more risk averse and adopt a decision rule which will result in lower benefits, but be less risky than would be expected from simply maximizing expected returns. There will also be differences in the time frame over which individuals consider their options.

Regardless of the decision rule followed, interests do not attempt to prepare for the occurrence of all expected events. Investment costs would increase as an interest attempted to prepare for every water level event that could occur over time. As an event becomes less probable it becomes more difficult to justify the investment to account for that event. For example, consider the hydro power interests on the Great Lakes, the St. Lawrence River and the connecting channels. This interest stands to benefit from increased generation as water levels rise. However, there have been periods when levels are so high that there is not enough capacity to utilize those levels. This arises as the interest perceives that the cost of investing in the extra capacity is higher than the value of the electricity that could be produced during those infrequent high level periods. That investment would provide more of a return elsewhere. In like fashion, harbour dock facilities (recreational or commercial and industrial) are not constructed to operate as effectively at extreme levels as at mid range levels, presumably because the interests judge the infrequency of the costly event not to justify the necessary expenditure.

6.3 THE FORMATION OF EXPECTATIONS

Expectations are central to understanding both the investment decisions of interests and their positions. The benefits and costs, be they economic, social or otherwise, of locating on the lake are not known with certainty. As such, expectations of future benefits and costs enter the investment decision as subjective probabilities. That is, each interest, subjectively, forms a notion of the probability of experiencing a particular level or range of levels. Additionally, to the extent levels are considered at all, each interest forms an expectation of how a particular level or range of levels will affect their welfare. Furthermore, the interest incorporates notions of probable government action as it is expected to affect levels, and as it is expected to affect the consequences of various levels.

The complexity and accuracy of the information used to formulate subjective probabilities can vary considerably from interest to interest and among individuals within an interest. The subjective probabilities need not be calculated explicitly, nor need they take the form of a distribution of probabilities. However, no interest makes an investment decision without some formulation of subjective probability for levels and an expectation for the consequences of different levels and flows, even if that expectation is that conditions are static or as observed over a short and recent time period.

It is tempting to consider that there exists some "objective" expectation that is the "true" distribution of lake levels and reflects the "true" relationships among levels and consequences. In practice, however, this is not the case. Rather than to define "objective" as the "true" situation, it is more appropriate to define "objective" as the best knowledge available at a particular time, recognizing that this knowledge can improve over time, for both the scientific community and the interests.

Typically, governments and the scientific community have access to detailed technical and historical data and have the capability of analyzing the data. This information does not necessarily represent known "truths", but represents the best scientific understanding of particular phenomena. Whether this information is stated clearly, accurately or consistently to the public is another matter. If the information is incomplete or inaccurate the expectations of interests can be biased. One case in point is information regarding historical levels. Governments and the scientific community have a continuous record of lake levels from the last century to the present. Failures in government information programs to communicate these data, however, may cause an interest to rely on levels of recent memory to formulate expectations which will be biased to the extent that recent levels are not representative of long term levels. This can be a source of considerable confusion as one interest's notion of high levels may correspond to another interest's idea of average or low levels. Horvath et al (1989), for example, suggest that shoreline property owners have relatively short memory with respect to previous crisis events. As evidence, some people dismantled their protective structures after the 1970s high water crisis and were caught unprepared for the mid 1980s levels. This tendency for assuming that recent events reflect a full range of possibilities has been termed anchoring in the psychological literature (Norris and Kramer, 1986).

6.4 INTERESTS PETITION GOVERNMENTS

An important component of the water levels issue is the requests by interests for government action. Interests make investments in order to capture services from the lakes over time, and in making an investment an interest forms expectations of how future events are likely to affect their future welfare. These expectations form the basis of the positions held by interests, and as such provide the impetus behind petitioning for government action by the interest.

Petitions for government action vary in nature and intensity over time and within and among interests. Petitioning can arise for numerous reasons, including emotional, social, economic and/or environmental concerns. The purpose here is not to explain the reason for petitioning but to determine how the petitioning of interests relates to the policy themes and responsibilities of governments. Interests petition at all levels of government, but the primary concern here is with how petitions relate to the responsibilities of the federal governments. In this study, four areas where petitioning relates directly to an established responsibility of federal governments have been identified: 1) surprise due to inadequate information, 2) lack of resiliency to natural hazards, 3) benefit enhancement, and 4) cost shifting.

- **Surprise**

  An interest is surprised by the occurrence of a particular level a consequence of a level, or a government action or inaction, when subjective expectations prove inaccurate. An interest with an understanding of the probability of events and the consequences for location benefits and costs, presumably has incorporated that information into their investment decision, and has modified that investment in accordance with their willingness to take risks. Thus, the unexpectedness of an event, from the interest's perception, is one reason for taking a position that government action is needed. As an example consider an operator of a marina. In making the decision to invest in the marina the operator might expect there is a 10% chance in any year the levels would be so low that income from boat slip rentals would be reduced. This expectation is then incorporated into forming the expected return on the marina investment. If the levels have a 10% chance of falling to that level, the operator may elect not to petition government when that occurs. However, should this condition occur with a higher frequency than expected, the operator may request government assistance to cope with the event. Similarly if an individual expected levels to remain relatively constant or expected governments to ensure that levels remain stable, that individual would be surprised by fluctuations, and might petition for government action.

  An interest may be surprised by water level fluctuations and their implications, or by a government action or inaction. This surprise can be explained in terms of the values and expectations of an interest, their memory of previous events, their understanding of the physical process, and their knowledge of the political-economic environment and

the roles of government. The policy theme of federal governments is to have informed decision making on the part of the interest. If surprise results from failure of government information programs to inform interests making planning and investment decisions, then it is the governments' responsibility to take action to better inform interests.

- **Resiliency**

Even an unexpected event may be acceptable to an interest, if the interest is resilient. Resiliency may be brought about in several ways: where costs are not significantly affected by changing water levels, where another source of income provides a cushion to level-induced costs, and where the interest makes a conscious effort to adapt to changing water levels. As an example of the latter, consider an electric power generating firm which suffers unexpected costs from fluctuating levels in the form of reduced power production at a plant. The greater the number of plants, the more diverse those plants are in terms of input requirements and in terms of location, and the greater the number of inter-ties with other firms, the less this firm is adversely affected, because the cost of adaptation decreases. As another example, consider a small marina which is the sole source of income for an owner/operator. As lower levels force boats to other deeper docks, the operator will be less resilient in adapting to the unexpected costs of the event.

The federal governments seek to improve resiliency of interests. Governments consider resiliency to be a problem if it threatens economic bases for major industrial or energy sectors, or if it creates financial hardship for shoreline owners. Governments can employ measures to improve resiliency such as by providing information for improved planning of investments, and by broadening the access to financial support.

- **Benefit Enhancement**

Certain measures may provide benefits to an interest, sometimes even after the interest pays its share of costs for the measure. If a measure is perceived to reduce costs of fluctuating levels or increase benefits, and if the measure can only be implemented by government, an interest may petition for such a measure. This petitioning for benefit enhancement may occur even if the interest's initial investment was well informed, and regardless of the interest's resilience.

Governments are responsible for seeking means to enhance the benefits of interests making investments in the Great Lakes - St. Lawrence River Basin. In the past, if a measure resulted in improved returns to an interest, and also in general economic development, federal governments have implemented the measure. The regulation works controlling Lakes Superior and Ontario are examples of such measures. However, governments are now reluctant to create benefits by modifying the physical system at the expense of the environment or at the expense of the public. Any measure considered by governments is now subject to strict tests of cost recovery and environmental protection.

- **Cost Shifting**

  An investment decision by an interest may be based upon an expectation for the future actions of government and the costs they will bear for those actions. When there is an expectation that some of the cost can be shifted to others (taxpayers, the environment, etc.) the interest's welfare will be enhanced. To illustrate, expectations for disaster aid payments or construction of protection works at government expense will increase benefits to the recipients. If such government actions are not forthcoming as expected the interest will be inclined to petition governments for redress.

  If an interest is shifting costs to others or expects to be able to do so, governments consider this a problem when the costs for realizing private gain are shifted to the environment or to the general taxpayer.

The framework outlined in the preceding pages provides a basis for interpreting the petitions of interests in terms of the established responsibilities of government. Four policy-relevant interpretations are isolated, all rooted in the premise that interests develop expectations of the future in making investment decisions in the present. In the following sections, the positions of the interests are discussed using this framework.

SECTION 7

POSITIONS OF INTERESTS

7.1 INTRODUCTION

The following sub-sections deal in turn with each of the 10 interest classes. For each interest the following questions are addressed:

- Who, what and where is the interest (and its sub-classes), how does the interest use or invest in the resources associated with the lakes and channels, and generally what are the major implications of fluctuating water levels for the interest?

- What are the positions of the interest regarding water levels (and other physical processes), implications of levels, and measures?

- How can the positions of the interests be interpreted in the light of government policies?

Information on the interests was collected primarily by working groups consisting of at least one U.S. and one Canadian specialist. Sub-classes of the interest, how they use and relate to the lakes, and the impacts of fluctuating water levels on the interest, were identified through a review of past studies and from contacts with various representatives of the interests. The perceptions and positions of interests regarding fluctuating water levels and measures were collected from numerous sources. These included questionnaire surveys and telephone interviews, participation in group depth interviews (GDIs) at various locations in the Basin, and review of documents, newspaper articles, publications and correspondence from organizations and individuals. The sources of information and the working group members who provided the information are outlined more fully in Appendix 4.

By presenting the views expressed by members of the interests themselves, the elements of the water levels issue that the interests see as problematic are identified. This is a first step in helping governments to better understand what actions to take to address the concerns of the interest and how they can better respond to petitions to governments and conflicts. The next step is to provide some interpretation of interests' positions, based on the physical setting and processes, and relevant government policies that deal with the issue (See Sections 2.2 and Section 5 of this report, respectively). The framework presented in the previous section suggests that interests' positions on the need for government action can be interpreted in terms of: 1) surprise; 2) resiliency; 3) benefit enhancement; and 4) cost shifting.

The analysis of interests' positions and sensitivities focuses upon consequences of fluctuating water levels but recognizes that there are many other factors which influence the welfare of interests. Furthermore, the analysis is based upon the assumption that future conditions will generally be consistent with the historical record. Discussion and assessment of major

climatic changes (possibly causing levels to change significantly from the historical range), and major policy and economic shifts are reserved for another section of the Annex: Future Uncertainties.

7.2 RIPARIANS

Introduction

Riparian is a term which means relating to or living on the banks of a river, lake or any other water body. Consequently, riparian can refer to almost all interest groups using and interacting with the lakes, including farmers, commercial and industrial enterprises and recreationists. In this discussion, as in most Great Lakes studies, the term riparians refers only to the group of individuals who own residences (either seasonal or permanent) on the shoreline. This group is also referred to as residential shoreline owners.

The number of residential shoreline owners, both seasonal and permanent situated on or near the Great Lakes is not known at this time. A proposal to conduct a detailed inventory and survey has been developed as part of this research effort and is presented in Appendix 1.

Although accurate data are currently unavailable, it is known that the greatest concentrations of permanent residential shoreline owners are in and around the major urban centres (see Figure C-7-1). In the United States, large urban centres are located on the southwestern shores of Lake Michigan (Chicago), the western shores of Lakes St. Clair and Erie (Detroit, Toledo), and the southern shores of Lakes Erie and Ontario (Cleveland, Buffalo and Rochester). In Canada, urban development of similar density and size can be found at the western end of Lake Ontario (Toronto and Hamilton) and on the St. Lawrence River (Montreal and Quebec City). In contrast, seasonal cottage owners tend to be located away from the major urban centres, but within a reasonable distance from their permanent residences.

The location benefits to riparian residential owners relate to such factors as proximity to water for recreational purposes, scenic views, natural setting, family history, and real estate investment. In addition to the costs of purchase and normal maintenance, the location costs for riparians are tied to erosion and flooding. Average annual lake levels have been continuously above long term average from 1970 to 1988; with extreme high water periods in 1985-1987 and 1973-1974. Flooding costs are greatest when storms coincide with high levels, and costs associated with short term shoreline erosion and recession can also be increased under these conditions. Many areas along the Great Lakes - St. Lawrence River shorelines suffered extensive storm damage during the latest extreme high water period. These included Long Point (Stewart, 1986) and the northeast shoreline of Lake Erie (North Shore Coalition, 1986 ; Township of Wainfleet, 1986), western Lake Erie, including Point Pelee (Stewart and LLoyd, 1987), southern Georgian Bay (Stewart et al., 1987), various locations along the Canadian shoreline of Lake Superior (Stewart, 1988), the cities of Chicago, Illinois and Windsor, Ontario, and many other smaller communities along both the U.S. and Canadian shoreline. Some shoreline owners in these areas suffered the loss of land and trees, and

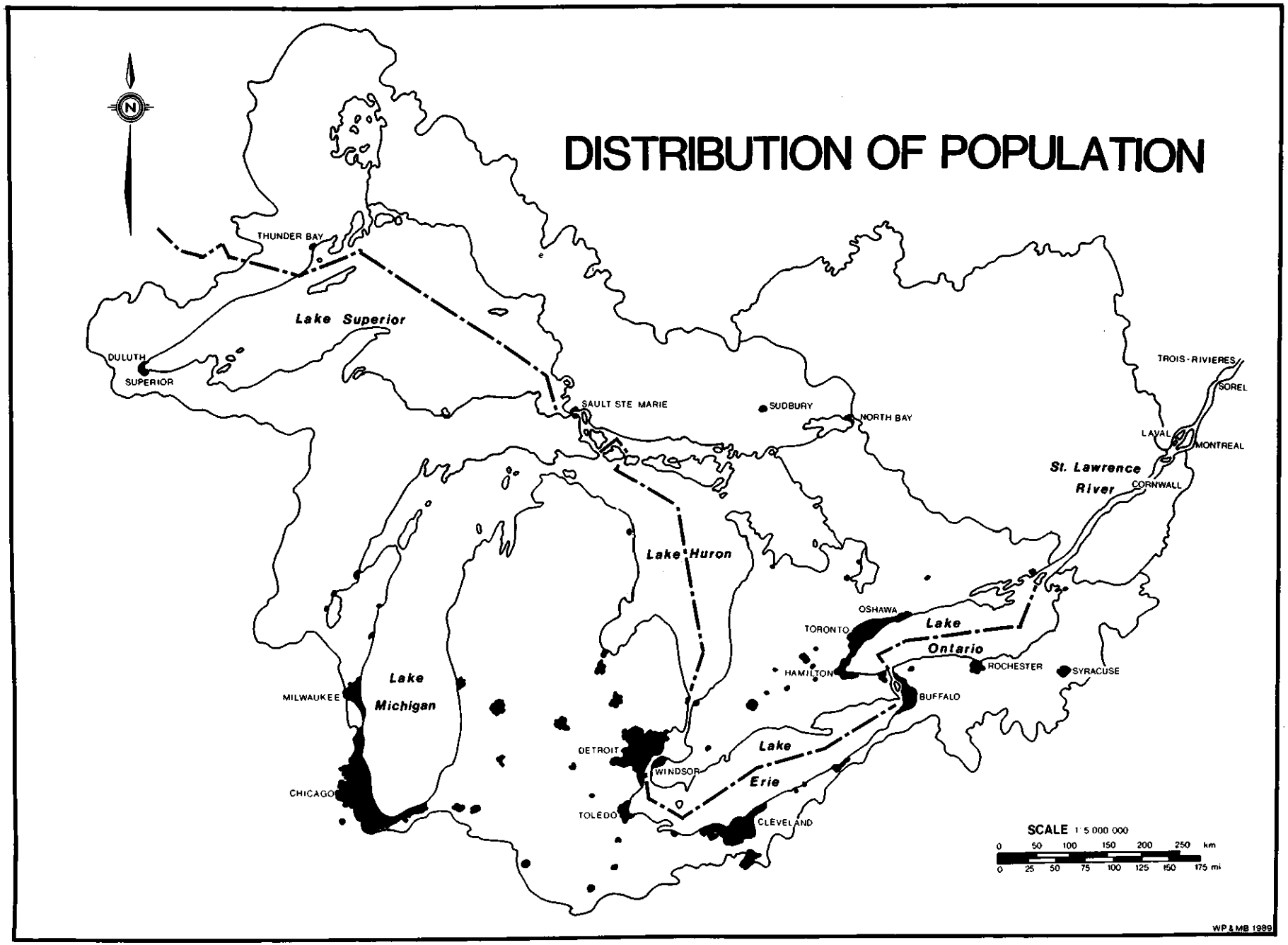


Figure C-7-1: Distribution of Population

Source: U.S. Environmental Protection Agency and Environment Canada, 1988. The Great Lakes: An Environmental Resource Book. ISBN 0-662-15189-5

damages to (and in extreme cases loss of) shore protection structures and buildings and their contents. Losses have occurred mostly in low lying areas. In the spring, damages may be more severe when ice is carried by waves and pushed against structures.

Property losses have associated with them a number of other economic and social impacts. Some of the possible economic impacts of flooding and erosion during extreme highs have been the costs of alternative accommodation, costs of maintaining septic systems, and the costs of repairing or replacing damaged shore protection works, buildings and their contents. Some of the social impacts have been increased stress and anxiety, disruption of people's lives, reduced enjoyment of property, restrictions of recreational boating and deterioration of aesthetic amenities. For example, extremely high water levels reduced the size of beaches, and for riparians who have beaches, this hindered their aesthetic and recreational enjoyment of the property. Extremely high waters have also led to problems for shoreline owners with boats. When boathouses have been flooded, or the water level is too high, boats stored in the boathouses could not be accessed, while those outside the boathouse during high waters had to be stored elsewhere. Furthermore, flooding of roads has prevented access to residences.

A common response of riparians to higher water levels and storms has been to protect their investment. Sudar (1987) found that over 50% of the riparians surveyed had taken action to protect their property from the effects of higher water. The majority of these people spent less than $5,000 on this protection, while nearly 30% spent in excess of $10,000.

The extreme water levels of 1985 and 1986 gave rise to local coalition groups of riparians (most prevalent on Lake Erie). These local coalitions form a network around the Great Lakes, with an umbrella organization for each nation (the Canadian Great Lakes Coalition and the U.S. Great Lakes Coalition), and an international organization that ties together all groups (the International Great Lakes Coalition). The main function of these groups is to lobby for government actions to further regulate the Great Lakes water levels.

The impacts of extremely low water levels on residential shoreline owners are not as readily apparent as those associated with extreme high water periods and storm events, likely because levels below long term averages have not been experienced since the 1960s. However, the recent significant drop in water levels on the Great Lakes from recorded highs to the long term average, after twenty years of above average levels, has affected shoreline owners in a variety of ways (Walsh and Weidman, 1988). Impacts include, from a riparian point of view, the expansion of beachfront property and a reduction in the amount of short term erosion that they observe. In low lying areas, the threat of stillwater flooding is reduced as is the threat of damage due to storms. In many cases, the aesthetic value of the property has also increased with lower levels.

Another impact of the lower water levels has been restrictions on recreational boating. Docks built in a period of high levels can become high and dry when levels drop, even just to long term averages, forcing some property owners to rent boat dockage space elsewhere, and to put their boats in winter storage

before the end of the normal fall season. Riparians who own boats have found that they are unable to navigate channels that they have been able to clear easily in previous higher water years. In some cases this has resulted in propeller and hull damage to their boats. Lower water levels have required some property owners to extend their docks or to modify them in other ways in order to be able to tie up their boats near their dwellings.

Positions

Riparians are primarily concerned with problems of flooding and erosion which they see as directly caused by high water levels. Much of the correspondence (mail, public forum and group depth interviews) relates of damage to property suffered during storms in the high water period of 1985-86. These riparians tell of lost (eroded) lake frontage, the loss of structures, the cost of moving structures inland, and of expenditures on shore protection. Low water problems are very rarely mentioned. The riparians, as a whole, expressed surprise (explicitly or implicitly) that the high extreme levels of 1985-86 could have occurred. They were not informed that such levels would occur, and hence did not expect them.

Riparians generally share a similar position in their search for government measures to reduce and/or prevent property damages due flooding and erosion, which the interest associates with high levels. Typically, riparians define "government" in the broadest sense with little mention of specific levels of government or of specific agencies within governments. On occasion there is reference to the IJC. There are strong feelings of anger and frustration rooted in the riparians' inability to protect their property or to draw the government assistance that they feel could solve their problems.

Depending on their situation and perception of the physical system and governments' roles, individual riparians differ in the measures they promote. There are several categories of measures suggested by the riparians. Some of these measures may be mutually exclusive while others are not. It is not uncommon for an individual to favour more than one measure.

To some extent, geographical distinctions can be drawn among riparians. Those on the middle lakes tend to favour complete levels management of the lakes, although this feeling is neither unique to this group nor held uniformly within it. Riparians on Lake Superior are strongly opposed to the use of that lake for storage to help modify levels downstream. This group feels it is unfair that they should have to suffer in order to reduce damage to commercial or other riparian interests elsewhere in the Basin. Lake Superior residents are generally opposed to diversions out of the lake to control levels. Some riparians on the middle lakes see diversions out of Lake Superior as an acceptable levels management practice. Riparians on the St. Lawrence River are wary of any levels management plan. They see the St. Lawrence River as the "system drain" which will experience extreme flows for the benefit of others upstream with little consideration of their needs. Fairness is also a major concern of the middle lake riparians. There is a pervasive perception that they have incurred or might incur damages in order to protect other interests, riparian or otherwise, from damage.

A survey by Sudar (1987) provides some evidence of the variation in perceptions regarding water level fluctuations. Sudar interviewed 620 people in southern Ontario between Port Severn on Georgian Bay and Gananoque on the St. Lawrence River. Of the total respondents, 222 were shoreline property owners, the general public making up the remainder. At the time of the survey, December 1986, the water levels on lakes Huron, St. Clair and Erie were the highest since 1900 for that month. Care must be taken in interpreting these results as there was no input from riparians on the lower St. Lawrence River or the Great Lake states in the U.S. Of the shoreline property owners, 17% felt that the high levels were caused by humans, 39% felt that natural forces were the cause while an additional 22% felt that both natural and human factors contributed to the cause. With respect to questions regarding the preferred type of remedial action, 53% of the riparians felt that regulation of levels would be most effective (39% of the general public agreed). Of the riparians, 21% felt that shoreline protection would be the most effective (22% of the general public agreed). Of the general public 11% felt that shoreline management (zoning, setbacks, etc.) would be the most effective action; none of the riparians agreed.

Subsequent statistical analysis of the Sudar data was directed at determining whether knowledge of the attributes of individual respondents could be used to reliably predict an individual's views regarding the cause of high levels, solutions to the problem and who should pay for the solution. Factors considered were age, income, information sources, property ownership, membership in a shoreline group, awareness of high water damages and the effect of lake levels on the individual. The analysis concluded that there was no clear basis for predicting how different individuals within the population would view the cause, the solution or who should pay for any solution to the lake level fluctuations. This analysis concluded that riparians are a diverse group in terms of their individual attributes and perceptions regarding the fluctuations of the lake levels and in terms of what, if any, measures should be taken to address such fluctuations.

It is difficult to say if those riparians who support regulation of levels in the lakes system are in the majority, but it is clear that this group is the most vocal. It is useful to explore the position and perceptions of the organized riparian coalitions formed on both sides of the international border. The International Great Lakes Coalition (IGLC) encompasses two national divisions, the Great Lakes Coalition (GLC) in the U.S. and the Canadian Coalition for Great Lakes Regulation (CCGLR). Each of these divisions has organized local chapters, thirteen in the U.S. and six in Canada (Curtis, 1988). The IGLC is a relatively new organization having taken its main impetus from the riparian property damage suffered during storm events in late 1985 (Curtis, 1988). Referring to its position paper, the Coalition (international and national levels) seeks:

> "reasonable and permanent solutions to the catastrophic flooding and erosion problems caused by extremely high lake levels and mitigate losses due to low lake levels. The Coalition proposes to cause reduction of extreme high and low lake level related losses, to the extent man is able, by promoting stabilization of Great Lake water levels through

effective and equitable hydraulic regulation of the Great Lakes system under a centralized management entity" (GLC, 1987).

The Coalition feels this can be accomplished:

"by compacting the range between extreme high and low water levels through use of various existing and/or new control devices located in the Great Lakes system...Although any single control device used independently may bring only limited results, the combined and coordinated use of all existing controls, together with new controls, operated under a central management plan would produce considerable results and benefits" (GLC, 1987).

Furthermore, the Coalition feels that lake level regulation would be of benefit to navigation, recreation, governmental and environmental interests and has issued a brochure stating this position (IGLC, 1989). More specifically, the Coalition states that regulation will stabilize wetlands, protect wildlife habitat, encourage water related business, result in faster and more efficient shipping, protect public roads, parks and facilities, secure tourist and recreational incomes and provide safer access to water facilities.

Underlying and associated with the above position are several perceptions as to the physical, economic and political environment affecting the levels issue. Most obvious is the perception that high levels lead directly to increased flooding and erosion. Another major perception is that lake levels can be successfully managed. This perception appears to be rooted in at least three main sources: i) statements by "experts" (including past IJC studies) which suggest that human control can be affected over the lake levels (IGL Coalition News, 1988, 1989 and GLC, 1987) and ii) the decline in levels from 1985 to 1988 appeared too rapid to be explained by changes in precipitation (Andresen, 1988) and iii) the levels of two of the lakes, Superior and Ontario, have been artificially controlled to some extent.

Much of the passion underlying the Coalition's endeavours may be attributed to their perception that riparians have been treated unfairly. Given the perceptions mentioned above, the occurrence of erosion and flooding in recent years suggests to this interest that lake levels have been managed in favour of other interests, particularly hydropower and navigation (IGL Coalition News, 1989). The issue of fairness arises again from the perception of the present practice of regulating the levels of only two of the lakes. The Coalition also feels that i) the opinions of the shoreline property owners have not been heard during previous IJC research into the water levels problem, ii) that estimated losses to other interests (particularly shipping) arising as a result of regulation have been overstated in past IJC analyses and iii) that the full cost of the damage they have suffered has never been accurately estimated (GLC, 1987 and IGL Coalition News, 1989).

The Coalition favours any measures, such as dredging, interbasin diversions and shore protection, which can compliment level regulation as long as they perceive a continued commitment to levels regulation (GLC, 1987). These same measures may be received unfavourably if they are perceived as stopgap

solutions and that these measures simply draw attention and support away from their main goal:

> "Our goal of lake level management is an abstract, intangible concept, but it must remain the singular goal of our group. Too often we are sidelined by more tangible objectives such as 50N plans, Chicago diversions, Black Rock canal, etc. because they are tangible and the public can readily understand their impacts. These objectives must all be addressed, but we have to remember that, without achieving our goal, all of these objectives will just perpetuate the crisis mismanagement scenario that has been followed in the past" (IGL Coalition News, 1988).

The Coalition strongly opposes any shoreline management measures which would limit their use of their property or eventually force them away from the lakes (IGL Coalition News, 1988, 1989). The suggestion that the riparians' problems could be solved by moving away from the lake can result near violent reactions (Turton, 1987).

Unlike the Coalition members, many other riparians are less politically organized. The current understanding of their positions relies largely on group depth interviews and letters from individuals sent to the IJC offices. The Coalition appears to represent some of the individuals' positions although it is not clear that these individuals are Coalition members. Other riparians express positions that differ from the Coalition position. The following paragraphs summarize the positions gleaned from riparians via group depth interviews and individual letters.

Many in this group subscribe to the view that the high levels of recent years were caused by the actions of humans. These riparians refer to the large number of regulating works and other structures in place on the lakes and see them as the cause of their problems. There is also the perception that increased tile drainage and urban development has caused increasingly more water to drain into the lakes. More directly, many riparians across the basin and on the St. Lawrence blame the government for not taking action they perceive to be within its power. Some members of this group feel that the government, at present, has full control of the levels, and can therefore control flooding and erosion damage, but that it chooses, inequitably, to manage the lakes to the benefit of others, specifically shipping, hydropower or other riparians elsewhere in the system. This is a strongly held conviction. Other riparians feel that the government may not have control of lake levels at present but that such control is feasible, and to not endeavour to control the levels indicates government neglect. Many riparians on the St. Lawrence want representation on the St.Lawrence Board of Control.

Those who feel that the high levels are due to the action of humans, government or otherwise, indicate that they are willing to accept the vagaries of nature but are not willing to accept the damage caused by others. There is a feeling that the riparians have a right to normal levels (not necessarily average) and that their rights have not been recognized. This feeling is most clearly stated by riparians on Lake Superior who feel that the rules would be changed midgame if Lake Superior levels were allowed to rise above the

maintained level of 602 feet in order to alleviate the high water problems downstream. (To some riparians this level is considered to be "natural".)

Some riparians perceive the high levels as a natural process that cannot be controlled by human intervention. Others feel that levels should not be controlled even if it were feasible, that to tamper with nature on such a scale is dangerous or otherwise undesirable because environmental resilience or purity may be adversely affected. This group prefers measures, such as various forms of shore protection, which reduce erosion and flood damage without attempting to affect levels. Shore protection measures also receive some support from those individuals who support Type 1 measures. They feel that shore protection may be a useful supplement to levels regulation.

Common to all riparians is the rejection of any measures which they perceive will restrict the use of their property, although some riparians favour restricting new developments in hazard areas. Zoning regulations, in particular, are seen as restrictions on private property rights. The notion of private property rights is held most strongly.

Whether the riparians believe that the high levels are caused by human action (passive or active) or by nature, there is a strong feeling that level fluctuations can be predicted with accuracy and that these predictions should be made available to the public. Riparians feel they would be able to make better informed planning and investment decisions if they have good predictions of storm events and levels for the short and long term. These riparians often indicate that both prediction and dissemination of the forecasts would be better served if the present lakes management and research groups formed a more unified organization. There is a feeling the information that is presently available from various sources is sometimes inaccurate and sometimes conflicting. Additionally, there is an expressed demand for more practical information about the lakes, technical or otherwise.

The demand for information and better prediction is tied closely to the concern over private property rights. That is, there is a feeling that with better information, individual riparians will be able to make more informed decisions regarding their shoreline investments, thus removing the need for any restrictions on the use of their property.

Discussion

Positions of riparians can be interpreted in light of the policies and responsibilities of governments as they relate to surprise, resiliency, cost-shifting and benefit enhancement. One of the major bases for riparians' concerns and petitioning is surprise due to inadequate information, misinformation, or misunderstanding. Governments' policy theme to have "informed" decision making on the part of land owners seems to have fallen short. There are significant differences among scientists, government representatives and riparians in the current understanding of physical processes and roles of governments. These differences can be related to such factors as the evolving scientific consensus, the dissemination of and access to information, and the varied length of experience on the part of riparians.

This information theme is reflected in some fundamental differences between the current scientific consensus and the perception of riparians regarding physical processes. In general, the riparians see a direct link between lake levels and the degree of erosion and flooding damages they experience. The scientific consensus (see Section 2.2) highlights the variability in short term erosion response to levels and points out the importance of storm events in causing damages. Much of the erosion and flooding damage occurs during storms, and storms of equivalent severity can cause severe damage, even without extremely high static levels. There seems to be a disagreement between many riparians and the scientific community about the degree to which erosion and flooding damages would be reduced under a regulated system. The scientists argue that regulation would have questionable influence on reducing erosion and flooding damages, in part because of the important role played by storms.

Another point of disagreement among the interested parties relates to feasibility and implications of lake levels regulation. Many riparians, the Coalition in particular, suggest that the regulation of all lakes would be feasible and equitable (GLC, 1987; IGL Coalition News). The scientific community argues that full system regulation is technically possible, but would have major implications for some components of the system (quite apart from economic and environmental considerations), and would have limited effectiveness in controlling levels because of the unpredictability of climatic conditions.

Scientists point out that regulation to reduce extreme high and low levels requires a means of storage or discharge in times of surplus and a source of supply in times of deficit. For example, Lake Superior is regulated by withholding water from downstream lakes during periods of low inflow or precipitation into Superior, and by releasing more water from Superior during high inflow or precipitation. To regulate the levels of all the lakes (essentially treating all of the lakes as one large lake) would require an outlet which would have to absorb all the fluctuations of precipitation in the entire Basin. The St. Lawrence River, as the only major basin outlet, would have to accommodate highly irregular flows. Thus, regulation of all the lakes is technically possible but has physical constraints in terms of the capacity of the St. Lawrence River (and other interconnecting channels) and opposition from riparians, and other interests including the city of Montreal, who would be faced with increased flows.

Scientists also point out that successful regulation for the system would require prediction of climate, particularly precipitation and evaporation. The unpredictable nature of climate, the immensity of the system, and the time lags involved mean that even with controls in place, regulation to avoid or significantly reduce fluctuations in levels may not be possible.

The Coalition also argues that other major interests stand to gain from regulated levels. As mentioned above, many interests on the St. Lawrence River would oppose full regulation of the lakes. Contrary to the Coalition position, the environmental interest in general perceives fluctuations as beneficial to the integrity and health of the environment (see Section 7.3).

Furthermore, shipping and electric power interests are not seeking further regulation of levels (see Sections 7.4 and 7.5). Regulation of levels will result in greater fluctuations in flows in the interconnecting channels which can reduce the reliability of electricity generated at plants in those channels. Regulation would also reduce high levels that can be beneficial to lake carriers by allowing them to increase tonnage per trip.

Misinformation is clearly a part of the riparians' concerns and petitioning. They were not well informed about possible levels and the effects of storms on erosion and flooding, and they suffered damages. In addition, the riparians in general appear to be poorly informed of the policy of federal governments. For example, government policies regarding flooding and erosion damage appear not to be clearly articulated, since the Coalition does not recognize that governments' policy does not consider the stopping of erosion of private lands to be a matter of public concern. There is also little, if any, mention of governments' commitment to having those who benefit from the use of shoreline lands bear the costs associated with that location decision.

The situation regarding information is certainly improved over that of 5 or 10 years ago, when many riparians and others believed that level fluctuations were caused directly by the regulation on the part of government agencies. But there is still a need to better inform those making decisions about locating on or using the lakes and channels.

The petitioning of riparians can also be interpreted in light to their resiliency. Many of the landowners have little option but to fully absorb consequences of levels fluctuation or storm processes, because they do not have the financial resources to construct and maintain shore protection structures or other means of adaptation. In other cases this limited resiliency can be traced to the limited information and understanding of the likelihood of events and their consequences. Other individuals may simply not have factored these possibilities into their location decisions or they have chosen to take the risk.

It is difficult to determine to what degree benefit enhancement and cost shifting play a part in the riparians' petitioning for government action, because the question of who should pay for regulatory works is rarely addressed. Ozanne (IGL Coalition News, 1988) suggests a strategy where the beneficiaries of level regulation would pay the cost which the author feels would be less than the cost of shore protection. This would indicate benefit seeking behaviour. On the other hand, the Sudar (1987) survey indicates 67% of shoreline property owners surveyed felt that governments and the general taxpayer should pay for any measures taken. This may be more attributable to cost shifting behaviour. Regardless, governments are reluctant to create benefits by modifying the physical system (e.g. through regulation) at public expense or the expense of the environment.

7.3 ENVIRONMENTAL INTEREST GROUPS

Introduction

The environmental interest class consists of many groups and organizations, including citizens groups, governmental agencies, and scientific/research groups which act as advocates for the environment. Examples of some of the environmental interest sub-classes are environmental conservation and protection associations, hiking and camping organizations, scientific and environmental research establishments, health and medical agencies, heritage and cultural resource agencies, and groups interested in preserving and enhancing certain aspects of the Great Lakes environment, such as wildlife, wetlands, and soils.

The class as a whole is characterized by its concerns about the environment. These concerns are rooted, not so much in a desire to utilize the environment in a particular fashion, but rather in the desire to maintain the integrity of the ecosystem. That is, an individual interest may not have any direct interaction with the lake ecosystem but still receive a service from the ecosystem that is dependent upon its integrity and productivity. The interest consists of many individuals, often represented by organizations as well as government agencies, with mandates to protect the environment.

Some environmental interest groups are concerned with a specific issue or with the protection of a specific resource, while others have more general environmental concerns. The goals of groups with specific environmental concerns are generally related to protecting their interests and they are indifferent about how certain water level measures might affect the ecosystem at large. Other groups have a broader perspective the of Great Lakes - St. Lawrence as a system. They are usually interested in the entire environment, and often take strong positions on fluctuating water levels and measures.

There are a considerable number of studies devoted to assessing the environmental effects of natural fluctuations in Great Lakes water levels. However, given the complexity of the environmental system, it is difficult to draw many substantive conclusions regarding the effects of fluctuations on some components of the environmental system. The Great Lakes environment is sensitive to fluctuating water levels, but the ecological consequences are not altogether understood or quantified.

Cyclic fluctuations over the long term appear to have some effects on general water quality in the Great Lakes, especially in isolated bays and harbours. This happens because changes in lake volume affect the dilution of substances in the respective lake basins (IJC, 1981). Water level fluctuations also affect wetlands and the species that use the wetlands for some of their life cycle requirements. As water levels change spatially and temporally, the extent and diversity of wetlands and wetland species may also change. For instance, during high water periods wetlands may be temporarily submerged. This could have negative impacts on some fish and waterfowl species who use the wetlands for breeding grounds and for food sources. However, these effects are generally recognized as part of the natural process which maintain wetland diversity. The Great Lakes wetland environment is a direct reflection

of the long term water level regime (Davidson-Arnott and Law, 1988), and if this regime changes (due to regulation, for example) then changes in the extent and diversity of wetlands would result.

Water level changes and associated shore processes also affect the terrestrial environment. Erosion and deposition are constant processes in shoreline areas, and consequently occur at all water levels. However, with changes in levels, shorelines will reach new equilibrium positions. Storm activities, especially when they coincide with high water levels, tend to accelerate erosion and slope failure, and have caused destruction of some shoreline habitats and the creation of new ones.

Positions

Despite the diversity of environmental interest groups, their views regarding fluctuating lake levels are similar. Environmental interest groups feel that changing water levels are a dynamic, natural process, and that fluctuations are inevitable. They do not believe that natural fluctuations are harmful to their interests. To the contrary, they believe that their interests are dependent upon the natural fluctuations of the Great Lakes.

Generally, environmental interest groups do not favour structural measures that would alter water levels. They feel that these measures would alter the natural processes and not eliminate erosion and flooding, and that these processes would merely be transferred locally or downstream (e.g. from Lake Erie to Lake Ontario and the St. Lawrence). Environmental organizations are also strongly opposed to interbasin water transfer, because they feel that increasing diversions into or out of the Great Lakes would have severe long term environmental, social and economic impacts to the region, particularly during low water periods.

Environmental interest groups have differing positions regarding shore protection structures. The majority of groups does not support shore protection structures, particularly if they are used to protect hazardous areas for development purposes. They feel that structural measures only slow natural processes and benefit only a few individuals who live in coastal areas, which are not suitable for development. They also feel that these measures encourage encroachment on existing or potential wetlands and other hazard areas, and that any individuals choosing to live in sensitive areas should bear the full cost of that location decision.

Some environmental groups, however, do support shore protection devices. These groups are generally concerned with protecting an existing wetland or other environmentally sensitive areas. The use of shore protection works such as beach nourishment, barrier islands or offshore breakwaters is favoured only if they are proven to be environmentally sound, and if they do not result in damages elsewhere in the system.

Type 3 and 4 measures are supported as the best group of measures for dealing with fluctuations. Environmental interest groups favour land use planning and zoning to keep people out of hazard areas. Furthermore, they support continued and increased public education and information, because they feel

that more people need to fully understand the Great Lakes environment and the characteristics of its natural processes.

Great Lakes United (GLU) is a major international group that represents approximately 200 environmental organizations from the 8 states and 2 provinces bordering the Great Lakes and St. Lawrence River. GLU holds strong positions regarding fluctuating water levels and measures, which are consistent with other environmental interest groups, but which deserve further elaboration.

GLU was formed in May 1982 with the purpose of coordinating and unifying the diverse environmental interests of the Great Lakes Basin, and consists of many conservation, environmental, community, union and government organizations. The common goal of GLU is to protect, conserve, and properly manage the resources of the Basin. The objectives of GLU are: to educate citizens on Great Lakes issues, further conservation efforts in the Basin, provide information exchange on critical issues, encourage environmentally sound economic strategies, and promote public support and coordinate citizen action on Great Lakes issues. The major issues that GLU have been involved in are winter navigation, the 1978 U.S.-Canadian International Water Quality Agreement, the Great Lakes Toxic Substances Control Agreement, and water diversions.

The major premise of GLU is that an ecosystem approach to resource management be adopted to solve environmental problems in the Great Lakes - St. Lawrence System. Any water resource policy which is developed and implemented should take into consideration the system as a whole, and hence reflect what is best for the Great Lakes. Members of the GLU feel that this Reference must reflect this philosophy and not be unduly influenced by one or a few interest groups. The following is a recent statement of their position:

> "Our challenge is to maintain and reestablish a philosophy of natural resource stewardship in water level policies. Let us ensure that the IJC's reference reflects that philosophy and is not unduly influenced by the loudest special interest of the time. Policies which reflect what is best for the Great Lakes do not constitute a special interest, but a generic interest for us all. The Great Lakes need a water resource policy which will stand the test of time and not simply constitute a string of proposals to manipulate the lakes for human benefit" (Great Lakes United, Fall 1988, p.1).

GLU accepts that lake level fluctuations have been inconvenient to certain interests in the Basin. However, they feel strongly that natural fluctuations are vital to the long term ecological diversity and stability of the Great Lakes - St. Lawrence System. They encourage governments to choose a water resource policy which allows the natural fluctuations of the Lakes and St. Lawrence River while providing human benefits within the bounds of the Basin. This policy should be based on stewardship of the system, rather than on manipulation for short term gain.

They feel that one of the greatest benefits for interests using the Great Lakes - St. Lawrence System, is that they are able to access a clean

waterfront. Presently, a GLU special task force is developing campaigns aimed at cleaning up the Basin and improving the water quality of the System. Their work focuses on developing schemes to regulate toxic discharge and reduce source pollution inputs into the System, to recycle hazardous materials, and to ban all overflow dredging operations. Furthermore, GLU strongly advocates that governments maintain public access rights to the water by limiting non-water related developments, such as houses, hotels and condominiums, along the shoreline.

The positions of Great Lake United regarding measures are simple and straightforward. Like other environmental groups, GLU is strongly opposed to increased diversions into or out of the Great Lakes Basin or major restructuring of the water system as means of addressing lake level concerns. Great Lakes United believes that people must learn to live within the bounds of the lake levels, and that to try to control them would cause irreparable damage to the ecological system. Great Lakes United President Frederick L. Brown stated:

> "There are no quick fixes to the fluctuations of lake levels. Our efforts should be focussed on how we can best live within nature's bounds" (Great Lakes United Annual Report, 1988; p. 9).

GLU supports Type 2 measures, such as shoreline protection works and dredging, only if they can be proven to be environmentally sound. They feel that shoreline protection devices such as beach nourishment, barrier islands, and offshore breakwaters can be effective and appropriate provided that their implementation does not result in damages occurring elsewhere in the ecosystem. Likewise, they feel that before implementing dredging or channel modification projects, the environmental consequences of the project must be examined. However, GLU claims that at present most dredging practices are carried out without due consideration to their environmental impacts. Present overflow dredging operations, they claim, degrade the quality of the environment by releasing contaminated sediments into lakes and channels, and the group is strongly opposed to these operations. GLU feels that priority should be given to assessing the environmental consequences of dredging, and that new advanced dredging technologies be developed.

Great Lakes United advocates a long term water management approach for the Great Lakes - St. Lawrence System. They strongly approve of coastal zone management as the best means of addressing lake level concerns on the long term. They perceive that this would lower federal subsides to flood insurance in the U.S. because people would not be allowed to rebuild in flood hazard zones. In addition, the membership feels that federal assistance programs and home elevation, relocation, and, as a last resort, buy-out of properties for public use, are appropriate on a one-time basis. Likewise, emergency response measures (storm forecasting, emergency evacuation procedures) are appropriate temporary uses of funds until coastal zone management measures can be implemented.

In his statement before the U.S. House Public Works Sub-Committee on Water Resources, David Miller (Executive Director of Great Lakes United) stated that in order for coastal zone management programs to be successfully implemented

activities must be undertaken in an international, federal and state (provincial) partnership. He noted the need for federal and state (provincial) programs to be coordinated and not to be at cross-purposes.

Discussion

The environmental interest group perceives fluctuations as a part of the natural process. They accept fluctuations as a process that is necessary for maintaining the quality and diversity of the Great Lakes - St. Lawrence environment, and hence are not surprised by the occurrence of particular levels or the consequences from the levels. Environmental interest groups have developed strong positions based on their concerns for the environment. They take positions because they believe that some of the costs of government actions or potential actions should not be borne by the environment but should be shifted away from the environment to other interests. They argue that human activities should be developed compatible with or resistent to the environmental processes. Their strong views with respect to measures are based on their concern for conserving, protecting, and enhancing environmental resources within the Great Lakes - St. Lawrence River Basin.

Environmental interest groups are strongly opposed to control and diversion works because they feel they will alter the natural processes, and not completely solve the problems due to erosion and flooding faced by some shoreline interests. Evidence supports the position that structural measures, such as regulation, redistribute environmental processes, such as erosion and deposition, but that they do not stop the processes. Damages to shoreline structures still occur on the shores of Lakes Superior and Ontario, despite the structural works which regulate these lakes (e.g. Stewart, 1988). Evidence also indicates that if Lake Erie were regulated, this could have significant downstream effects for the shorelines of Lake Ontario and the St. Lawrence River (IJC, 1981).

Shore protection works are believed by the majority of environmental interest groups to alter the natural processes and to benefit only a few individuals who use the shoreline. Although there are numerous examples of shore protection works having been destroyed, or overtopped, causing flooding of protected areas during storm events, there are also cases where they have been successfully implemented (The Center for the Great Lakes, 1988). When successfully implemented, these measures benefit shoreline property users, without damaging the environment. Protection works, such as barrier islands, offshore breakwaters, and beach nourishment have shown particular promise as protective devices. While environmental groups, such as Great Lakes United, recognize the benefits of these measures, others may be unaware that they have been successfully implemented.

The desire by environmental interest groups to shift the costs of government actions away from the environment to other interests is reflected in their strong belief that shoreline management is the most effective long term solution for dealing with fluctuating water level concerns. By keeping people out of hazard areas through land use planning and relocation programs, the structural damages that occur as a consequence of environmental processes would be reduced. Many environmental interest groups feel that coastal zone

management is a means of rectifying past land use mistakes and preserving sensitive shoreline areas.

Land use planning and zoning programs, such as halting public investment in public areas, emergency home movement or buy out programs have been successfully implemented by some local governments (The Center for the Great Lakes, 1988). However, many of these programs take time to implement, and in addition, may not be appropriate in all shoreline areas. Environmental groups, such as Great Lakes United recognize that other measures, including environmentally sound shoreline protection devices and one-time emergency relief funds, may also be appropriate means of dealing with lake level concerns.

In summary, the environmental interest class considers fluctuating water levels to be part of a natural process, and critical for maintaining the character of the Great Lakes - St. Lawrence River ecosystem. Consequently, environmental interest groups are not willing to support actions which may alter lake levels and/or have detrimental effects on the environment. In order for measures to be acceptable to them, they must maintain and enhance the environment. There is also a need for improvement in the understanding of the ecosystem and environmental consequences of measures. The environmental groups also push for environmental concerns to be given appropriate weight in the decision making process. The review of policy themes showed that governments seek to protect the environment as they also seek to enhance economic development.

7.4 ELECTRIC POWER

Introduction

The electric power interest consists primarily of utilities and non-utility generators (NUGs) that operate plants in the Basin to produce power. A particular utility or NUG may generate electricity using hydropower, thermal power, or a combination of both. Thermal power is generated using various types of fuel: coal, oil, natural gas, or uranium. Hydropower plants operated by the power interests use the levels and flows of the Great Lakes and connecting channels directly to generate electricity, or indirectly as a source of water for pumped storage. Thermal power plants operated by the power interests use the levels and flows of the Great Lakes and connecting channels for the transport of fuels and as a source of cooling water.

Major utilities located throughout the Basin are interconnected by transmission lines, and electricity can be "wheeled" to different areas, depending on demand and capacity limitations of the transmission lines (see Figure C-7-2). Interconnection is meant to improve the reliability of supply during short term emergency periods (a few hours or days) and to reduce operating costs by enhancing the ability to rapidly trade in excess electricity in the short term. Interconnection allows long term contracts to be negotiated. The industry, however, does not maintain a reserve of transmission capability to allow for wheeling large blocks of power during protracted periods of drought. Local power pools and regional power councils

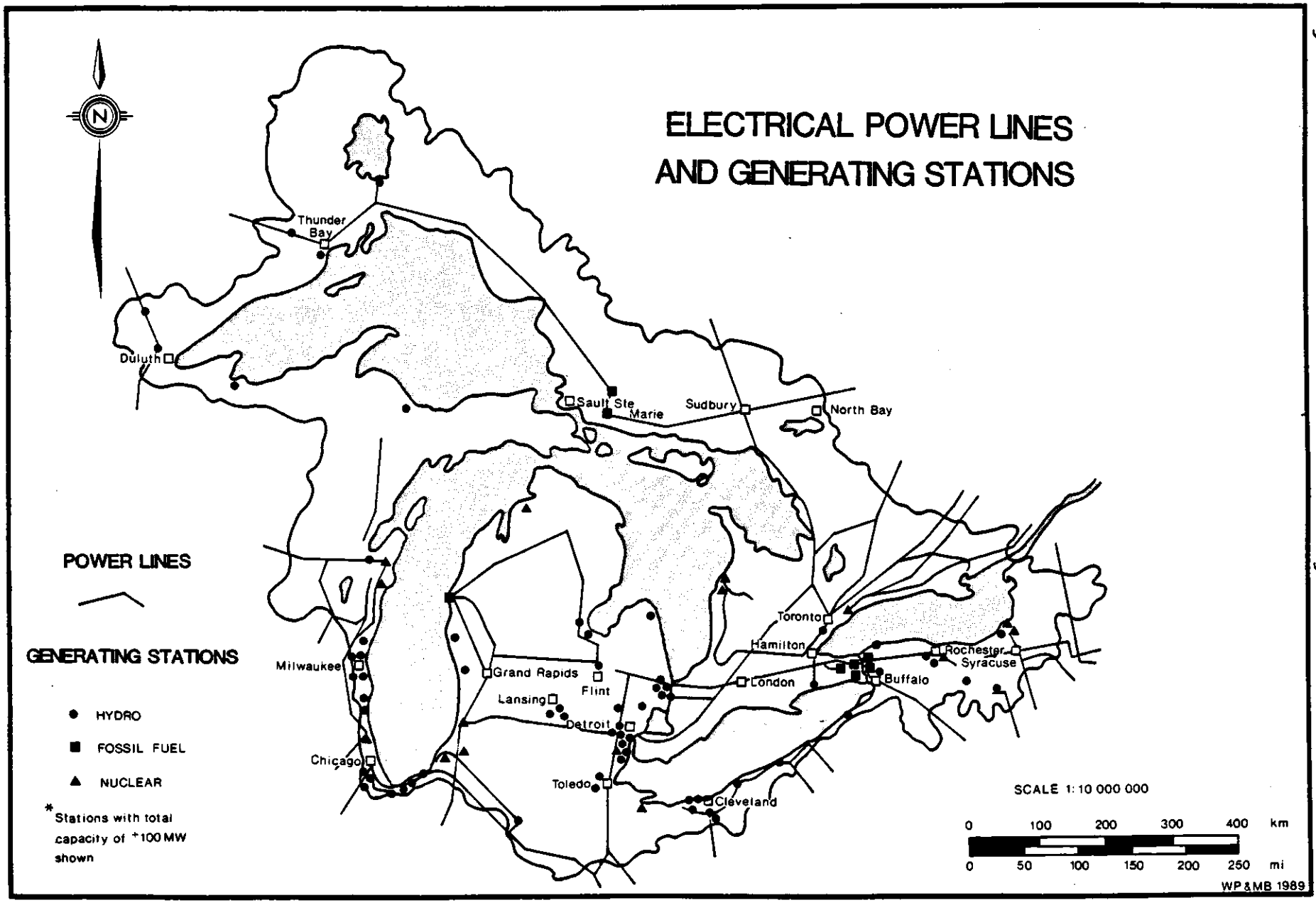


Figure C-7-2: Electrical Power Lines and Generating Stations

Source: U.S. Environmental Protection Agency and Environment Canada, 1988. The Great Lakes: An Environmental Resource Book. ISBN 0-662-15189-5

coordinate the transfer of electricity and prepare forecasts of energy needs in order to ensure reliability of the electric supply. Thus, the various reliability councils and power pools are also part of the electric power interest.

The North American Electric Reliability Council (NERC) is a coordinating body that was formed to promote reliability of electric supply, and it consists of virtually all of the power systems in the United States and Canada. NERC is divided into 9 regional reliability councils (and 1 affiliate). Four of these councils border on the Great Lakes [East Central Area Reliability Council (ECAR), Northeast Power Coordinating Council (NPCC), Mid-America Interconnected Network (MAIN), Mid-Continent Area Power Pool (MAPP)]. These four councils also encompass a large area outside the Great Lakes Basin. ECAR and the NPCC account, respectively, for 33% and 39% of the power production within the four councils bordering the Great Lakes. The New York Power Pool (NYPP) is one power pool in the basin and is made up of 8 utilities that supply 99% of the electric energy needs in New York State. This also represents 27% of the NPCC capacity.

Approximately 94,400 Mw of power is generated by plants located in counties bordering the Great Lakes. This represents 33% of the total power produced within the four regional reliability councils that border on the Great Lakes. The hydropower plants that directly use the levels and flows of the Great Lakes and connecting channels are, for the most part, located along the Niagara River (total capacity 4,500 Mw), in the St. Mary's River at Sault Ste. Marie (total capacity 101 Mw) and on the St. Lawrence River (total capacity 2,720 Mw). Collectively, these hydropower facilities represent 8% of the capacity in the counties bordering the Great Lakes and 3% of the power produced within the four regional reliability councils that border the Great Lakes. In addition, there are numerous small hydropower plants located on tributaries to the Great Lakes. The output from all hydropower plants in the lake counties is 22% of the total capacity in the lake counties and 7% of the total capacity within the four regional reliability councils that border on the Great Lakes.

Other subclasses of the power interest include electric power customers, other electric power utilities within and outside of the basin who conduct business with the directly affected firms by way of power sharing through interconnection, and shareholders of the generating firms. To the extent that governments are concerned with the supply of electrical power, they are part of this interest group. For example, public utilities such as Ontario Hydro, the New York Power Authority and Hydro Quebec are directly accountable to governments. Governments also set rate structures and environmental standards. In general, the concerns of these subclasses coincide with the concerns of the basin's generating firms. For example, in the long run, an increase in the generation cost for basin firms can reduce profit levels to shareholders and can lead to higher prices for consumers and for other electric utilities. Regulating authorities set the rate base by taking account of the long term production costs, which include capital costs and expected variations in operating costs of the system. These expected operating costs account for expected fluctuations in water levels and flows.

The primary interest, generating firms with plants in the basin, is concerned about both high and low extremes in lake levels if these extremes affect the capability and profitability of operation. Generating firms make investments in productive capacity based upon the electricity demand expected to prevail in the investment period, and upon their ability to meet that demand. Additionally, firms consider trade made possible by long term contracts through interconnections. As such, the decision to construct and operate a plant within the firm's service area requires an understanding of the present and future operating environment, both physical and otherwise. For plants depending on the Great Lakes, the probability of events associated with different physical processes (storms, erosion and fluctuating lake levels) is incorporated into the investment decision. The understanding of these processes has grown over time with technological improvements in methods of evaluation. Due to these improvements, many of the projects designed in earlier years would be designed differently today. Despite the improved understanding, there remains a considerable level of uncertainty regarding physical processes and their associated probabilities.

Individual electric power facilities potentially can be impacted by fluctuating water levels in various ways. During high water periods, thermal power facilities could experience greater generating efficiency due to lower temperatures of cooling water, and pumping and transportation costs of raw materials could also be reduced. Hydropower outputs in general can be increased with increasing levels and flows, although there is a threshold of extreme highs above which extra flow cannot be utilized due to physical limitations of equipment and/or hydraulic limitations. Extreme high levels, or average levels with more extreme fluctuations, can cause flooding of some facilities while at some hydro plants high tailwater levels can reduce the maximum generating capacity.

Low levels may present a more difficult investment problem. If levels decline, hydro generating capacity is reduced and the shortfall in production must be made up from other sources with higher associated costs, whether these sources are owned by the affected firm or by other interconnected firms. In the past, the alternative source has been fuel fired thermal energy. Yet, thermal power plants may also be adversely affected by low levels. Some of these plants rely on lake transportation services for obtaining fuels. The cost of fuel delivery might rise if shipping capacity is reduced and if more dredging is required. Thermal power generating processes face additional complications. Thermal power stations use the lakes and tributaries as a source of cooling water. Under low levels the water temperature of the lakes and connecting channels may be higher. This can affect output capacity in two ways. First, the efficiency of generating equipment is reduced if cooling water temperatures are above a critical level. Secondly, the temperature of the cooling water discharged back into the water bodies is subject to regulation. Plant output capacity must be reduced if the temperature of the discharged water exceeds the level set by the government. There is a greater chance of this occurring if the intake water temperatures are warmer. Extreme low level problems are compounded when low levels are caused by widespread drought. Drought affecting large areas may cause an increased demand for electricity putting greater pressure on hydro and thermal facilities alike.

Indications of the possible implications of drought conditions were observed during the summer of 1988 when levels fell from previous highs to levels near average; this coincided with a drought. The New York Power Pool (NYPP) and Ontario Hydro experienced record breaking load demands for a short period of time. Hydropower production was less than in previous years because of lower levels and flows on the Great Lakes and tributaries. As a result, Ontario Hydro resorted to public appeals to reduce power demand. The New England Power Pool request for power from the NYPP was denied because of the need to meet demands in New York State. New England utilities instituted voltage reductions to avoid total power outages. Utilities outside the Great Lakes basin were also affected. For example, a Public Service Co. of Indiana coal-fired plant that is located on a tributary just outside the basin had to temporarily shut down operations due to a lack of cooling water. These previous examples were isolated incidents, but they reflect what can happen during periods of drought.

In essence, the electric power interests have designed their systems using the hydrologic information and evaluation techniques available at the time to operate over a fairly broad range of levels and flows. The designs have also been developed, in cooperation with government regulating agencies, to take into account tradeoffs between costs, benefits, risk and uncertainty.

Positions

Within the past few years, the interest has experienced few negative impacts from the fluctuating levels. As levels recede toward long term average, there has been a reduction in hydropower output and an increase in alternative fuel use. The interest expects that it will experience negative consequences if serious drought occurs in the future.

This interest wants to be informed, as early as possible of any measures that might be undertaken by governments. The interest believes this is necessary to evaluate and react to effects of measures upon their operating environment. The willingness of this interest to share costs for any measure will depend on, among other factors, the measure, its associated costs and how those costs would be shared among all interests affected. They are interested in measures which would enhance their ability to provide power during drought periods, such as a modification of the 1950 treaty to allow for temporarily reducing the flow over Niagara Falls. This could help alleviate the effects of drought in the eastern portion of the basin.

The interest feels that structural measures to regulate levels would do little to ameliorate the adverse consequences associated with droughts. The interest does not promote the maintenance of above average levels via Type 1 measures but would rather see limited fluctuations in flows on the connecting channels to increase the amount of firm power for which they can contract. However, they realize that this plan is unacceptable to other interests as controls to even out channel flows would cause even greater fluctuations in lake levels.

Discussion

Power generating firms, in cooperation with governments, develop to the greatest extent possible an understanding of their present and future operating environment prior to investing in generation capacity. Firms and governments acquire historical data regarding levels, flows and storm events and they employ qualified professional personnel to review the relevant physical processes. The concerns of these firms and those of governments are closely connected due to the rate regulatory process and to government concerns regarding electricity supply. The firms' understanding of their operating environment is incorporated into their investment decisions, including some knowledge of the low probability of levels outside the design range (which is the levels or flows that are exceeded 95% of the time). Because of this high degree of understanding, relative to other interests, this interest experiences little surprise with respect to levels and flows.

This interest appears to be quite resilient to fluctuating levels (at least within the design range). It was noted earlier that the hydropower plants on the connecting channels and on the St.Lawrence River make up less than 3% (about 7,300 Mw) of the electricity generated in the four reliability councils bordering the Great Lakes. Fluctuating levels threaten only a small portion of plant capacity. The plants within the affected firms are interconnected and the firms have inter-ties which allow demand to be met by electricity from a variety of sources which can be changed as demand and production dictate. Thus, generally, the loss of a small amount of generating capacity can be made up relatively easily. However, under extreme and widespread drought the generating capacity throughout the basin can be adversely affected; excesses available for short term "wheeling" would not be available.

Environmental, social and economic consequences are expected when levels and flows fall below the design range. Utilities have not designed for this likelihood because it is not economically feasible to do so. Utilities, generally, do not have drought contingency plans and assume that power can be obtained elsewhere in the event of a drought. However, other interconnected utilities may be experiencing difficulties meeting their own demands and may not have extra power to sell. The amount of power that can be transmitted between systems is also limited, due to system conditions and transmission line capacity. For example, transmission capability from ECAR to the NPCC during the summer represents only 1.8% of the total NPCC production and this may not provide enough make-up power when levels and flows fall below design levels. Furthermore, any increase in thermal power generation due to a decrease in installed hydropower output results in negative impacts on the environment. For example, the environment could be negatively affected due to: increased emissions of "greenhouse" gases (NOx, COx, SOx) and other atmospheric pollutants (e.g. selenium), thermal pollution from cooling water discharge, and the increased need to dispose of solid wastes such as flyash and spent nuclear fuel. Moreover, the cost of makeup power can be several times greater than the cost of the lost hydropower generation.

In summary, within a range of fluctuations around the long term average, the interests can reliably generate electric power to meet current demands with attendant environmental, social and economic impacts. However, in the event

of low levels, such as those observed in the 1930's and 1960's, pronounced social and economic impacts such as brownouts and blackouts could be experienced. Any increase in thermal power production due to a decrease in installed hydropower output can have a negative impact on the environment.

Although the interest appears to have adapted its operations to the physical regime of the lakes, the extreme level events of 1985-6 and 1988 lead to questions about the predictability of future levels and flows. The future environment of the interest will be affected by many factors which include changing environmental regulation, demand changes, changes in supply, changes in the lake level regime, and the possible effects of climate change upon these variables and other variables affecting firm operations. Some changes may require more capacity and others, less.

7.5 TRANSPORTATION

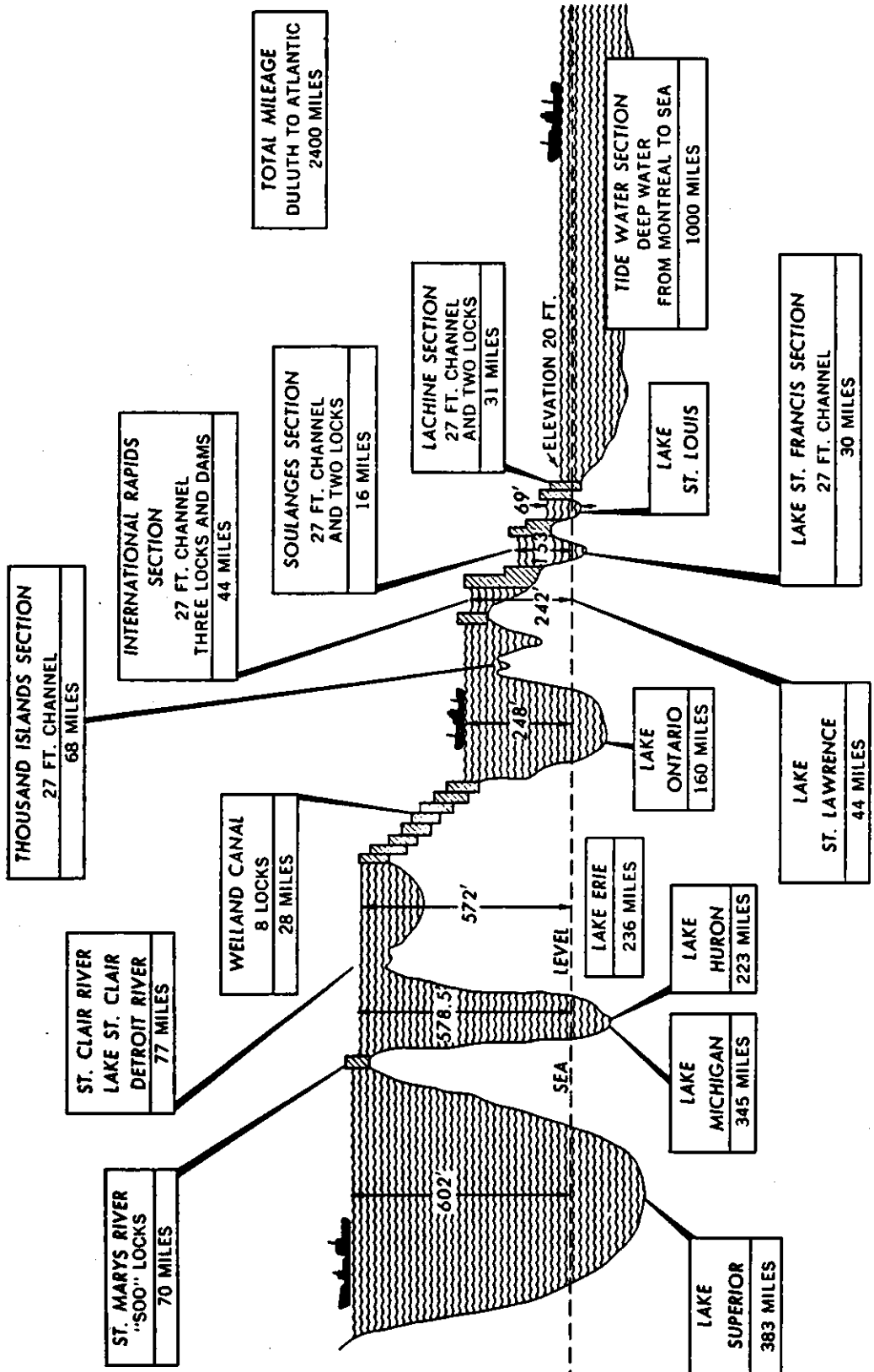
Introduction

The five Great Lakes, the interconnecting channels and the St. Lawrence River form a navigable waterway which runs deep into the North American continent. While a large portion of this transportation system is comprised of open water, the connecting channels and man-made locks and canals often limit the exploitation of naturally deep lakes and harbours. Maintenance of this infrastructure of canals, locks and harbours requires extensive effort to prevent and repair damage caused by the natural forces of the lakes: storms, erosion, silt deposition and ice buildup. Ongoing dredging, particularly in harbours, is required to counteract silt deposition. The standard design depth of the connecting channels and locks varies from site to site. Design depths available within the connecting channels were developed to accommodate seaway-size vessels which enter the Great Lakes at Montreal, and upper lake vessels which can move from the head of the lakes (western Lake Superior) to the Gulf of St. Lawrence. In most cases, low water drafts of 25.5 feet in the upper lakes channels (Superior and Michigan-Huron) and 26.0 feet (plus 1 foot clearance) in the lower lakes channels (Erie and Ontario) are available for maritime users. Figure C-7-3 illustrates a profile of the Great Lakes - St. Lawrence Navigation System.

The transportation interest class is comprised of several subgroups including vessel operators, shippers/receivers, port associations and shipyards. Federal governments also have an interest in the navigation on the lakes. Government agencies play a major role in dredging channels, maintaining the seaway system infrastructure, and setting the operating rules and regulations, pilotage requirements and toll schedules. The lock operating agency publishes the "Seaway Handbook" which contains the rules and regulations; it is updated annually and distributed to interests. To the extent that other industries (trucking, rail) provide services that are sometimes substitutes and sometimes complements to Great Lakes shipping, they are subgroups of the interest class.

Vessel operators can be affected by water level fluctuations in several ways. Low levels may require the light loading of vessels to avoid grounding. Alternatively, more dredging may be required to allow access to channels and

Figure C-7-3: Profile of Great Lakes - St. Lawrence Navigation System



PROFILE OF GREAT LAKES–ST. LAWRENCE NAVIGATION SYSTEM

harbours. High levels can allow heavier loading than normal in cases where the vessels are not restricted by lock, channel and harbour depths. However, at high levels ships may have to reduce speed in narrow channels to prevent wake damage to shoreline property and to reduce the risk of accidents. Port associations, shipyards, railroads and shipper/receivers are concerned with potential infrastructure damage. High levels combined with storms can cause flooding leading to damage of docks and other structures. Low levels can lead to rotting of exposed piers and the need for additional dredging, while both high and low levels can result in increased difficulty in the loading and unloading of vessels.

Positions

The positions summarized below were obtained from a survey of individual members of the interest class representing vessel operators, dock terminals, railroads, port associations and ship yards. By far the strongest statement made by the interests, and most consistent among the respondents, is a demand for accelerated dredging to maintain harbours and channels at federally specified depths. This demand is in response to the decline in water levels since 1986. Various representatives describe negative impacts to their business activity arising from level fluctuations, but overwhelmingly, the interest indicates a recognition that these fluctuations are an inherent part of their operating environment. Furthermore, the interest feels fluctuating levels play much less of a role in their business decisions than do general economic conditions. This view is held almost unanimously by those contacted.

There is a widely held conviction within the transportation interest group that management of lake levels is not feasible and that interests should learn to adapt to the lakes environment. There is cautious support for "looking into" the feasibility of some measures although the interest stresses that any measures must be shown to be cost effective. There is no particular measure which draws large or concentrated support. However, Type 1 measures receive particularly little support and are often perceived as less preferred than no action. A statement by George Ryan, President of the Lake Carriers' Association (LCA), at a hearing before the House Budget Committee Task Force on Community and Natural Resources, summarizes this position:

> "it's Nature that primarily controls lake levels and can most effectively undo her aberrations. LCA believes the best course of action, based on what we now know, is to adapt to current water level conditions. Being realists, we accept the fact that lower water levels mean less cargo moves each trip. Conversely, we capitalized on 1986's higher water levels and carried more cargo per trip. Future studies may well prove that some minor structural modifications can slightly correct some imbalances in the system, but absolute control of the Lakes is improbable even with massive expenditures."

Although this interest appears to be prepared to accommodate the vagaries of the lake levels, there is strong opposition to increasing diversions at Chicago. There is a feeling that such an action would set a precedent that would be difficult to reverse, with potentially negative consequences for transportation conditions in the Basin.

Discussion

The interest does not appear to be surprised by the range over which the lake levels can fluctuate but does exhibit some surprise at the speed with which levels fell between 1986 and 1988. This surprise is manifested in their desire for accelerated federal dredging activity to keep pace with the rapidly declining levels. Federal agencies on both sides of the border are responsible for dredging to maintain channels and harbours at a specified depth. However, federal agencies are not responsible for all harbour dredging. Dredging of the harbour area closest to the dock face is the responsibility of harbour authorities. This is analogous to using public funds to construct and maintain streets, leaving construction of driveways to individual residences.

All dredging depths are related to a reference water plane called the Low Water Datum (LWD). The LWD planes of reference for the Great Lakes, the planes to which navigation improvement depths and Great Lakes navigation chart depths are referred, has been selected by the U.S. and Canada so that the majority of the time during the navigation season the actual levels will be above that plane. All members of the interest have a knowledge of the depths which the federal authorities attempt to maintain. Dredging provides maritime interests with a specific channel depth to use during the short term. Typically, this depth degrades over the navigation season due to natural sedimentation, littoral drift and lake storms. Often, the activity of the ships themselves will cause turbulence and resuspension of bottom sediments. Immediately after dredging, vessel operators can load vessels to the maximum physical limit. Further gains can be achieved if water levels are above the low water reference plane. However, if levels are at or near the low water reference plane, the channel depths may still permit use beyond design depths since additional clearances may exist. In dredging to satisfy a particular depth requirement the federal authorities dredge beyond that depth for two reasons: so that the same area need not be dredged as often and to allow a risk margin. In some major harbours dredging is carried out twice a year and, in others, once a year. In harbours of minor importance dredging is carried out less often.

It is difficult to determine without more information, whether the federal authorities have not provided dredging services as expected. The interest experienced extremely high levels in 1985-6 followed by a rapid decrease in levels. The abruptness of this change may have contributed to the demand for authorized depths. Another potential source for this perception may be any difference in the depths maintained by the federal and the port authorities. Possibly, the stated concern for dredging could be no more than a reiteration of the interests' expectation of the federal authorities. Under extreme low level conditions port authorities responsible for harbour dredging may petition governments as they experience the increased costs of accelerated dredging required to maintain harbour depths.

Generally, the transportation interest is reasonably well informed about levels and fluctuations and about government policies, and has adapted to the prevailing conditions. The interest perceives that there are serious limits to feasible regulation of the lakes, and does not lobby for Type 1 measures.

It is rather indifferent to measures of Types 2, 3 and 4, but pushes for actions, such as dredging, to which it believes it is already entitled.

7.6 COMMERCIAL AND INDUSTRIAL

Introduction

Commercial and industrial interests are those whose activities are tied to a fixed location along the shoreline and whose net income position is potentially affected by fluctuating lake levels and measures taken to address such fluctuations. These interests are comprised of a number of businesses that are often represented by specialized trade organizations and, because of the diversity of activities and geographic dispersion, are not uniformly affected by lake level fluctuations.

This class of interest includes all commercial and industrial businesses that are based on the Great Lake - St. Lawrence shoreline. Although there are many different lake and river front businesses which use the lakes in a variety of ways, they may be classified into two broad sub-interest classes: 1) industries, and 2) commercial businesses. Each, in turn, can be further categorized based upon type of activity and sensitivity to fluctuating lake levels.

o Industrial Interests

Industrial interests use the Great Lakes services directly as an input into a production process (e.g. water supply, waste disposal) and indirectly for movement of production inputs and final products. The most significant industrial subgroups are grain elevators, pulp and paper processing, iron and steel production, petroleum and chemical refining, metal mining and refining, food processing, and metal fabrication, casting and plating. In Canada, the greatest concentration of industries is found in south central Ontario, along the shorelines of Lakes Ontario and Erie, and along the St. Lawrence River at Montreal, Quebec. The manufacturing sector in the U.S. is concentrated along the southern shores of Lake Michigan and Huron, as well as along Lakes Erie and Ontario. (Figure C-7-4 illustrates the major production centres around the Lakes and the commodities produced.)

Like other shoreline interests members of the industrial sub-interest class have been impacted by fluctuating water levels. Many industries have been negatively impacted by both extreme high and low water levels and by shoreline processes. The most severe negative impacts tended to be increased erosion of exposed property and flooding of some structures during storm activities. In a study on Lake Superior, Stewart (1988) found that of all the industries identified, a number of grain elevators in Thunder Bay were the most severely affected. Problems included flooding of grain receiving pits and severe erosion of exposed property. Problems for other industries have included drainage and sewer problems, and damage and resulting repairs to dock space. Some industries such as grain, pulp and paper, and iron and steel have benefitted from the higher water in that it has reduced their transportation costs by allowing them to load more cargo on ships. Higher water levels have

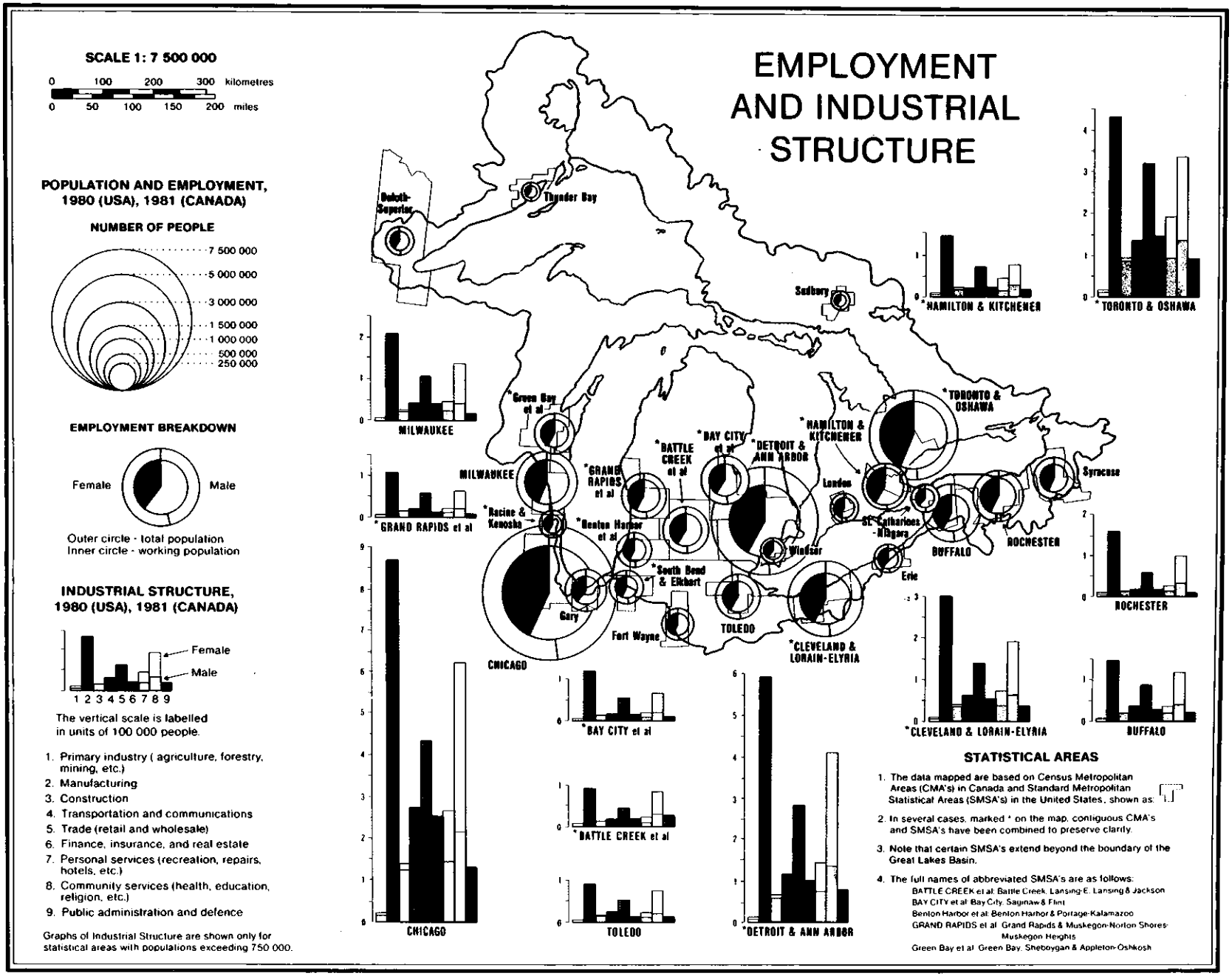


Figure C-7-4: Employment and Industrial Structure

Source: U.S. Environmental Protection Agency and Environment Canada, 1988. The Great Lakes: An Environmental Resource Book. ISBN 0-662-15189-5

also allowed for reduced pumping costs, less dredging, and ample volumes of water for intake purposes. Vessel groundings were also reduced during higher water periods.

When water levels dropped, some industries experienced negative impacts. The low water levels in 1964 and the drop in water levels that occurred in 1988 caused problems with loading and unloading, and with channel and dock access. Water pumping costs also increased slightly as water levels dropped due to loss of hydraulic head. Other impacts included dry rot of wooden piles exposed to air for extended periods, and increased dredging and transportation costs.

To minimize their risk of damages and financial losses due to fluctuating water levels, many industries have taken steps to adjust to water level changes. These include the building of shore protection structures, the installation of floating docks, the floodproofing and renovation of certain structures and the installation of pumps to control flood water. In addition, as a means of coping with the extreme low water levels of 1964, most major industries extended their water intakes. Consequently, these pipes are now well out into the lake and it would take a major drop in levels to expose them.

o **Commercial Businesses**

Commercial interests are distinguished from industrial in that they do not directly use lake services, but rather they sell access to the lakes and provide services to lake users. The most important tourism and recreation related commercial businesses in the Basin are i) marinas, ii) tour boat companies, and iii) hotels, motels and resorts. Marina business development occurred in response to the strong demand for recreational boating and sports fishing. Hotels, motels and resorts rely on the seasonal income generated by tourists, who utilize the Lakes and St. Lawrence River for a variety of reasons including boating, fishing, sightseeing, or simply taking in the scenic beauty. Other commercial operations include tour boat companies, bait shops, equipment rental stores, trailer parks, concession stands and restaurants.

Commercial interests have been affected by fluctuating water levels and associated processes. High water levels combined with storm activity have caused severe structural damage to some marinas. Some resorts have lost their beach resource and suffered damage to waterfront structures (Stewart, 1988). Small towns that rely on wide, sandy beaches to bring in the tourist trade, have suffered losses, as beaches became submerged under higher levels. However, at the same time, there are a number of commercial businesses that are largely unaffected, or in fact benefit from higher water levels. Some Marina operators offset a fraction of their damage costs by docking larger, deeper draft boats (Cadham, 1988), which have more expensive berthing fees. They have also saved money in dredging costs, as higher levels allow for easy access by boaters. Higher water also allows some tour boat companies in the St. Lawrence River to access smaller and more scenic channels.

Some of the most severe negative impacts have been incurred by marina operators and touring boat companies when water levels drop. Extreme low levels of 1964 and the significant drop in levels over the past two-and-a-half years has greatly reduced the ease of ingress/egress of boats from some marinas. Dredging costs and permit approval problems increased as owners had to dredge their channels to allow for deep draft boats. In 1964 some docks and marinas had to cease operations, as water levels were just too low to allow for safe and proper usage (International Great Lakes Levels Board, 1973). In 1988, some marinas had to restrict their use to smaller and shallower draft boats (Cadham, 1988), thereby reducing the income received in dockage fees. Some touring companies in the St. Lawrence also had navigation problems and channel and dock access problems in 1988.

Like the industrial interests, some commercial businesses have taken steps to protect their investments. Some businesses have adapted by installing floating docks, and/or building ad-hoc shore protection structures. Others however do not have the financial resources to cope well with extreme water level fluctuations. Some tour boat operators on the St. Lawrence River have had to cease operations when water levels dropped in 1988 because they were no longer able to access the shoreline. Many marina operators are affected by the shorter boating season they are now experiencing, as tourists and boaters have left their areas earlier, causing a significant drop in the September and October income of these businesses. During the recent drop in water levels, many marina operators have also been faced with the marketing expense of attracting new customers. These marina operators have lost customers who have relocated when lower water levels restricted their movements in and out of marinas.

Positions

Although industrial interests are negatively impacted by extreme water level conditions (both high and low), the general consensus is that lower water levels are more harmful to their interests than higher water levels. Most industrial interests prefer water levels to be relatively high, as they have been in the past 10-15 years, because costs of operation are reduced. Some industrial interests have commented that their costs of transporting goods, costs of dredging costs of harbours and docking areas, and costs of water intake and pumping are reduced during higher water level periods. Industrial interests perceive that if levels approach the extreme lows of 1964 or lower, they will suffer severe financial losses as these costs increase. Likewise, if levels reach the extreme highs of 1985-1986, flooding and erosion damages may exceed the benefits of higher levels.

The positions of commercial interests vary with respect to fluctuating water levels. For commercial businesses, such as campgrounds, concession stands, water sport rental businesses and a number of resorts, net income is linked to shoreline amenities; specifically beach, the loss of which is perceived by this interest to have a negative effect. Since a beach can be lost with higher water levels, and since many of the buildings of these businesses are located on the beach, the major concern of this interest is the negative effect of high water and storm activity.

Other commercial businesses, like the industrial interests, perceive lower water levels to be most harmful to their interest. Some marina operators, charter boat companies, tour boats, resorts and hotels, and other businesses related to boating, perceive lower lake levels to be more damaging because of increased haul out problems and other low water impacts. Even though these interests have experienced infrastructure damages when storms coincide with high water levels, they still perceive higher levels to be more beneficial. As some marina operators have commented, they have been able to offset the infrastructure damage costs from storm activities by docking larger, deeper draft boats during higher water periods. These larger boats have more expensive docking fees. Tour boat operators have said that they too prefer water levels to be higher because they are able to extend their season and access smaller and more scenic channels.

Finally, there is a group of commercial interests who are most concerned with the abrupt changes in lake levels that they have experienced in recent years. Some marina operators, for example, have said that they had just spent several thousand dollars to protect their investments from high water levels, only to now be absorbing the costs of dredging channels in order to cope with the lower water levels. They say that there has been too drastic a change and that they have had no time for recovery.

As a consequence of the perception that extreme water levels, particularly low levels, are more harmful to their interests, many industrial businesses want lake levels to be controlled. They feel that regulation is the only means of preventing low water impacts. Likewise, commercial businesses support regulation because they perceive it as the only measure which will alleviate the impacts they incur. Water level regulation, they feel, would allow better predictions of water levels to take place, and allow them more time to adjust to any changes. Many marina operators, (those represented by the Ontario Marina Operators Association, for example), are in fact members of the International Great Lakes Coalition, and actively lobby governments for regulation of all lakes.

Similar to the riparian interest class, there are geographic variations in support for regulation. Interests located on the middle lakes are in favour of regulation, while those located on the St. Lawrence and connecting channels, do not support regulation. Commercial and industrial interests along the St. Lawrence feel that there are a lack of measures dealing with low water levels, and that most measures are designed for lakes, not rivers. Consequently, this portion of the interest class believes that most measures do not really relate to them, but they oppose measures which would exacerbate the problems they face.

Many of the commercial and industrial interests in the Basin and along the St. Lawrence are dissatisfied with current predictive capabilities as far as water level changes are concerned. Some interests quoted the recent drop in water levels as an obvious example: if they had known levels would drop so much, they could have taken steps to deal with the drop. Those who favour regulation perceive that the degree of predictability can be improved because by regulating the lakes, the variation in water levels will be reduced. Many of the interests are frustrated with inaccurate data and admit that it has led

them to be extremely suspicious of government officials. As a recent example, there was a great deal of confusion and uncertainty about the recent drop in water levels, after many experts had "predicted" it would take a number of years for levels to return to average.

Discussion

For the most part, commercial and industrial interests make informed investment decisions for locating on the shoreline. These decisions include an expectation of a certain range of water levels, which leads to a number of related costs that the interests can expect (e.g. shore protection, dredging, floodproofing, etc.). When levels exceed the expected range, the interest is surprised. For example, commercial and industrial interests suffered damages when levels reached the unexpected highs of 1985-1986, and especially when severe storms also occurred in this period. This was a surprise to many of these interests because the water levels and storm events that occurred had not been experienced before.

While all commercial and industrial interests have been surprised by water level fluctuations, the key difference between the two sub-classes is their resiliency. It is evident that, due to their large capital investment in shoreline location, most of the industrial interest groups have adapted to fluctuating water levels. Recognizing the inherent risk of damage due to their location they take the necessary steps to protect their investment. While this has led to increased costs (for shore protection, shutdown time, increased pumping costs, damage, etc.) and some inconvenience to a few businesses, such expenses have been viewed by most interests as a lake related cost, which is still outweighed by their location benefits. While some industrial interests may dispute this and state that high water levels and storm activity have been devastating, the incidence of major damage to industrial properties during 1985-1986 was limited to a select few businesses and was not a basin wide problem. This was somewhat reflected by two factors: 1) low attendance at the group depth interviews held by Functional Group 3 (see Walsh and Wiedman, 1988); and 2) the fact that if the interest groups had not been contacted in connection with the Study, it is likely that they would not have contacted governments about problems related to water level fluctuations.

Many commercial interests are able to adapt to fluctuating water levels in much the same way as industrial interests. Like the industrial interests, these individuals have not petitioned governments, and deal on their own with implications of fluctuating water levels. However, some commercial interests, particularly smaller businesses, are not resilient to the lakes environments, and have petitioned governments to address their concerns. Many of these businesses have been established and made investments during the high water level period since the late 1960's, and may have been unaware that long term average levels were actually much lower. In addition, due to their smaller sizes, these businesses may not be financially capable of adapting to changes in water levels.

Whether they are resilient to water level changes or not, a common consensus among most commercial and industrial interests is their preference for water

level regulation. Both commercial and industrial interests support regulation because they perceive it to be one of the only measures that would alleviate the negative impacts they incur as a result of fluctuating water levels. Some businesses, especially small commercial businesses such as marina operators, which are not resilient to fluctuating water levels see water level regulation as a means of increasing their resiliency. Most commercial and industrial interests, however, are resilient to water level fluctuations, and apparently perceive regulation as a way of either enhancing their benefits or as a means of shifting their costs of doing business on to other interests. It is unclear as to which is the case, since it is not known who members of the commercial and industrial interests feel should pay the costs of implementing and maintaining regulation.

7.7 RECREATION

Introduction

Recreation is increasingly becoming an important social and economic activity in the Great Lakes Basin, as more and more people have greater amounts of leisure time. Millions of people, both within and outside the Basin, use the Great Lakes and the shoreline for a variety of recreational purposes. Some of the major activities include boating, sports fishing, hunting, bird watching, camping, swimming, windsurfing, hiking, picnicking and scenic drives along the shoreline (See Figure C-7-5).

Within the Great Lakes Basin, an extensive network of both private and public facilities exist along the shoreline to meet the needs of the recreational population. Private facilities including marinas, sports fitters, resorts, hotels and motels, are located throughout the Basin. Furthermore, all levels of government in both Canada and the United States have acquired extensive systems of parks, wilderness areas, and conservation areas, most of which are situated directly on Great Lakes - St. Lawrence River shorelines.

The implications of fluctuating water levels for private and public facilities are discussed in other sections of the report (Commercial and Industrial and the Government Infrastructure Sections). This section deals strictly with the implications of fluctuating water levels and measures for non land-owning recreational users. The interest group includes individuals, some of whom are represented by specialized associations, who use the lakes and shoreline for recreational activities, but do not own shoreline property. Recreationists depend on the services around the lake (e.g. public beaches, wetlands, marinas and other boating facilities) to serve their interests.

The implications of fluctuating lake levels for recreationists vary depending on the activity in which an individual is engaged. In this discussion, recreationists are grouped according to activities that use the lake resources in similar ways and have similar sensitivities to lake levels. Four categories of recreationists have been identified:

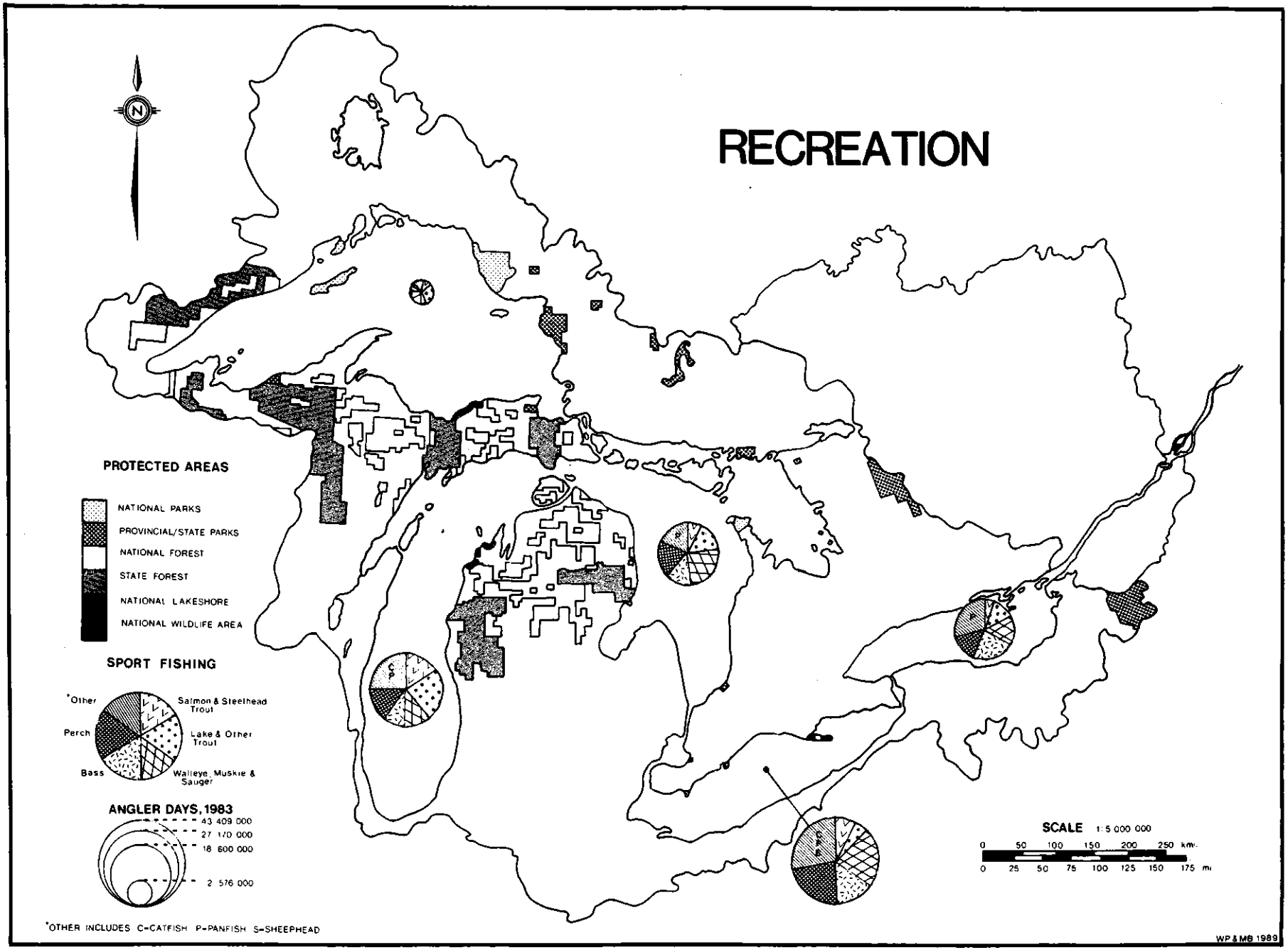


Figure C-7-5: Recreation

Source: U.S. Environmental Protection Agency and Environment Canada, 1988. The Great Lakes: An Environmental Resource Book. ISBN 0-662-15189-5

- **Swimmers and related beach uses**

Swimming and related beach use is one of the leading water-dependent recreational activities in the Great Lakes Basin. These recreationists are impacted when water level changes affect the amount of shoreline available for their use. During higher water periods some beach area may be temporarily reduced, whereas when water levels decrease recreational areas expand.

- **Boaters**

Boating on the Great Lakes and St. Lawrence River has increased dramatically in recent years, and in terms of economic impacts, is the most important recreational activity in the Basin. The major boating sub-classes are power boating (and water skiing), boat fishing, sailing, and smaller boating activities, such as canoeing and kayaking. Boaters are the most organized recreational group, and are often organized into clubs and associations.

When water levels are high, as they have been since the late 1960's and particularly in 1985-1986, boating generally is safer, and there are more boating areas available. Problems associated with these high levels tend to amount only to minor inconveniences, such as impeded access to docks and launch ramps, and insufficient clearance under bridges.

Lower water levels, on the other hand, have had many negative impacts on boating activities. When water levels dropped in 1988, some boaters, particularly those with larger boats, experienced problems with dock and berth access, and insufficient depth in channels to allow boats to get from marinas to open waters. Larger boats also could not access shallower bays and channels. This leads to congestion problems in deeper areas. In low water areas boaters sometimes ran aground, and in some cases hull and propeller damages to their crafts resulted. Occasionally boaters indicated that they had switched to boats with shallower drafts and were thereby coping with lower water levels.

- **Waterfowl Hunters, Anglers and Bird Watchers (Habitat Dependent)**

Recreational activities, such as hunting, sports fishing, and bird watching are habitat dependent. This means that if changes in fish or waterfowl resources occur, these related activities may also be affected. From a system perspective, fluctuating water levels are needed for the sustainability of wetlands, which are used as breeding and nesting areas by fish and waterfowl. During periods of extremely high or extremely low water levels some wetland areas along the Great Lakes - St. Lawrence shoreline may be temporally lost, making them unavailable for habitat dependent activities. When water levels dropped in 1988, some wetland habitats dried up (the marshes in the Detroit area, for example), resulting in fewer bird and fish species for recreationists to fish, hunt and observe.

- **Hikers and other nature enthusiasts:**

  This category largely represents the multi-purpose shoreline activities engaged in by nature enthusiasts, including hiking, camping, viewing the water, and taking scenic drives along the shoreline.

  The impacts of fluctuating water levels on nature enthusiasts are minimal. Fluctuating water levels may affect hiking if they limit the ability of hikers to use shoreline trails. Campgrounds, picnic areas, and roads for coastal driving have also been damaged when storm activities have coincided with high water levels. However, in most cases, these activities are sufficiently above high water levels that flooding is rarely a problem. In some instances, the aesthetic experiences of these activities could be affected if rising water levels result in substantial damage to shore properties and structures.

Positions

Given the diversity and extent of recreationists using the Great Lake - St. Lawrence System, it is difficult to precisely identify the positions of this interest group. Perceptions and positions tend to vary with activity and location. For example, many boaters feel that lower water levels are more harmful to their interest than higher water levels, and some feel that regulation of the lakes is an overall solution to their problems. Hikers and nature enthusiasts as well as some hunters and anglers, on the other hand, tend to accept fluctuating lake levels as being a natural process and are not in support of large scale structural measures, such as regulation. They understand that fluctuations are needed to produce the marshes that provide habitat for waterfowl and other semiaquatic species. In essence, their positions are the same as those of the environmental interest groups.

The level of concern regarding fluctuating water levels and measures to address them also vary with activity. Some recreationists, such as swimmers and other beach users appear not to be very concerned about fluctuating lake levels, perhaps because their activities can be easily accommodated elsewhere. Evidence suggests that although beaches can be lost due to flooding, shoreline park attendance does not appear to be affected as a result (Cain et al., 1987).

Boaters and boat anglers are the recreationists most concerned with fluctuating lake levels and their impacts on their activities. Consequently, they often hold strong positions with regard to measures. Unlike swimmers and beach users, they feel that higher water levels are most beneficial to their interest, and are much more concerned when water levels drop to levels that they perceive to be harmful to their interest.

Many boaters and boat anglers feel strongly that inadequate consideration is given to their interests by governments. They feel that they are being left out of many government policies and programs which deal with Great Lake water and related land use management. In particular, those along the St. Lawrence River feel they are being ignored or forced to bear the costs of actions to benefit others. Some recreational boaters expressed the belief that

governments exert more control over lake levels than they say they do. Furthermore, they question the experts because some of the data that they have received on lake level forecasts have been contradictory, and have therefore hindered their activities and operations. A strong view among all boaters is the need for more accurate information on water level forecasts. If predictions were more accurate, boaters and marina operators indicated that they would be able to better plan their activities and operations.

The views of recreational boaters vary with respect to measures, but some recurring positions are evident. Many boaters around Georgian Bay, Lake Huron and Lake Erie, for example, strongly favour regulation of the lakes and other Type 1 measures. For instance, the Ontario Marina Operators' Association, a group of marina operators and boaters in Ontario, supports the International Great Lakes Coalition in its call for regulation of all the lakes. Boaters along the St. Lawrence, however, question regulation because it is considered a solution for the "lake problems", and could worsen the problems in the St. Lawrence River. These recreationists feel that they have no say in the setting of water levels, and that they want a representative on the International St. Lawrence River Board of Control. The boaters who support regulation suggest that one agency be set up to oversee all the Great Lakes.

The positions of boaters with respect to Type 2 measures vary, with some feeling that offshore barrier islands and structural flood-proofing are acceptable, while others feel that they create more problems than they solve. However, one common concern among boaters and boat anglers is the frustration with the dredging operations, especially within public channels and around marinas.

Like other interests, recreational boaters are concerned more about measures that will directly benefit their interests. They are in favour of tax abatements and low interest loans to protect their interests, just as shoreline landowners and commercial fish harvesters favour these measures as means of dealing with losses that they have incurred due to water level fluctuations. Recreationists at the group depth interviews suggested that governments focus on ways to find funding for damages incurred by boaters due to water level changes, such as using a percentage of gas taxes to aid boaters.

Discussion

Recreationists, with the exception of boaters, are among the most flexible and resilient of all interest groups. Fluctuating lake levels tend only to amount to inconveniences for swimmers, beachgoers, hunters, bird watchers, and hikers and other nature enthusiasts. This is perhaps because their investments in these recreational activities are generally small and they are easily able to relocate their activities. Hence, they can easily adjust their activities to cope with the consequences of fluctuating lake levels. In many cases, these recreational activities can easily be accommodated at other locations. In general, water quality, the weather, access to the water and proximity of recreational areas are more significant determinants of quality and quantity of most recreational experiences than are fluctuations in water levels.

Boaters, especially those with large boats, have greater investments in their activities than other recreationists. They tend to be the recreational interest group most concerned with fluctuating lake levels. Although some boaters mention that they are able to adapt to water level changes, and that they enjoy the challenge varying water levels pose for their activities, others indicate that they were taken by surprise when water levels dropped quickly in 1988. These boaters found some channels to be less negotiable than they were in past years. As a result, there have been many cases of boaters running aground and sustaining keel and propeller damages. Launching and mooring difficulties have also been experienced.

Many boaters surprised by the sudden drop in water levels in 1988 were upset with governments for not predicting the sudden drop. In fact, some officials suggested that it would likely take several years for the water levels to drop from 1985-1986 highs to average levels. The abrupt drop in water levels was a surprise to governments as well as the public. Much of the boaters' petitioning can be traced to inadequate information at the time of their decision making.

Many of the boaters who were surprised by the drop considered water levels in 1988 levels to be extremely low, when in fact these levels were still slightly above long term average. This suggests that boaters who experienced unexpected problems as a result of the sudden drop, had based their expectations of levels on recent memory when levels were well above long term averages (since 1970). These boaters geared their plans and purchases in anticipation of continually high water levels. This limited information base and the seeming lack of resilience on the part of these interests indicates that the policy themes of informed and responsible decision making have fallen short in practice.

Some boaters and boating associations are in full agreement with the Great Lakes Coalition, in that they strongly support lake level regulation. No information is available on who they feel should pay for regulation or other measures. Consequently, whether their support for regulation is based on benefit enhancement or on a means of shifting their costs to other interests is unclear.

Another strongly held view of boaters and some other recreationists is that inadequate consideration is given to their interests by governments. Water development for purposes of supporting recreational opportunities is explicitly given lower priority than development for other interests in the budget process by both U.S. and Canadian federal governments. However, in response to an increased demand for recreation facilities, both nations have developed a variety of programs and policies which support outdoor recreation in the Great Lakes Basin (See Policies of Government, Section 5).

7.8 COMMERCIAL FISHING

Introduction

The commercial fishing interest class is comprised of all those groups and individuals who have an interest in the commercial fishing industry on the Great Lakes and St. Lawrence River. The main interest sub-class, which is the major topic of this discussion, is the commercial fish harvester who is sometimes represented by non-governmental fishing associations. Other sub-classes of the interest include fish product processing industries, and regulatory and governmental agencies (federal, provincial, state and regional).

Commercial fishing on the Great Lakes began in the mid 1800s and grew into an important region-wide industry late in the century. Since this time fish species and populations have undergone significant changes. These changes have been caused by many factors, including over-fishing of some species, predation by sea lamprey, competition from smelt and alewife, deforestation, siltation and damming of tributaries, draining of coastal marshes, eutrophication, and the introduction of toxic substances.

The effects of fluctuating water levels on fish populations are not known in detail, but are not considered major relative to these other factors. Evidence suggests that, generally, higher water levels increase fish production, while low water levels decrease fish productivity. The greater the increase in levels between January and June, the more beneficial it is for spawning and the higher the success rate for young of the year. Lower water levels, on the other hand, seem to reduce the amount of wetlands available for spawning and nurseries, and thereby decrease fish productivity. However, while sustained high or low levels can affect fish productivity, it is apparent that fluctuations are a positive force to which fish and other aquatic life forms have adapted. Fluctuating water levels are critically important to maintaining the genetic diversity of the fish species in the Lakes and St. Lawrence River. For example, evidence indicates that several species, such as yellow perch, trout, perch, and walleye, have sub-populations that utilize the open lake and estuarine environments for part of their life cycles, and it is believed that these differences in reproductive strategies have a genetic basis that is linked to fluctuating water levels.

In the United States the number of commercial fish harvesters has declined since the turn of the century. This is due to changing economic and regulatory conditions which have made it more difficult for commercial fishing to remain a viable industry. The restrictive regulations imposed on the commercial fishing industry to protect and enhance recreational fishing have also played a role in the decline in the number of U.S. commercial fish harvesters. Today, most of the commercial fishing in the U.S. occurs in Lakes Michigan, Superior and Erie, where the major species harvested are whitefish and alewife, herring and lake trout, and walleye, smelt, and yellow perch, respectively (Botts and Krushelnicki, 1987).

In Canada, participation in the Great Lakes fishery has been declining slowly in recent years, partly as a result of quota introductions. However, overall

commercial fishing remains a viable industry in the Canadian portion of the Great Lakes. Landings have consistently been high (over 60 million pounds annually) in recent years and continue at near record high levels. The Lake Erie harvests represent approximately two-thirds of the Canadian Great Lakes harvests. Major species of value to Canadian Great Lake fisheries include yellow perch, yellow pickerel, smelt, whitefish and lake trout.

Commercial fish harvesters are affected by fluctuating lake levels in much the same way as other boaters. The most common problem they have experienced has been difficulty in navigating in private harbours during low water periods. Private harbours are generally shallower and not as well maintained as public facilities. Water level changes also alter the degree of convenience with which docks can be used.

Commercial fish harvesters are also affected when water level fluctuations affect fishery resources. One way in which fishery resources are affected by water levels is to cause fish to migrate as water temperatures change with water level changes. During low water levels temperatures of the lakes increase, and fish species, such as lake trout which prefer cooler temperatures, migrate to deeper cooler waters. Fish harvesters have noted that water level changes have caused them to change where they fish in the lakes.

Fish processors are affected by changing lake levels, in the same manner as other shoreline based commercial and industrial interests. Dredging, dock height, and drainage adjustments are required at some plants to deal with fluctuating water levels. If the changes in the water levels are not drastic enough to warrant spending time and money making capital changes, the processors will often put up with the inconveniences of non-optimum dock heights or channel depths (See Section 7.6, "Commercial and Industrial Interests", for a more complete discussion of the impacts and positions of shoreline based industries, such as fish processors).

Positions

Fish harvesters on the Great Lakes do not share a single view about water level fluctuations and their implications for their operations. Perceptions of fish harvesters who fish in the same area with the same type of gear and vessels often differ. Some perceive highs to be more detrimental to their operations, while others perceive lows to be more harmful. In general though, most fish harvesters contacted believe that fluctuating water levels do not have significant impacts on their operations. In the U.S., fish harvesters tended to be more concerned about the restrictive commercial fishing regulations that most of the states have imposed in order to protect and enhance the recreation fishing industry. In Canada, they are concerned about the recent quota introductions.

Because fish harvesters are of the opinion that fluctuating water levels do not impact their operations very much, they also tend not to be very interested in measures. Those contacted felt that most measures would not influence commercial fishing operations. In general, those contacted were opposed to control and diversion works to regulate the lake levels because

they feel they are not necessary, or that the lakes cannot be regulated enough to make a difference. On the other hand, they supported tax abatements and low interest loans for income losses as a result of vessel and net damages due water level fluctuations and storm activities.

As for other measures, commercial fish harvesters were split on their views. Some felt that shore protection measures were not necessary in their areas, whereas others felt they would lessen shore erosion. (Most of the fish harvesters contacted who favoured the latter are also riparian land owners.) Likewise, fish harvesters were split on their need for additional emergency response capability. Those on Lake Superior felt that current emergency capabilities are sufficient, whereas those on the other lakes tend to be dissatisfied with the level of Coast Guard protection and the accuracy of storm forecasting.

Discussion

Fish harvesters are not very concerned about the fluctuating water level issue. If they were not contacted directly regarding their views about fluctuating water levels and measures, it is highly unlikely that they would have petitioned governments. Rather, they would continue to deal with the consequences of water level fluctuations on their own.

On the whole, the commercial fishing interest is not very sensitive to water level changes. The need to adjust to changing circumstances is an ongoing fact of life for fisheries, and hence, the commercial fishing interest is aware of the risks and uncertainties associated with fluctuating water levels. They have adjusted their boats, docks and fishing methods to make the best of changing levels. They are not unduly surprised by extreme water levels that might occur, and they are relatively resilient to fluctuations. They support measures, such as tax abatement programs, which would benefit their interests but not because they are severely impacted by water level changes.

The most significant effects upon the commercial fishing interest occur when their harvests are affected due to changes in fishery resources. For instance, changes in water quality as a result of urbanization, agriculture and deforestation, the accidental introduction of exotic predator species such as lamprey, and restrictive regulations have had significant changes in commercial harvests, and the commercial fishing interests are particularly concerned about these effects.

Scientific evidence indicates that as water levels change, fish productivity may also change. However, any relationships that exist between lake levels and fish harvests are not known. Fish harvesters have commented that they have not noticed changes in their harvests as water levels change, and hence, they feel that fluctuating water levels have no effect on their harvests. What is clear, is that fluctuating water levels are necessary to maintain genetic diversity of the fish species in the Great Lakes - St. Lawrence System. Consequently, any measure or human action that changes the water level regime, could cause changes in the fishery resources.

Measures such as regulation and diversions could change fishery resources and affect commercial fishing. Moreover, there is the possibility that diversion works could lead to the introduction of new exotic species into the Great Lakes System and have serious implications for fishery resources. The development of the Welland and Erie Canals, for example, had severe consequences for commercial fishing by introducing sea lamprey into the upper lakes. The commercial fishing interest is reluctant to bear costs associated with measures intended to benefit others.

Shore protection structures may also impact fishery resources and habitats, which in turn might influence fish harvests. Some productive fishery areas (Long Point, Point Pelee, etc.) are dependent on a balance between erosion and deposition that renews shorelines and adjacent bottom areas. It is possible that large scale shoreline protection would affect productivity of lakes for some species and hence species mix which could eventually affect the commercial fishing interest.

The commercial fishing interest is most sensitive to changes, whether natural or human induced, which affect fishery resources and ,in turn, their harvests. Consequently, any measure or future government action that might affect the quantity and quality of fishery resources (e.g. regulation, diversions and major shore protection works) may affect the welfare of the commercial fishing interest. Unexpected changes in fishery resources may take fish harvesters by surprise, reduce their resiliency, and prompt petitioning to governments.

7.9 AGRICULTURE

Introduction

The Great Lakes region of North America, taken as a whole, is of major significance in agricultural production. Farmers who locate along the Great Lakes - St. Lawrence shoreline benefit from the services of their location, namely the fertile soils and moderate climates. The warm, moist climate of shoreline location is such that very little irrigation is required in the region of the Great Lakes - St. Lawrence River. In Canada, agricultural shoreline use is limited to areas on Lake St. Clair, Lake Erie, eastern Lake Ontario, and areas east of Montreal (on the islands and around Lac Ste. Pierre). In the United States, most shoreline production occurs on Lake Ontario and eastern Lake Michigan, and to a lesser extent on the shorelines of Lake Erie and Huron (See Figure C-7-6). The Basin is a major production area for grain corn and wheat as well as for specialty crops including fruit, vegetables, and tobacco.

Overall, agricultural industry is not threatened by fluctuating water levels since the amount of agricultural land that can be impacted by fluctuating water levels is minimal compared to the total amount of land used for agricultural production in the Basin. However, the welfare of farmers whose business are located on the shoreline can be affected by water level fluctuations. Often these lands are devoted to specialty crops uniquely suited to the shoreline lake environment. These farmers are affected by fluctuating lake levels in much the same way as other shoreline owners. The

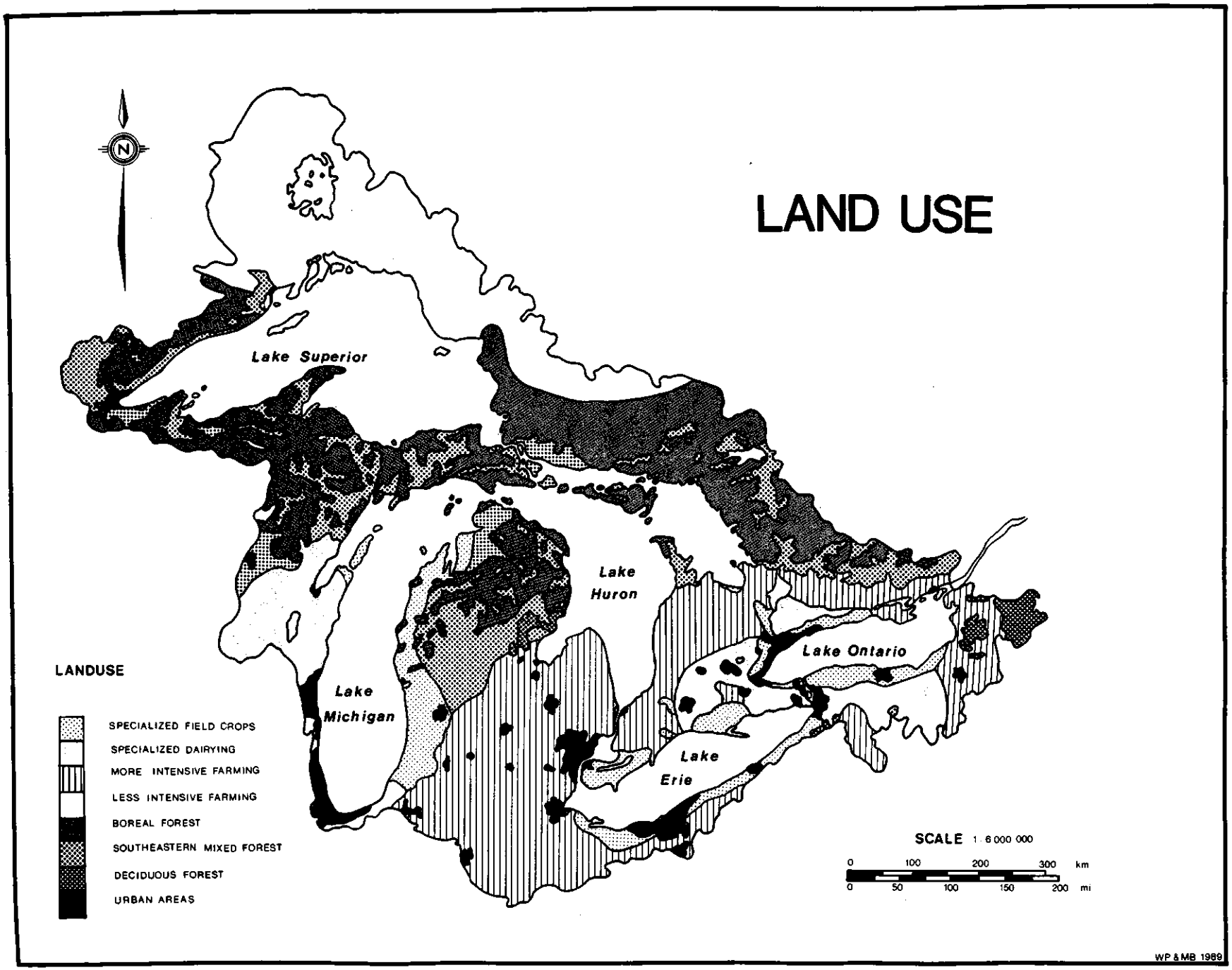


Figure C-7-6: Land Use

Source: U.S. Environmental Protection Agency and Environment Canada, 1988. The Great Lakes: An Environmental Resource Book. ISBN 0-662-15189-5

direct causes of their problems usually accelerated are erosion and inundation, both of which are most severe when storms coincide with high water levels. Erosion and flooding have caused crop yield losses, damaged dikes and increased costs for protective works and pumping, particularly those in low lying and drained areas.

Farmers, like other riparians, can also be impacted by lower water levels. However, these tend not to be as severe as those suffered when storms coincide with high water levels. The major problem encountered by farmers during the recent drop in water levels has been with their water supply systems. Farmers noted that with the drop in water levels many of their wells have dried up.

Changing water levels have occurred throughout the development of agricultural areas in the Great Lakes, and as development occurred adjustments to water levels were made by the farmers to accommodate production activity. In some areas, farmers adjusted to inundation by installing drains which carry water back to the lake. In areas where flooding is more severe, and drains cannot carry water away from fields fast enough, some farmers have adjusted by installing pumps to lift water back to the lakes. These farmers may still experience occasional flooding and crop loss.

The areas most subject to problems of runoff and lake-induced flooding are those that have been reclaimed from the lakes at some time in the past; the former wetlands. In order to claim the lands for agricultural use, an extensive network of dikes were installed. Notable areas where dikes have been used as a means of claiming wetland areas are the lower Saginaw River Basin in Michigan, the southwestern part of Ontario in Kent and Essex counties, and around Lac Ste. Pierre on the St. Lawrence River. The dikes in Canada have been constructed with federal financial assistance, perhaps because the reclaimed areas were deemed essential to the nation for specialty crop production. These dikes have been overtopped by water at various times in the past. For example, during the high water period of early spring of 1986, the dikes in Essex County overtopped due to an ice jam which backed up flood waters in the Thames River. Although crop loss did not result because the flooding occurred before growing season, the dikes themselves and structures behind the dikes were damaged. Furthermore, dikes had to be breached to allow water to drain out of the reclaimed flatland.

Positions

Much is still not known about farmers' positions regarding fluctuating lake levels and measures. However, it appears from interviews with some farmers that, like riparians, the positions of farmers vary. Some are very concerned about the loss of their lands due to erosion, and like other riparians, attribute this to high water levels. Some of these farmers are active members of the International Great Lakes Coalition, and hence strongly favour regulation as the only means of solving their problems. Other farmers, however, do not feel that fluctuating water levels are a problem, and they do not hold very strong positions regarding measures.

The farmers most concerned, by far, about lake levels are those located in the wetland areas behind dikes. Any threat to the dike system or even occasional

overtopping is viewed as a disaster, and government assistance and compensation is expected. Furthermore, these farmers expect that the dikes will continually be repaired when they are damaged by high water levels or storm activities. Some feel strongly that to avoid further damages, the dikes should be built higher. This position in Canada is understandable given the federal dike building program.

Discussion

Some farmers located along the shoreline of the Great Lakes - St. Lawrence Basin hold the same positions as other riparians (See Section 7.2). They are surprised by the range of changes in water level, their investments were threatened, and some strongly support regulation as a means of solving their problems. They see regulation as a means of increasing their resiliency to water level changes. Other farmers however, are not as concerned about the fluctuating water level issue. They seem to accept the uncertainty of water level fluctuations as part of the risks associated with farming on the shoreline. These farmers do not approach governments, but continue to solve any problems they face on their own.

The farmers most susceptible to extreme water levels (i.e. extreme high water events) are those located in diked areas. Many of these farmers have located in these areas with an understanding that the dikes would protect them from water level changes. The dikes have given these farmers a false sense of security, and when they are overtopped many are surprised and also have limited ability to adapt. By expecting compensation for damages that they incur as a result of dike overtopping, these interests seek a means of shifting some of their costs on to taxpayers. They consider this consistent with long standing government policy towards agriculture in the Basin.

7.10 NATIVE NATIONS

Introduction

Native peoples use the lakes, St. Lawrence River, and other connecting channels in much the same way as other interests. Those living along the shoreline are impacted by fluctuating water levels in the same ways as the riparian interest class. Natives also have agriculture, fishing, recreation, and environmental interests. However, they are classified here as separate interest class because of their unique legal and cultural situation.

In Canada, native peoples living on reserves have distinct authorities, and do not have to pay income tax, provincial tax and certain excise taxes. Each Nation has an elected or appointed council with some power of self administration. However, most of the costs of education, health, and welfare on the reserves are paid for by the federal government. Government programs for Native people are implemented primarily through Indian and Northern Affairs Canada (INAC). Decisions on what programs and services INAC and other agencies should provide to Native people are generally made by the federal government in consultation with Native groups, rather than by Natives. Native

people in Canada are increasingly demanding the right to design and implement their own programs.

In the U.S., American Natives have more self-governing power. The U.S. federal government promotes tribal self-determination and self-sufficiency, and tribes share a government-government relationship with the U.S. federal government. In the early 1960s Indians were specifically brought into various federal programs, and today portions of the federal budget are given over to reserve control. In areas, such as fishing, mineral, and forestry resources, American Indians are able to implement their own programs. Other programs dealing with Indian Affairs are implemented through the federal government. The Bureau of Indian Affairs of the U.S. Department of the Interior is the primary agency responsible for Indians living on or near reservations.

Natives in both countries differ in some respects from the overall population. Many Native communities place a high value on non-economic factors such as the environment, aesthetics and spirituality. The environment is central to the way of life of most Natives. A larger proportion of the Native population is dependent on primary production activities such as fishing, hunting and trapping, and farming for their subsistence than is the population as a whole. Furthermore, average incomes are much lower for Natives than for the rest of society, while unemployment is higher.

In the Great Lakes Basin there is an estimated 350,000 Native people. Most of these people live on federally recognized Indian reserves which approximate 7 million acres of land in total. Each reserve represents a different Native Nation, and there are about 110 different Nations in the Basin. The majority of reserves or nations are located on the Great Lakes - St. Lawrence River shoreline at major tributaries, or along the connecting channels (See Figure C-7-7). Reserves are located in these areas because they are the most productive areas in terms of fish and wildlife, and they also offer easy access for water transportation.

In Canada, there are several reserves located in northern Ontario along the Lake Superior and Georgian Bay shorelines, and on Manitoulin Island. The main subsistence of Native on these reserves is fishing and hunting, and to a lesser extent logging and agriculture. Native reserves are also located at Lake St. Clair (on Walpole Island), Lake Ontario (east of Belville), and along the St. Lawrence River (near Cornwall). Many of these Natives are farmers and fish harvesters, but some also supplement their incomes by working in near by cities. In the U.S., there are fewer reserves located around the Great Lakes. The major Indian reserves are located along Lake Superior, the Niagara River, and along the St. Lawrence River. American Indians also engage in fishing, hunting and farming activities, and may also work in cities depending on their proximity.

The impacts of fluctuating water levels for Natives are similar to those experienced by other interests with similar lake related activities. Many of the reserves are located very close to the shoreline. Consequently, when storm events coincide with high water levels property damages have occurred.

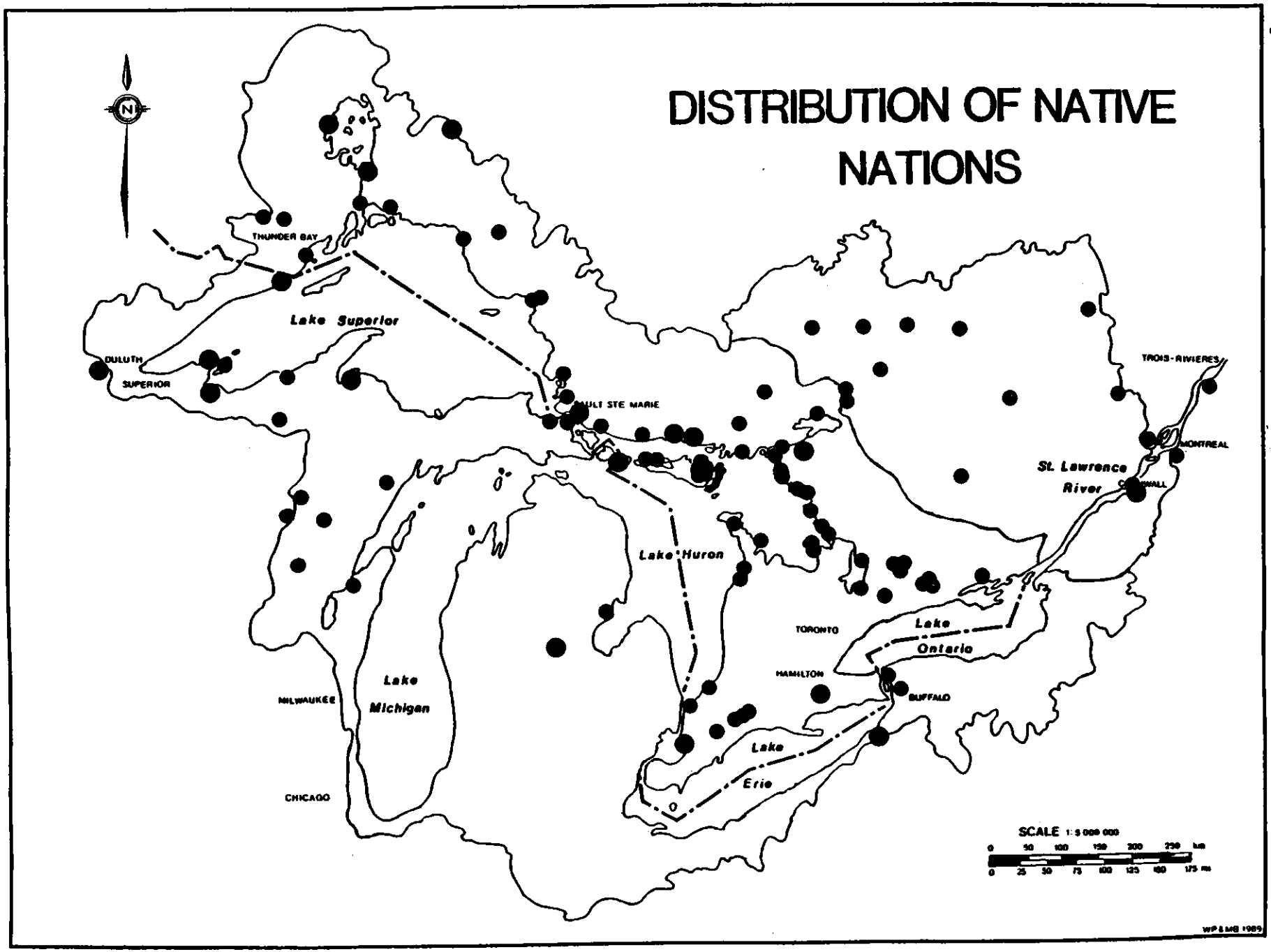


Figure C-7-7: Distribution of Native Nations

Sources: Energy, Mines and Resources Canada, 1980. The National Atlas of Canada, 5th Edition.
U.S. Department of the Interior, Bureau of Indian Affairs, 1971. Indian Land Areas Industrial.

Examples of damages due to storm activities and high water levels are at Walpole Island and along the St. Lawrence River. Fluctuating water levels have also affected farming and fishing activities. For example, wild rice farming of Indians at the Bad River Indian Reserve on the U.S. shore of Lake Superior have been affected by fluctuating water levels. At extremely high water levels wild rice production suffers, while at lower water levels wild rice production prospers. At extremely low water levels Indians on reserves along Lake Superior have noted that fish spawning areas are in jeopardy. Changes in the ability to produce agricultural goods and catch fish, in turn, affect the economy of tribes whose subsistence depends on these activities (See Sections 7.8 and 7.9 on Agriculture and Commercial Fishing, respectively for a more complete discussion of these impacts).

Extreme water level fluctuations have also had negative impacts for Native boaters and marina operators (See Sections 7.6 and 7.7 on Commercial/ Industrial and Recreation, respectively for a more complete discussion of these impacts). When these activities are negatively affected the economy of reserves that are somewhat reliant on the tourist industry may be affected. The Grand Portage Indian reserve which operators a lodge on Lake Superior is an example of such a reserve.

Positions

Although Native jurisdictions from many shoreline reserves have not been contacted, it appears from initial analysis that Native views are fairly consistent. In essence, the views of Natives are similar to environmental interest groups, in that they are not willing to support measures in which the environmental impacts are detrimental or not known. Natives place a high value on the environment, and have stressed the importance of considering the whole environment in any planning and decision-making regarding lake levels. The Mohawk people of the Akwesasne Nation on the St. Lawrence River, for example, have indicated that they will mobilize around environmental issues whenever they are raised. Furthermore, they feel that the focus on water levels may leave out the very important water quality and ecosystem impacts of fluctuating water levels.

The Natives along the St. Lawrence River near Cornwall, Ontario on both sides of the border are particularly concerned about water levels and water quality, and they have expressed their concerns several times to the IJC. They feel that the construction of the St. Lawrence Seaway and Power Project and associated works have led to changes in the water level regime of the St. Lawrence River. Scouring, erosional and depositional areas have been redistributed in the River with the practices of regulating the Seaway waters, which they feel has had implications for toxic sediments, water quality, wetlands, fish spawning beds, and shoreline access. Although Natives along the St. Lawrence River are not completely opposed to Type 1 measures, they feel impacts of existing structures and regulation of water levels should be better understood before the water level regime of the Great Lakes System is modified further. These people feel that a long term effort to understand the entire Great Lakes - St. Lawrence River ecosystem, including water levels, flows, and live components of the ecosystem must be seriously funded before attempts are made to further regulate the system.

Like environmental interests, Natives along the St. Lawrence River, favour shore protection works only if they can be proven to be environmentally sound and not to have negative impacts on interests and the environment downstream. They also reacted positively to Type 3 (direct restrictions on land and water use), Type 4 (programs to indirectly influence use), and Type 5 (emergency response) measures.

Another point raised by Natives is that the St. Lawrence River has been ignored in government policies dealing with the management of the Great Lakes Basin. To ensure that the Native perspective is included in the decision-making process, Natives feel that they should have a representative on the St. Lawrence River Board of Control, and on any taskforces dealing with Great Lakes Basin waters and related land resources. Furthermore, Natives who live on reserves straddling the Canada/U.S. border have commented that actions by governments to address their concerns have been uneven.

Discussion

Since the environment is central to the way of life of many Natives, they are not surprised by fluctuating water levels. They believe that fluctuations are part of the natural process and necessary for maintaining the quality and diversity of the Great Lakes - St. Lawrence River environment. Their major concern is that human interference with the system, through the construction of regulatory and diversion works, has disrupted these natural processes, leading to problems of water quality, ecological processes, shore access, etc., especially along the St. Lawrence River. They feel strongly that the implications of existing regulatory and diversion works should be assessed before modifying the system further.

Although Natives are not surprised by fluctuations, they are often not very resilient to damages that they may occur. Since their way of life is often dependent on their shoreline location, the economic self-reliance of Natives living in sensitive shoreline areas may be seriously threatened by extreme water level events. Natives are generally not as well off financially as other riparian land owners and may not have the financial resources to install shoreline protection works, or to deal with damages that may result from water level fluctuations or storm events.

7.11 GOVERNMENTS

Introduction

Governments are involved in many different aspects of the fluctuating water level issue, and as such have many different responsibilities. These responsibilities differ among levels of government, and also between Canada and the U.S. A number of these are covered elsewhere in the Annex, especially in the section on 'Policies Themes of Government' (Section 5) and 'Government Organizations and the Decision Making Process' (Section 9). This particular discussion examines governments, and hence the general public, as an interest; that is, as a group that can be affected by fluctuating water

levels, or measures that address fluctuating water levels. This section discusses two responsibilities of governments not reviewed elsewhere.

The first is fiscal responsibilities. In this context, the term fiscal responsibilities refers to the expenditures governments assume in dealing with the water level issue. Public funds collected from the taxpayers are used by governments to implement programs and policies deemed to be in the interest of society. Actions or measures implemented by governments to deal with fluctuating water levels, therefore, have an indirect impact on the general public, whether they own shoreline property or not. The positions and sensitivities of the general public with regard to government actions pertaining to water and land management in the Great Lakes Basin are elaborated on in this section.

Another major responsibility of governments, which has not been discussed elsewhere, is that of maintaining publicly owned property and infrastructures. Publicly owned roads, sewage treatment systems, parks and marinas, dikes and other shore protection works located on the shoreline can be affected by fluctuating water levels. The major focus of this section relates to the impacts of fluctuating water levels on publicly owned lands, along with the related positions and sensitivities of affected governments.

All levels of government own properties and infrastructures along the Great Lakes - St. Lawrence River shoreline. Public funds are spent to maintain and operate these properties and infrastructures. Governments at all levels (federal, state/provincial and local) have had to spend public funds to repair and/or replace properties and structures impacted by fluctuating water levels.

Federal, as well as provincial and state governments, own tracts of park land for public use along the Great Lakes - St. Lawrence River shoreline (See Figure C-7-5). In Canada, the Canadian Parks Service of Environment Canada is responsible for maintaining and operating national parks, while the Ministry of Natural Resources is responsible for provincial parks in Ontario. In the U.S., national and state parks are operated by the National Park Service, Department of Interior and State Departments of Natural Resources, respectively. The physical, cultural and recreational resources of these parks have been impacted by water level changes. When storm events coincide with high waters, park facilities have been damaged, and access to trails and roads has been reduced. This has affected general works, resource conservation, visitor services, and other aspects of park operation.

Federal governments on both sides of the border are responsible for operating and maintaining a number of publicly owned marinas and port facilities. Similar to privately owned and operated marinas, these facilities are subject to many impacts that result from fluctuating water levels and storm activity (See Section 7.6 Commercial and Industrial Interests). Public marinas in Canada are constructed, operated and maintained by Small Craft Harbours, Department of Fisheries and Oceans, while in the U.S., the Army Corps of Engineers is responsible for marinas and port facilities.

Other publicly owned infrastructures at the federal and provincial/state levels that have been affected by fluctuating water levels and storm

activities are dikes and other shore protection works. Agriculture Canada and the Ontario Ministry of Agriculture and Food, for example, have assisted with repairs to dikes and other structures protecting reclaimed agricultural lands along the Canadian Great Lakes shoreline (See Section 7.9 'Agriculture' for a discussion of these impacts).

Although the upper levels of government operate and maintain publicly owned properties and facilities along the shoreline, the level of government that is most affected by lake level changes and measures is the local or municipal level. This is because repair and maintenance of most public properties and infrastructures falls under the jurisdiction of local governments. This portion of the interest class is comprised of all governmental bodies which provide services that are more effectively discharged through local control. Local levels of government (municipalities) include cities, towns, villages, townships, and regions. In addition, in this discussion local governments include conservation authorities which were created in Ontario under the Conservation Authorities Act on the basis of watersheds, and represent partnerships between the Province and member municipalities. There are hundreds of local governments on both sides of the border which vary greatly in population and geographic area.

Local governments within the Basin have reported impacts of 5 types: transportation (e.g. roads), water and sewer, public buildings and parks, marinas and docks, and erosion or flooding of protective structures. During high water periods, storm activity exacerbates damages to each of these types of infrastructure. For example, in 1985-1986 when storms coincided with high water levels, impacts to some local governments' infrastructures included the destruction or severe damage of existing shoreline protection, the washout of roads and erosion of parks, damage to public docks, flooding of public properties, damage to water intakes and problem with sewage treatment plants. The degree of these impacts varies with shoreline location. In 1985-1986, most impacts occurred on Lakes Huron, St. Clair and Erie.

The main impacts as water levels dropped in 1988 included problems with water intakes, sewage disposal, and restricted access to municipally owned marinas and docks. In addition, 'unsightly' shore protection works, which were constructed during the high water phase are now interfering with public access to the shoreline. Where these structures exist, the public is pressuring the local government to have them removed.

The responses of all levels of government to damages incurred by lake level fluctuations has included increased public investment to maintain and repair infrastructures; repair, replacement or abandonment of damaged infrastructures; and/or operating changes. However, since governmental bodies, particularly those at the local level, vary greatly in size, they do not have similar levels of resources to deal with the impacts of fluctuating water levels.

Positions

The positions of the federal governments regarding fluctuating water levels and measures are reflected in their policies. Generally, they feel that fluctuations are a natural process, and are committed to information development and distribution so interests will be able to make better informed investment decisions. Federal governments on both sides of the border seek to reduce the ability to shift hazard costs, to increase resilience, to promote economic development, subject to environmental protection constraints, and to assure public involvement in decision making. (See Section 5 'Policies of Government' for a more detailed review of the positions of federal governments.)

The positions of non-federal governments regarding fluctuating water levels and measures are sometimes quite different from those at the federal levels. Consequently, like other interests, the positions of non-federal governments must be reviewed in light of federal government policies. Through group depth interviews and contacts with various government representatives, the positions of non-federal governments (primarily those at the local levels) were obtained. Most of the contacts were made in Canada, and included municipal and regional governments, and conservation authorities. Some government officials in the U.S. at the state and local level were also contacted.

Most non-federal governments have said that they accept record high and low water levels as an act of nature and something that has to be expected. There are however some who have mentioned that they are 'suspicious', that lake levels are being controlled to benefit other interests. For example, some officials in communities along Lake Superior feel that lake levels are being controlled to keep the lower lakes from flooding, which they see as having a negative impact on their own areas.

In some cases non-federal governments hold similar positions as the riparian interest class. For example, they perceive that controlling lake levels by regulation is the only feasible alternative to lake level management. On the other hand, there are some non-federal government officials who favour moving people out of hazard areas (Type 3 measures) as the best option. In Ontario, some conservation authorities have mentioned that they would like to see legislation in place "with some teeth in it" to stop development in hazardous areas. Many non-federal officials, regardless of their view on regulation and land use zoning, would like to have an ongoing shoreline protection program in effect.

A common view of most non-federal government contacts is that they would like to have better information regarding lake levels and improved dissemination of this information. Mention was made by some officials in Canada that Environment Canada has lost a degree of credibility because lake levels dropped drastically after 1985/1986 when forecasts were otherwise.

Some local governments in Canada, especially those smaller municipalities, feel that they are given a low priority by upper levels of government regarding fluctuating water level impacts. For example, some small local areas that were hard-hit by the 1985-1986 high water levels and storm

activities, feel that because of their size they are 'low on the government's priority list' when it comes to funding. They have stated that they often feel lost in the bureaucratic tangle when applying for funding assistance for repairs or protection.

Governments on both sides of the border, especially the smaller ones, have commented that they need financial assistance from upper levels of government to deal with the negative impacts that they have incurred due to fluctuating water levels. For example, financial aid may be needed to repair roads, sewer systems, and other infrastructures that have been damaged in extreme water level events, and local governments have approached upper levels for funding assistance. Likewise, local governments have stated that they would like assistance from upper levels of government to implement measures to protect their investments and the investments of their constituents. It has been suggested by various local officials that senior levels of government get involved in cost-sharing for erosion control and land acquisition programs, shore protection works, and also to share the costs of regulating the lakes.

The funding for programs to assist local governments to deal with fluctuating lake levels comes from the general tax base, and consequently affects all members of the public. Some inland property owners have mentioned that they do not want their taxes going to support those that live on the shoreline, who should bear the costs which go along with the benefits of their location. While they support measures such as emergency response and information programs, they do not want their taxes going to fund major works such as regulation. In addition, the general public perceive that they have a right to public access to the shoreline and will pressure governments whenever they feel that this right is threatened.

Discussion

Federal governments (and provincial governments) generally view fluctuating water levels as natural processes, and attempt to take these processes into consideration when developing programs and policies. Of course, even these levels of government do not have a perfect understanding of the system and can be surprised by events, such as extreme levels, rapid changes, or severity of storms. However, they attempt to take a Basin-wide perspective when dealing with the fluctuating water level issue. Local governments, on the other hand, are most concerned with the immediate impacts of fluctuating lake levels on their own area, and hence may not relate to the Great Lakes as an interacting water system.

Many government officials at lower levels of government feel that fluctuations and extreme events are inevitable, and hence are not surprised when they occur. Others, however, have been surprised by changes in water levels that have occurred over the years. This surprise stems from a number of factors, including a misunderstanding of the physical processes and an unclear understanding of the policies of higher levels of government. In many respects, these governments are like riparians.

Whether they are surprised or not, the sensitivity of non-federal governments to fluctuating lake levels depends on their resiliency. The degree of

resiliency of local governments to fluctuating water levels varies. Large cities such as Chicago, Toronto, or Buffalo may have the financial capability (i.e. a larger tax base to acquire funds) to deal with any consequences of fluctuating water levels (e.g. repairing roads and sewers, building shore protection works, etc.), although potential impacts on established infrastructure may be greater. Smaller communities on the other hand, may not have this capability, and thus may be less resilient to water level fluctuations, although the investments at risk may be more modest.

Lower levels of government seek assistance from upper levels of government to repair damages to infrastructures, and/or to build shore protection works. In addition, some have suggested that upper levels of government share the costs of measures such as land use zoning and regulation. By these actions, local governments seek to shift costs, at least in part, to the general public.

7.12 SUMMARY

This section reported the positions of the interests with respect to fluctuating water levels and measures. Positions were taken directly from statements by representatives of the interests and were inferred by interests' support or opposition to measures. These positions were then discussed in light of interests' investment decisions and the policy themes of governments. Interests make investments in order to capture flows of services from the lakes, and in making investments, interests form expectations of how future events are likely to affect future welfare. These expectations form the basis of the positions held by the interests and, as such, provide the impetus behind petitioning for government action by the interest. Petitioning by interests, which are policy relevant, can arise from a number of sources, including 1) surprise, 2) resiliency, 3) benefit enhancement, and 4) cost-shifting.

In the presentation of the positions and in the discussion of those positions several main points emerge. There is considerable disagreement among the interests with respect to the effectiveness and/or the desirability of regulating lake levels; disagreement can also exist within an interest group. There is general, although not complete, agreement among the interests that more localized measures would be appropriate, particularly those providing information on storms and levels.

Measures to regulate levels (Type 1) find favour largely among riparians although some recreational boaters, commercial interests, farmers and local governments are also supportive. These interests expressed surprise at the high levels of 1985-86 and at the rapid decline in levels which followed. Riparians and some owners of commercial shoreline property were most concerned primarily with the high levels while the boaters and the sellers of related services were concerned with the rapid fall in levels. In addition to inadequate information as an impetus to petitioning federal governments to act, these interests are often not resilient to the fluctuating levels.

The "surprise" of these interests can be partly attributed to their seeing lake levels and associated processes as both more predictable and controllable

than the scientific evidence suggests. The firmly stated "predictions" by governments about levels are partly responsible for this perception by these interests. Instead of seeing levels and storms as probabilistic phenomena, "predictions" by governments have led some interests to see more certainty in the system, and make their location and investment decisions accordingly.

Some riparians, and particularly the International Great Lakes Coalition, feel that lake levels can be regulated to prevent a recurrence of the flooding and erosion damage of recent years. Yet, most interests are opposed to level regulation, because they feel that it would be ineffective in preventing flooding and erosion. The important elements of the Coalition's position that full system regulation is feasible and that the controlled levels would prevent flooding and erosion damage is at odds with the scientific consensus. There is clearly a need for improved communication and information sharing on these matters.

As opposed to those interests seeking Type 1 measures, most interests either petition for maintenance of the status quo or seek more localized measures. They perceive Type 1 measures to be ineffective in regulating levels or to reduce the value of services they obtain from the lakes, or to increase the costs they would have to bear.

The commercial fishing interest and some commercial and industrial interests support the status quo. The electric power interest declines to support any particular measure without in depth study, by default preferring the status quo. To a large extent, these interests have not been surprised by the level fluctuations and are quite resilient to those fluctuations. Given their understanding of the physical and governmental system in the Basin, these interests feel that attempts to control water levels would be ineffective. They are often more concerned with other factors unrelated to water levels, such as general economic conditions.

The transportation interest, in response to the declining levels, has petitioned governments to accelerate the channel and harbour dredging programs already in existence. This interest believes Type 1 measures would be ineffective in managing lake level fluctuations. Furthermore, levels management for the lakes could be problematic for navigation channels and could prevent the interest from taking advantage of high levels.

The environmental interest opposes the regulation of lake levels. This interest perceives the fluctuating levels as beneficial to the health and integrity of the Great Lakes environment. This group tends to favour measures which will reduce human influence on the lakes, such as zoning to prevent shoreline use in areas of potential conflict (high flood and erosion risk areas). They support policies which prevent incremental encroachment of human activity into damage susceptible or environment degrading areas.

Natives tend to hold similar views to those of environmental interests. They also support measures they feel will reduce manipulation of the lakes and St. Lawrence River. They are not completely against Type 1 measures, but feel that the impacts of existing structures that affect levels and flows should be

understood before the water level regime of the Great Lakes system is modified further.

For most recreationists (with the exception of boaters), their use of the lakes is flexible over time and usually involves low investment, both of which increase the substitutability of various recreation activities and increase the resiliency of the interest. Perhaps for these reasons this interest displays little in the way of a unified position regarding level fluctuations.

Some interests have made a reasoned determination to not prepare for certain high and low water extremes. These interests, while recognizing the possibility of such extreme events, have determined that making investments now to deal with events that may or may not occur in the future, cannot be justified, either as costs to themselves or as costs that would be borne by their customers (in the case of power). These interests may or may not have made contingency plans for such rare occurrences and the feasibility of such plans actually working in these rare events may not have been adequately tested.

Some of the positions of the interests are rooted in notions of fairness. This is particularly visible among riparians, recreational boaters, some commercial and industrial enterprises and some local governments. Some feel the lakes are managed at present to the benefit of certain interests and to the detriment of them and others. Some feel that it is unfair to regulate levels on two lakes and not on the other three. Some riparians on Lake Superior feel that to alter the existing regulation plan for that lake would be unfair to those who have accounted for that plan in their investment decisions. Riparians, boaters, and others on the St. Lawrence River feel that they already bear costs of actions which benefit others and that they would suffer unfairly if the lake levels were to be regulated. They recognize the St. Lawrence as the main basin outlet and that to stabilize lake levels the levels and flows of the St. Lawrence would become even more erratic. Often underlying these perceptions are strongly held notions of rights to private property and to existing agreements and policies, where these are known. These perceptions of inequity present a source of disagreement which is difficult to resolve in managing the levels issue. Another source of disagreement is positions can vary by geographical location, even within an interest class. This is especially true among the riparians. For instance, riparians on the St. Lawrence River oppose water levels regulation, although other riparians vigorously support it.

Apart from the different positions regarding Type 1 measures, there is no unified support for all or any particular measure among the interests. Some interests feel that shore protection and dredging are appropriate in specific situations. Others reject these measures as ineffective perceiving them as methods of diverting attention from their most desired option, Type 1 measures. Some interests, in particular the environmental interest, support measures such as zoning to restrict the use of the shoreline and could with appropriate environmental safeguards support Type 2 measures. Riparians tend to reject Type 3 measures as an infringement upon their property rights.

However, there is both a demonstrated need and broad support for information measures. There are several types of information which are seen as desirable by the various interests, regarding such factors as i) government policy and responsibility relating to levels and their consequences, ii) levels and storm events in the short and longer terms, iii) hazards associated with specific locations, and iv) the processes affecting the physical and biological environment.

There is a feeling among many interests, especially riparians, that government policy is vague, confusing and contradictory and that the quality of this information could be improved. Most interests, even the most informed and resilient, want storm forecasting and in information on levels for the short or long term. Information regarding the hazards of locating in specific areas is supported particularly by riparians and some commercial and industrial interests. Some interests, such as the environmentalists, support research into (and dissemination of) information about basic environmental processes as a means of preventing future environmental damage.

Perhaps a most general comment on all measures is that the question of "who pays" for any measure is rarely considered in the formation of an interest's positions. While government policies are quite sensitive to defining "who pays", the interests seem to assume that costs for any measure will be born by someone else. To illustrate, Type 1 measures are often assumed to be paid for by general taxes, and Type 3 measures are assumed to be implemented with no compensation to landowners who may lose some of their land use rights to serve public access or environmental goals.

In short, analysis of the positions of the interests indicates a wide variety of views on the issue of fluctuating lake levels. Despite claims to the contrary, there is not broad support among the interests for Type 1 or most other types of measures. Some of the views expressed appear well founded with respect to the available knowledge regarding the physical system and government policy; some of the positions appear to be based on inadequate information or understanding of such important items as: governments' responsibilities, possible water level fluctuations, the likelihood and effects of storm events, shore processes such as erosion, the feasibility and implication of control measures, cost implication of most types of measure, and so on. For many interests this information base is reflected in investments which are not especially resilient to the changing environment, and hence generate concerns and petitioning to governments. In other cases, the interests' positions may be interpreted as attempts to seek benefits or shift costs to others. In any event, it is clear that the successful management of the water levels issue requires recognition of these widely divergent notions of the physical and political environments.

SECTION 8

FUTURE UNCERTAINTIES

8.1 INTRODUCTION

In previous sections the issue of uncertainty has been addressed with respect to expected water levels and the consequences of those levels as they affect the welfare of the interests. Yet, many factors, alone or interactively, such as the physical environment, the economy, social organization and values, political institutions and policies can influence lake level fluctuations or the effects of such fluctuations on the welfare of the interests. All of these factors are subject to considerable change over time.

Uncertainty is an integral element in human decision making and will continue to play a role in future human activity. It is sometimes possible for humans to observe and characterize the likelihood of particular events. In so doing a distribution of the probability of a particular event or range of events is formed and can be used to anticipate a range of outcomes with an acceptable level of confidence. With such an understanding, people can make informed investments in capturing the services of the lakes. However, fundamental and unidentified changes may occur in the processes that generate observations, such that previous probability distributions no longer describe the likelihood of events or ranges of events. This results in a considerable reduction in the confidence which may be placed in any particular expectation of outcomes.

To this point in the report the analysis has focussed upon changing conditions within the historical record, especially those conditions experienced in recent years or decades. However, the factors influencing Great Lakes Water levels and the welfare of interests affected by them appear to be changing in ways that may render the historical record of little use in providing reliable predictions. A most important point is that these factors rarely act in isolation from each other. Political policies, the economy and the physical environment evolve and affect each other in sometimes unforeseeable ways. Thus, an investment made today, no matter how well informed, may prove imprudent with the benefit of hindsight.

8.2 PHYSICAL ENVIRONMENT

Future climatic and weather conditions are indisputably uncertain. Cumulative climatic conditions (especially evaporation and precipitation) are the driving forces behind long-term fluctuations in Great Lakes water levels, and storm events are important factors in shoreline erosion and flooding. Predictions of levels and storm conditions are likely to be viewed with less confidence if the possibility of global climatic change, such as the greenhouse effect becomes more likely. Should climatic change become an undeniable reality, the historical record will offer little as a basis for confident depiction of the physical system. Furthermore, it is often difficult to determine whether newly observed extremes actually do arise from

fundamental changes in processes such as the greenhouse effect, or whether such extremes are drawn from the existing probability distribution of outcomes.

At present there is general agreement with respect to the implications of the accumulation of "greenhouse gases" although there is considerable debate about the magnitude, timing and regional climatic effects on the Great Lakes system; it is certainly not clear whether recent extreme conditions are evidence of climatic change. They, and perhaps even more extreme conditions, can reasonably be expected (although with low probability) even without climatic change.

Climatic change may affect levels directly in the form of more severe extremes and heightened variability; it may also affect the frequency and intensity of storm events. More importantly, climatic change or its threat can be expected to affect the political economy which plays a role in how levels affect interests' welfare. Patterns of agricultural production may change, which could affect the shipping industry. New seasonal patterns in the demand for electric energy may emerge along with an altered ability to supply hydroelectricity. Furthermore, government policies on resource use may change.

Climatic change aside, there is considerable uncertainty regarding the cumulative effects on the environment of human activity. It is not known how industrial wastes interact in the environment, and the chance that such interactions are of a harmful and irreversible nature is receiving increasing attention in the decision making process.

8.3 ECONOMIC ACTIVITY

The economy influences opportunities for interests to benefit from the services of the Great Lakes. Just as it is difficult to confidently predict certain important physical phenomena, it is also difficult to predict future economic activity in the Basin.

In the energy crisis of the 1970s, availability of cheap and reliable energy sources was recognized as crucial to economic decision making. Although the initial energy crisis is over, there is an increased awareness of the finite nature of fossil fuels and of their effects upon the environment. A search for alternate energy sources and conservation techniques followed the crisis. The recent development of superconductors may result in an entire restructuring of the energy industry.

Most obviously affected by changes in energy supply and technology is the electric power interest. In attempting to shift away from uncertain fossil fuel sources, more emphasis is being placed upon hydro facilities. Thus, uncertainty regarding levels and flows could play an increasing role in power supply planning. However, uncertainty regarding energy sources goes beyond the electric power industry, with repercussions economy-wide. Changes in energy prices can affect shipping, commercial and industrial interests, and it may influence business cycles and the general level of affluence.

Population growth within the Basin suggests an increased demand for recreation. This trend could be either dampened or heightened by the general level of economic well being in the Basin. However, there may be a change in the type of recreation facilities demanded if the trend toward environmental awareness continues. Additionally, increased population may require increased energy supply, transportation services and commercial and industrial services.

8.4 GOVERNMENT POLICIES

Government policies reflect, in part, social conditions and values, the structures of the institutions for decision making, and the perceived elements of the physical environment within which human activity must be conducted. In turn these policies affect institutions and social conditions; if any one element characterizes these relationships, it is change over time. As with the economy, policy change is unpredictable and equally as important to interests as possible changes in the physical system.

8.5 PLANNING FOR THE FUTURE

Uncertainty regarding the future is not new. However, in recent years the increasing ability of humans to influence their environment has been added to previously existing uncertainties. This may represent a fundamental change in the relationships between factors affecting human welfare, such that it may require many years of observation and analysis to be able to make confident predictions. It is not known if these fundamental changes are already being observed or when some new equilibrium will be reached.

This fundamental uncertainty regarding the future has significant implications for planning. Although changes in conditions tend to spur mitigative action, large scale efforts to mitigate any particular predicted affect may prove to be a waste of resources if the affect of concern does not materialize. Indeed, the mitigative action itself may have affects which alter the economic and social systems in unpredictable ways. Thus, there is a choice between immediate response to potential events of serious consequence that are predicted with little confidence, or a wait-and-see response supported with ongoing research and contingency plans should immediate action become necessary. The choice invariably involves value judgements regarding the "risk of waiting" versus the risk of incurring response-related financial and social costs.

The main elements involved in the choice of response are the seriousness of the predicted event, the probability of the event, the degree of (and need for reversibility of) immediate action. The lower the probability of the event, the more appropriate becomes the wait-and-see approach. The immediate action becomes more desireable the more catastrophic the predicted event. The more harmful and the more nearly irreversible the immediate mitigative action, the more attractive the wait-and-see approach. With today's concern over budget priorities, fiscally costly actions for highly uncertain future events are difficult to defend. At the same time, environmental considerations

discourage environmentally costly methods for dealing with uncertain future events. In addition to discouraging the construction of expensive (fiscally and environmentally) structures, the wait-and-see approach also discourages such non-structural measures as immediate land use controls.

Given the current concerns reflected by tight budgets and environmental awareness the management issues to be addressed must be defined in near term future conditions whose probabilities of occurrence can be predicted with confidence. Contingency planning programs can establish an ability to identify and respond to changes in the fundamental economic, physical and social factors.

SECTION 9

GOVERNMENT ORGANIZATIONS AND THE DECISION MAKING PROCESS

9.1 THE ROLE OF GOVERNMENT ORGANIZATIONS

An inextricable linkage exists between the policies of a government and the institutional arrangements and processes that exist to fulfill those policies. The role of institutions (including government organizations) in determining policy effectiveness is capably articulated by the National Academy of Sciences' Commission on Natural Resources (1980):

> "The characteristics of anticipated problems are shaped by existing institutions, and any attempt to improve matters that ignores this fact will probably come to very little. No amount of monitoring, or science advising, or projection modeling is going to improve our record if the relevant problem-recognition system, the approaches to mitigate the problems, and the incentive systems to provide alternatives remain unchanged."

If policies are viewed as an output of governments, the institutional arrangements that shape, interpret, and administer such policies become a critical determinant of those policies' impact and effectiveness (Zile 1974). Thus, institutional analysis is a requisite, and perhaps dominant, component of any problem mitigation strategy that purports to be comprehensive in scope and effective in application.

The role of government organizations is a relatively subtle, but nonetheless powerful, factor in policy development in the democratic system of government. Government organizations - at any level - are not merely vehicles for operationalizing policies formulated by legislatures or officials of a given administration. Rather, they can determine the success or failure of a given policy, and even the very existence of that policy. Organizations of government provide an environment in which policies can be devised, altered, interpreted, advocated, ignored, or otherwise transformed. Examples of this linkage include governmental agency adjustments of budgetary allocations, and the issuance of guidelines that serve to, de facto, interpret executive, legislative, or judicial policies. The U.S. Federal Council for Science and Technology (1968) found that "effective and adequate" institutional arrangements are the critical determinant in translating policy pronouncements and technological capabilities into social effects. It also noted that the administration of a single law can have even more social impact than ten years of research.

There is an immutable relationship between the public's perception of a problem and that of the government organizations responsible for administering policies to mitigate the problem. When a governmental entity responds to a perceived problem in a delayed or otherwise inadequate manner, the differentiation between the problem and the mitigation effort is often blurred; the agency is viewed as a contributor to the problem rather than a giver of a solution (Ostrom et al. 1970). The complexity of institutional

arrangements in policy administration is problematic as well; a complex and seemingly irrational system typically results in public confusion, coordination and administrative inefficiencies, and less than optimal mitigation strategies. The common perception is that of governmental unresponsiveness, of the agencies trying to grapple with "problems of much simpler times" (Hennigan, 1970).

The disparity between government policies (as described in Section 5) and the positions of interests (as described in Section 7) suggests shortcomings in the existing structure or operation of governmental organizations. Almost two decades ago, Hennigan (1970) pointed out that an understanding and subsequent reform of the Great Lakes institutional system would be the critical factor for establishing a "workable system incorporating the action elements of persuasion and education, legal action, and economic incentives which can make effective water quality management an attainable goal." The same could be said today with respect to lake levels and related management issues. It is imperative then, to conduct a critical evaluation of government organizations in the Great Lakes Basin related to the water levels issue.

Any response of governmental organizations must be devised and assessed in the broader context of the overall governance system of the Basin. The governance system includes the multitude of public and private entities that set or influence policy as well as the formal and informal linkages and interactions among them. Over time, the Great Lakes governance system has evolved into a complex management framework in which responsibilities are allocated between and among an array of public entities in the federal, states, provincial, local, and international arenas. It also has recently evolved to include non-governmental organizations which, de facto, have authority to influence management. Any new institutional response must acknowledge, accommodate, and work within this framework to acquire the support needed for effective implementation.

9.2 INVENTORY OF GOVERNMENTAL ORGANIZATIONS

The existing (and, in fact, historical) Great Lakes governance system is commonly and quite accurately portrayed as a complex, dynamic, and rather loosely defined amalgam of governmental and private sector entities with the authority to manage, or the ability to influence the management of, basin resources. The institutional arrangements within this governance system are almost overwhelmingly complex. The eight states and two provinces that share the Basin each have their own governmental structure in place to manage their vested interests in the Basin's resources. Well over a dozen federal agencies, U.S. and Canadian, have a mandated interest in the Basin's resources. Literally hundreds of other governmental entities are charged with some responsibility relating to the lakes as well, including regional and international agencies, townships, counties, and municipalities. Each of these agencies has their own associated laws, agreements, mandates, directives, and programs.

Simply listing agencies and organizations involved in Great Lakes related management would be a major undertaking. Past inventories, summarized by Donahue (1987), highlight the magnitude of effort required even for non-comprehensive listings. No comprehensive listing of individual agencies or organizations is attempted herein. However, significant strengths, weaknesses, and opportunities for change within the present institutional setting are evident by examining categories of institutions in a broad, generic sense.

International Organizations

International institutions include those governmental units and organizational linkages established by joint agreement between members of two or more nations. Examples include international commissions, informal working groups, declarations, treaties, binding and non-binding agreements, diplomatic exchanges, and others. While international institutions typically include only governmental units at the federal level, agreements or compacts between non-federal governments across the international interface are included in this category as well.

International institutions have their own advantages and disadvantages. Formal binational institutions are limited in number, but those that do exist are long established and programmatically well-defined. International institutions are products of their signatory parties and, as such, possess only limited autonomy. However, no Great Lakes-related international institution is exercising the full range of authorities vested in it (Donahue, 1988). International institutions are oriented mostly toward "soft" management approaches such as coordination, research, planning, and advisory functions. They generally rely on their signatory parties to fulfill construction, standard setting, regulatory, and enforcement functions. International institutions are largely accountable only to federal governments, not withstanding state and provincial involvement in institutional activities. Thus, they tend to be somewhat "buffered" from the resource management conflicts and pressures generated at the more localized levels of government. This, combined with their "soft" management responsibilities, results in a rather low profile and low level of recognition among intra-state/provincial and local institutions.

Intra-national Regional Organizations

These institutions are multi-jurisdictional arrangements, within a single nation but across the interstate or interprovincial interface, formed for the cooperative and coordinated management of a shared resource or addressing issues of joint concern. They include interstate compacts, federal-state compacts, federal-provincial agreements, interstate councils or commissions, and interagency working groups, among others.

Intra-national regional institutions share many characteristics with international institutions since they are each multi-jurisdictional organizations. In particular, they are creatures of their signatory parties with only limited autonomy, they focus on "soft" management activities, and are not exercising their full range of authorities. Intra-

national regional institutions have been used to present a unified regional block in approaching higher levels of government. They thus have a consensus-building orientation, although consensus-building activities typically occur outside formal institutional settings. Even though they have existed for decades, these institutions are still viewed somewhat as "experiments"; thus, if member jurisdictions allow, intra-national regional institutions can be quite flexible and creative in addressing the emerging needs of its members. However, these institutions are also highly sensitive to the political climate within member jurisdictions; political support by members is the overriding determinant of success of these institutions, transcending even the most restrictive or most innovative institutional structure.

Federal Units of Government

These institutions and their linkages operate on the federal governmental level, within a single nation. They include independent federal agencies, their departments and other subunits, federal boards, councils, commissions, task forces, and working groups, among others.

In the U.S., the federal government exerts a dominant role in Great Lakes management, both in terms of institutional presence and power. Accountability for Great Lakes management efforts ultimately lies at the federal level. Although policies and programs may be dictated or delegated to the states, the federal government retains oversight authority. In addition, where federal legislative control may be weak (e.g. land use management) fiscal dominance is often used to influence policies and actions of lower governments. The constitutional separation of the executive, legislative, and judicial branches of the federal government, and its attendant system of checks and balances, ensures that each branch of government has an influential role in Great Lakes issues. The political allegiance of elected officials typically lies first with the constituents and second with the party affiliation. Thus, they are sensitive to, and encourage, consensus-building among diverse interests. Because each branch is relatively accessible to the public, interest groups have a number of avenues for influencing policy, including submitting legislative initiatives to Congress, pressuring the executive branch to emphasize or de-emphasize an agency's resource management authority, or filing suits in the courts.

The role of the Canadian federal government in Great Lakes management is markedly different from that of its U.S. counterpart. A common theme running throughout Canadian federal policies is the recognition of the stature of the provincial role in resource management and the necessity for intergovernmental devices to address multi-jurisdictional (domestic and international) issues. Federal-provincial relations provide for a separation of powers and "checks and balances" lacking within the federal government alone. The Canadian federal government is characterized by a concentration of power within the majority political party, and thus within the executive branch. Majority parties typically retain power for relatively long periods (even decades) and can be insensitive to pressures to address perceived inadequacies in a given area; however, the stability of power can also provide continuity necessary for achieving long-term

objectives. Due to the concentration of power within the executive branch and the traditional respect for "professional decision making", the civil service enjoys a fairly large role in federal policy development in conjunction with elected officials. Regardless of where policy decisions originate, the Canadian federal government prefers to use broad interpretations of existing legislation rather than developing new statutes; the interpretations are made by the executive branch via issuing rules and guidelines.

State/Provincial Institutions

These institutions include agencies and their linkages that operate on the state or provincial level, within a single jurisdiction. They include independent state and provincial agencies, their departments and other subunits, state and provincial boards, councils, commissions, task forces, and working groups, among others.

Although the Great Lakes states exercise substantial authority in matters pertaining to the management of the Great Lakes, such authority is not intrinsic; it is largely derived from and therefore subject to a preemptive federal authority. Although the federal government has delegated much authority, especially for monitoring and enforcement, to the states, that delegation depends upon state compliance with federal requirements. Federal funding assistance has historically provided an incentive for compliance with federal requirements. However, with the emergence of the "new federalism" philosophy, the states have been accorded even more responsibilities, but often with a reduction or elimination of federal funds. The reduction in federal financial commitments and the shift of political power to the South and West has recently fostered, in the Great Lakes region, an emerging sense of self-determination at the state/inter-state level. The states have become initiators in water management efforts, in an effort to exert the states' "legal and political obligation to take primary responsibility for protecting the lakes," as stated by the Great Lakes Charter. This may ultimately result in federal/state conflicts as the federal government has historically treated the states as, in a sense, "second-class citizens" in binational Great Lakes issues. While the federal government has delegated to the states an operational role in meeting binational commitments (increasingly without federal financial assistance), they have been reluctant to allow the states to have an expanded, much less equal, role at the policy-setting level. Outside their lesser authority for resource management, the states have generally the same characteristics as federal governments, especially concerning the separation of powers between branches of government, the importance of consensus-building within the political structure, and the many avenues available for interests to influence policy.

In Canada, the provinces have much more authority, granted by the Constitution, for resource management than the U.S. states. However, when binational issues are involved, the role of the provinces is much less certain. In addition, as the definition of water has shifted so that it is no longer considered a proprietary resource owned and controlled by the provinces, the jurisdictional roles of the federal and provincial

governments have become even more blurred. According to the Canadian Environmental Law Foundation (1986), it is "impossible to define precisely the respective roles of the federal-provincial governments in water management." It is perhaps this shared authority and omnipresent jurisdictional uncertainty that has given rise to the extensive use of federal-provincial management agreements (e.g. Canada-Ontario Environmental Accord, Canada-Ontario Flood Damage Reduction Agreement). According to MacNeil (1970), "It is difficult if not impossible to visualize any political or institutional structure, or any system of powers, that would reduce the importance of such cooperation or that would work without it." Provincial governments have generally the same characteristics of the Canadian federal government, regarding the primacy of the executive branch, the formation of policy within the civil service, and preference for broad interpretation of existing legislation.

Intra-state and Intra-provincial Regional Institutions

These institutions are multi-jurisdictional arrangements, within a single state or province, formed for the cooperative and coordinated management of a shared resource or addressing issues of joint concern. They often have a hydrologic or resource-based geographic distinction. They include joint county/municipality management boards, regional development councils, intrastate special districts, watershed councils, conservation authorities, task forces, and interagency working groups, among others.

In most instances, intra-state and intra-provincial regional institutions are membership organizations comprised of and financially supported by communities within their geographic jurisdiction. Thus, they have many of the same characteristics as other regional institutions, including limited autonomy, a focus on "soft" management activities, potential for flexibility, sensitivity to the political climate of member jurisdictions, and the critical need for political support for effectiveness. The importance of intra-state and intra-provincial institutions cannot be overstated. Localized zoning decisions, shoreline development activities, erosion control, floodplains and agricultural practices, to name a few areas typically under the purview of these institutions, have a tremendous cumulative impact on Great Lakes resources. Intra-state and intra-provincial institutions can serve a valuable function as the "field level" component of a broader regional effort, substantially increasing program effectiveness. However, the role of intra-state and intra-provincial regional institutions in Great Lakes management is complicated by their typically parochial perspective; because they are comprised of local jurisdictions that generally represent only a relatively small constituency, they are less capable of responding to system-wide concerns, without incentives (financial or legislative) from higher levels of government. This can result in conflict with higher levels of government when parochial concerns are inconsistent with broader regional concerns.

Local Institutions

These institutions include agencies and their linkages operating within a single local jurisdiction, such as a municipality, township, or county.

In the same manner that the U.S. states have been delegated authority for resource management by the federal government, the states have typically, in turn, delegated authority for land use policy and decision making to local governments. Similar delegation of authority has occurred in Canada. Local institutions are also very important in the Basin governance system. Localized zoning decisions, shoreline development activities, erosion control, floodplain and agricultural practices, etc. are typically under the purview of these institutions, and have a tremendous cumulative impact on Great Lakes resources. Nowak (1988) documents the diversity of local institutions with jurisdiction along the Great Lakes shoreline. Two characteristics shared by local institutions, however, have important implications for Great Lakes management issues. First, local institutions are precisely that: local. They typically have only a parochial view that may be inconsistent with broad regional or system-wide concerns. Second, local institutions are very sensitive to constituent pressures. Even where their policies may be consistent with a regional perspective, there is often tremendous pressure by constituents for local institutions to provide variances and allow actions inconsistent with established regulations. As with intra-state and intra-provincial institutions, local institutions can serve as the critical "field level" component of broader regional efforts, but only within the limits that their parochial view and sensitivity to constituent demands enables.

Nongovernmental Organizations

In addition to the various governmental institutions with a role on the Great Lakes management arena, there is a growing cadre of nongovernmental organizations (NGOs) with a substantial influence in the formulation and direction of Great Lakes management policy. Their omnipresent influence on Great Lakes policy at all levels of government demands that they be reviewed in the context of the institutional setting.

NGOs are generally of two distinct types: those organizations with broad resource management interests capable of impartial and independent functions, and those with a narrow issue-oriented focus directed toward promotion or advocacy of their views. NGOs include institutes within colleges and universities, foundations, nonprofit organizations, citizen groups, property owner associations, professional associations, business round-tables, trade groups, labor groups, and business/industry coalitions, among others.

Although they lack the public standing and direct management authority vested in governmental institutions, NGOs possess a number of characteristics that contribute to Great Lakes management efforts. Not subject to the often extensive jurisdictional constraints that limit public institutional activity, NGO mandates tend to be flexible and thus NGOs can be comparatively more responsive to emerging issues. NGOs have substantial followings within the region and have a proven effectiveness in swaying public opinion and influencing the direction of policy action. NGOs, particularly those with research and education functions, can complement and support the governmental sector by assuming or strengthening roles left

unattended due to staffing or financial limits that typically plague public institutions. In some respects, NGOs are immune from the bureaucratic procedures and diplomatic protocols ruling the actions of a public institution in domestic and binational arenas. Thus, with the possible exception of watchdog or advocacy NGOs, they often enjoy a high level of access to, and cooperation from, governmental institutions. Finally, because they have no governmental affiliation, impartial and independent NGOs can serve as effective intermediaries between and among governmental and private sector interest groups, by providing a forum for constructive interaction.

There are, however, several weaknesses associated with the use of NGOs in the management of resource use issues. Because they are accountable to their own boards of directors or constituents, NGOs are less accountable to the general public as compared to governmental entities (in principle, at least). NGOs are dynamic, typically without the stability, longevity, and resources for a sustained commitment for influencing management. The NGO setting is a very complex, crowded one in which there are no mechanisms, beyond rudimentary coordinative efforts, available to structure and allocate functions among often competing organizations. This complexity can have a detrimental effect in the sense that the advocacy groups can neutralize each other's efforts and duplication of effort can occur as research institutes compete to establish and assert their roles.

9.3 THE ISSUE OF COMPLEXITY

Complexity is a fact of life in the existing system of Great Lakes governance. Over the years, a number of researchers have attempted, for various reasons, to inventory and document the management functions of all or part of the Great Lakes institutional setting. Many have found the task almost overwhelming. For example, Bulkley and Mathews (1973) identified 650 governmental units, from the local to international level, with jurisdiction over the Great Lakes shoreline.

The current institutional setting is actually a rational response to several inherent characteristics of the Great Lakes system and governmental behavior. Certainly, by virtue of its expansiveness alone, one might infer that management of Great Lakes resources demands a complex, multi-jurisdictional approach. Water bodies have historically been used as convenient lines to separate political jurisdictions, and the Great Lakes Basin is no exception. In addition, the nature of the system, essentially a series of large reservoirs with continuous but constrained outflows, has historically obscured the interconnectedness of the lakes and the need for system-wide management. Thus, many governmental units were organized to focus only on hydrologically distinct parts of the system. The Great Lakes Basin also represent an intensively used "common pool" resource shared among a wide variety of interests, each seeking to influence (directly or indirectly) resource management policies and programs of governmental institutions. At all levels of government, resource management functions tend to be compartmentalized and geographically defined, to focus on specific constituencies. Hence, there is a large number of governmental entities

throughout the region, many with distinct policies, programs, and management functions; even when agencies share similar goals, they generally have distinctly local orientations. Finally, despite its importance to the region, the Great Lakes system is not the dominating economic, social, or political feature. Water resource management must be accommodated within the organization of other governmental functions (e.g. transportation, education, economic development, social support).

Institutional complexity also results from adaptation to new knowledge, whether scientific, social, or political. Adaptation of the institutional setting to emergent knowledge culminates in one of three responses: 1) internal re-ordering and/or expansion of management processes within existing institutions, 2) formation of inter-institutional linkages, or 3) creation of new institutions. In each case, increased complexity is the outcome. These responses largely result from the tendency toward institutional inertia endemic among governmental bureaucracies. The adaptation of government structures to a changing environment is typically subtle; changes are, in general, incremental and prolonged. Rather than responding with dramatic alterations to the status quo, the established political jurisdictions tend to resort to ad hoc working groups, inter-governmental committees, interagency agreements, and a host of other "soft" management forms in lieu of dramatic changes to their own structure and function. As Schon (1971) explains,

> "When the problems and crises disappear or change drastically in nature, the old organizational structure persists. In government, as in most other established institutions, the organizational equivalent of biological death is missing... Everything known about changing organizations indicates that change in bureaucratic organizations is a slow and difficult task, resisted by the organization itself."

Great Lakes governmental entities and their linkages are largely products of this phenomenon of "dynamic conservatism." Rather than subject themselves to dramatic change to address emerging challenges, established institutions appear willing to sanction (or at least practice indifference to) new mechanisms. As a result, numerous regional institutions have been established over the years, each carefully designed to remain accountable to established political jurisdictions, while filling previously unaddressed needs.

The abundance of agencies and organizations, each with their own associated laws, agreements, mandates, and directives, can be overwhelming for interest groups wanting to ensure that their concerns are incorporated in Great Lakes management, especially if they are not well-informed about the governance system. Thus, among some interest groups (e.g. some riparian sub-classes) there is a strong sentiment for establishing a central authority responsible for overall Great Lakes management. Such sentiment also plays on the typical preoccupation that political leaders have with "newness", who find it more advantageous to create new institutions or institutional mechanisms than to review and refine existing ones. As the Great Lakes Basin Framework Study (1975) observed, "The easy solution when things are not working as desired is to create a new institution. The more

difficult approach, but undoubtedly more effective in the long run, is to build new relationships among existing institutions." Yet, such approaches are generally studiously avoided, in favor of "new" initiatives, policies, or institutions.

However, it's clear that a central authority is not necessarily the best approach. As noted by Ingram (1973),

> "Multiple-issue watershed management organizations are not created into an empty world. Instead, a web of relationships already exists among federal, state, and local agencies and interests groups... Political considerations cannot be sidestepped by granting...[the] organization more formal authority. ...decisions are going to be made by process of negotiation and consent-building, not by fiat of...[the] agency."

Any central authority would face the same limitations as existing regional institutions. Regional institutions are embodiments of, and therefore constrained by, the prevailing political support of member jurisdictions. They generally have only limited autonomy, being directed by and therefore accountable to, the political jurisdictions which comprise their membership. At times, their political support can be limited, as their member jurisdictions spurn regional cooperation when domestic interests are of more immediate concern. In brief, regional institutions can do only what the member political jurisdictions allow them to do. As a consequence, the preponderance of past and present Great Lakes regional authorities have only "soft" management capabilities. In only relatively few issue-specific cases have they been permitted (or have taken the initiative) to assert themselves as the guiding force for the breadth of the region's resource management efforts. Ultimately, regardless of intentions, the consequence, as Kelnhofer (1972) notes, is that "no one is in charge."

Complexity actually doesn't appear to be the primary institutional problem at all. Based on interviews and questionnaires administered to a cross-section of individuals associated with the Great Lakes management effort, Donahue (1987) found that those individuals knowledgeable about the governance system didn't consider sheer complexity to be a significant problem. As Donahue (1987) points out, the problem of jurisdictional complexity is "undoubtedly overstated by a generally ill-informed, confused public and milieu of special interest groups." Thus, consolidation or outright elimination of institutions for the sole purpose of reducing the number of "players" is inappropriate; concerns of inefficiency or ineffectiveness must also be present.

While not the primary problem, institutional complexity does pose some secondary difficulties. While both federal governments, upon close examination, have clear and consistent policy themes promoting informed private sector decision making and prohibiting cost-shifting to the environment or general taxpayers (as explained in Section 5), general perceptions are that no such clear expectations exist. Thus, management

organizations seldom receive the appropriate level of attention and oversight to evaluate their success in meeting policy expectations. In addition, marginal performance tends to be rewarded by silent approval, as it generally raises fewer "turf protection" issues that could trigger the active interest of numerous jurisdictions. Institutions that do lose in "turf battles" (due to being less efficient or adaptable than other institutions) don't cease to exist, but generally remain as marginally functioning components within the overall institutional setting. Correction of such tendencies requires establishment of measurable goals and objectives, a system of accountability for institutions, performance evaluation procedures, and a mechanism to withdraw "marginal" institutions.

In addition, the multiplicity of government organizations can result in different agencies having different goals, even within the same level of government. This can result in increased confusion and conflict among interest groups. However, government agencies often, in effect, represent distinct constituencies. Thus, while there should be consistency among the broad policies that scope agency efforts (e.g. informed private sector decision making, prohibition of cost-shifting), other policy differences may be appropriate.

9.4 THE CURRENT DECISION MAKING PROCESS

Review of the positions of interests (Section 7) and the policies of governments (Section 5) suggests that more than sheer institutional complexity is the cause for the confusion and frustration of some interests. Thus, reduction in complexity alone will not resolve conflicts related to Great Lakes levels issues. Problems related to existing institutional structures and operations appear to be more serious than the problem of complexity. In particular, relatively recent social changes have tremendously reduced the effectiveness of traditional decision making processes. It is becoming increasingly difficult to develop implementable resource management decisions using the traditional administrative procedures of the past several decades.

Beginning in the late nineteenth century, professional resource managers largely replaced politicians in making decisions about the use of U.S. public lands and waters. Although negotiations between some powerful interest groups and the resource managers may have been common, the public generally had great faith in science and technology, which translated into public respect for the decisions of "experts." As resource decision makers are well aware, however, the picture is much different today; massive social changes occurring over the last four decades have led to conditions reigning in the discretion of professional managers. Because of these shifts, conflicts over the use of natural resources are much different in the 1980s than in previous decades. More interest groups, with a greater diversity of concerns and values, are involved in efforts to influence resource decisions, and agencies are finding it difficult to satisfy all these competing interests. Although many resource decisions are initially made by government agencies using established administrative procedures, the final decisions are increasingly being decided through the courts after a suit is filed by a group disgruntled with an agency decision, or by new

legislation after a group takes an agency decision into the political arena. As a consequence, the resolution of resource disputes is becoming more costly in terms of expenditures, agency resources, opportunity costs, and time. Decision making can be stymied for years in administrative appeals, legislative hearings, and legal battles. In addition, key issues that are really at the heart of the dispute aren't always addressed; instead, groups contest agency decisions on procedural grounds. Because the issues that underlie the conflict aren't addressed, the conflicts typically aren't really resolved, and they simply manifest themselves in other resource disputes.

The standard approaches traditionally used by agencies to address the concerns of diverse groups interested in a specific problem include public involvement campaigns and opportunities for public review and comment. Agencies ask for public input, conduct the evaluations themselves, return to ask for public review, and then make the decisions internally. The agencies assume that the public will recognize and appreciate the logic, objectivity, and rationality of their evaluations and decisions. However, the interest groups only see a "black box"; they don't see how their input affected decisions, how their concerns were accommodated or why they couldn't be, how the issues were synthesized, or the rationale in getting to the final decision. As interest groups become more numerous and diverse, it is more difficult for agency personnel to fully appreciate the merits of all the interests and forecast what tradeoffs will be acceptable to each group. In addition, not even scientists and governments can make technical judgements without also making value judgements; unfortunately, those technical judgements simply obscure the critical value choices that were made. Relying on professional expertise to assess values and make the inevitable tradeoffs results in mistrust of those "experts" and dissatisfaction on the part of interest groups affected by the decision.

Because of dissatisfaction with the traditional decision making process and the resulting decisions, interest groups are likely to contest the evaluations when the stakes are high. Typically, the groups contend the evaluations were incomplete or inaccurate, the process was flawed or subjective, or that the resulting decisions allocate resources in an unfair or inefficient manner. These disputes over the evaluation or decision can harm an agency's image and effectiveness in other areas.

One of the most illustrative examples of the failure of traditional decision making processes is the U.S. National Forest Service (USFS) Roadless Area Review and Evaluation experience (Wondolleck, 1985, 1988). According to Wondolleck, the USFS was quite aware that large interest groups had competing concerns and high stakes in the USFS designations, and that much of the general public, via the media, would watch the USFS decision making process closely. The USFS decided the best approach would be to involve the public and interest groups in each step of their decision making process; they planned for massive outside involvement. The agency conducted 227 workshops nationwide and involved over 17,000 people, just to determine the initial criteria for evaluating the roadless areas. A public review process brought forth another 50,000 comments that the agency considered in developing the final criteria. Those criteria were

used to evaluate 10 wilderness designation alternatives; 264,000 comments were received from 360,000 people when those evaluations were submitted for public review. In spite of all this effort, the resulting USFS wilderness designations were lambasted by all interest groups, considered a "signal failure", and eventually rendered invalid by the courts.

The public involvement effort of the USFS was tremendous. Large numbers of a wide variety of interests participated and their level of involvement was high. However, according to Wondolleck, the process itself, the manner in which people were involved, was inadequate. While the agency used the public to develop a "data base" that acknowledged the different values of the competing interest groups, it was the agency personnel who made the highly judgmental tradeoffs -- without the participation of the interest groups. Because the groups weren't involved in determining the key issues, developing alternatives, evaluating alternatives, and making the key tradeoffs, they couldn't understand or accept the tradeoffs made by the agency.

Similar dissatisfaction with agency decision making is identified by Clamen (1988) in a review of past IJC water level studies. Criticized for the use of a rather "narrow view" of economics as the bottom line for recommendations on measures, Clamen notes that the economic analyses have not met with much interest group approval. The reported economic analyses have been further criticized for not recognizing the possibility or costs of remedial or compensatory measures. Clamen also identifies criticisms for ignoring a range of evaluative criteria, especially social criteria. As well, environmental interests have argued that habitat needs and impacts were not fully considered in the decision making process, since natural resource criteria were not included in any evaluations. This suggests that, had the IJC studies resulted in any agency actions to implement measures (rather than the "do nothing" and "additional study" measures), there would have been demands for more analyses and reevaluation, and perhaps actions to prevent implementation. Demands from some interest groups dissatisfied with past IJC water level studies resulted in the present reference study and reflect the ability of those groups to influence government action. Given the disparate perceptions, values, and concerns of the many Great Lakes interest groups (described in Section 7), it seems inevitable that there will be dissatisfaction with results of the present reference study which call for implementing or not implementing specific measures; that dissatisfaction will likely be expressed by action in the legal or political arenas, to prohibit or force specific measures or reevaluation.

9.5 TOWARD ENHANCED DECISION MAKING CAPABILITIES

Better issue management and resource decisions are possible by improving the process for making decisions. The key change must be to attempt to build consensus among the various interest groups that have some stake in a resource decision. There are many approaches for trying to achieve this consensus, all generically termed alternative dispute resolution (ADR) processes. ADR supplements, rather than replaces, traditional

administrative, legislative, or judicial processes. While decision making under an ADR process may be guided by professional experts and based on scientific management principles, the distinguishing characteristics of an ADR process are that 1) interest groups are actively included in developing and assessing alternatives and in making tradeoffs between alternatives, and 2) issues are decided on their merits rather than on the mettle of the various interest groups. The four principles of ADR are: 1) focusing on the issues, not the individuals or groups involved, 2) focusing on understanding the positions of interests and the concerns which underlie their positions, 3) inventing options that provide for mutual gains, and 4) using objective criteria, both for assessing substantive issues and for procedures.

ADR processes are especially important when the issues are complex, decisions require value judgements, and when technical expertise is limited. The use of ADR is becoming more common as agencies become familiar with the process and as a history of success develops. In particular, ADR has proved useful in a variety of public disputes, including USFS forest management planning (Wondolleck, 1985); the allocation of costs among parties at Superfund sites, hazardous waste facility sitings, EPA rule making (Rich, 1985); offshore oil drilling (Scott and Hisrch, 1983); port developments and dredging, water supply reservoir development, small-scale hydroelectric power projects (Bingham, 1986; Kirn and Marts, 1986). There exists a wide variety of ADR approaches available for use in public resource conflicts, differing primarily by the level of involvement of a neutral intervenor. These approaches include unassisted negotiation, facilitated policy dialogues, collaborative problem solving, mediated negotiation, non-binding arbitration, and binding arbitration.

A consensus-building, or ADR, process offers important advantages over traditional approaches to dealing with the conflicts inherent in resource issues and decision making. The interest groups focus directly on the issues of concern, not simply on stated preferences regarding alternatives that might only indirectly satisfy their concerns. The groups focus their energies on devising and supporting mutually acceptable proposals, instead of finding fault with agency decisions. Because the interest groups are actively included in the actual decision making process, they feel a sense of ownership in the problem and the solution; thus, they have a stake in seeing that the ultimate decision is supported and implemented. Consensus between competing interest groups enhances the credibility of the decision among the general public and may help implementation endure even through changing political conditions. Interactions between competing interest groups and agencies are shifted from the adversarial nature of administrative hearings and public review (often viewed as "charades" by the participants), to the more positive nature of collaborative problem-solving, improving prospects for better long-term relationships and discussions on other issues as well.

For disputes with a strong technical dimension, ADR uniquely offers the potential for groups to change their positions based on the learning that occurs during direct dialogue with other groups. Negotiations foster critical questioning of each group's assumptions and rationale for their positions, and exposes inconsistencies or inadequacies in their perceptions.

As each group learns the merits of other groups' positions, they must reevaluate the adequacies of their own. While this learning process doesn't guarantee that groups will change their position, ADR provides a much better opportunity for it to occur than traditional public involvement efforts.

The process also can offer important advantages to agencies faced with making decisions that are otherwise likely to be controversial. The primary benefit is the increased efficiency of the entire management process. While the initial decision making may take longer, the decisions are less likely to be contested and implementation proceeds much smoother. Risks for extended conflicts between the agency and groups are reduced, as are the adverse publicity and severe drains on agency resources that usually result from formal hearings and administrative appeals. Prospects are improved for voluntary compliance with any agency mandates resulting from the process. Another benefit, that shouldn't be discounted, is that a successful ADR effort can improve an agency's image; they may be seen as reasonable, competent, and able to provide strong leadership for making difficult resource decisions.

Even when ADR doesn't result in a signed and implemented agreement, it still offers advantages over traditional agency decision making. Buckle and Thomas-Buckle (1986) interviewed participants in a wide variety of negotiation efforts where the mediators thought the process had failed because no formal agreement was reached. Most participants in the negotiation, however, considered the process successful, either because it contributed to successful resolution of the dispute in some other forum or improved their ability to handle potential conflict situations.

A complete, explicit ADR strategy at the outset of initiating the process shouldn't be expected, and isn't necessary for successful results. Typically, the "rules of the game" are determined each time ADR occurs. In addition, public disputes evolve and shift too much to expect any planned strategy to remain unchanged. Sufficient structure is provided by simply dividing the process into four general phases: conflict analysis, pre-negotiation, negotiation, and post-negotiation. Although the phases are presented in the context of negotiations, they are applicable for any ADR process.

- **Conflict Analysis**

  Success with an ADR process requires that the conflict itself, not just alternative solutions, be analyzed in detail. Even if the incentives for reaching agreement are high, inadequate conflict assessment will often result in failed negotiations. A conflict analysis is not intended to provide a solution to any dispute, but it does offer a non-partisan perspective on the dispute as a precursor to helping interest groups develop their own solution. A conflict analysis must address all three areas to be dealt with in an ADR process: interest groups, their relationships, and the substantive issues. All interest groups that have a stake in and can influence the outcome of the dispute must be identified, including those groups that may become involved for reasons

outside the primary dispute (e.g. only if certain alternatives are proposed). In complex disputes, it may not be possible to identify all interest groups, but at least the entire range of interest groups should be identified, along with their goals, values, attitudes, motivations, and perceptions.

Examination of the relationships between interest groups reveals whether a dispute is escalating or settling down, the distribution of power among groups, and the level of trust among groups. Analysis of the substantive issues is concerned with identifying the central issues in the dispute, and alternative solutions proposed by each group.

At least some government agencies will usually have to approve any agreement produced via an ADR process, and many agencies control the means for implementation. Those agencies must be considered as interest groups and be included in that capacity in any ADR process. Without their participation, the agencies will likely be unable to support the agreement or its implementation due to inconsistencies (process or substance related) with their statutory mandates. Including agencies as ADR participants also helps maintain a high level of commitment to the process on the part of groups that will have a continuing relationship with the agency; those groups may have difficulties with the agency on other matters unless they participate fully and in good faith. Different government agencies, even from the same level of government, must be considered as different interests. Due to the plethora of legislation affecting a single resource, there are often disputes among agencies based on their jurisdiction, conflicting statutory mandates, their focus on serving different clientele (e.g. energy, commercial fishing, wetland interests), and different agency styles and operating procedures. These conflicts can also exist between different units within an agency, requiring that they be considered as different interest groups as well.

- **Pre-Negotiation**

Pre-negotiation typically takes more time than actual negotiations, but should not be short-changed. Where there is no institutionalized structure for an ADR process, substantial effort is required of each interest group before any negotiations actually begin. Activities that must be conducted during pre-negotiation include: 1) identifying interest groups and their representatives that should take part in the negotiations, 2) determining if a mediator is required and if so, selecting a mediator acceptable to all involved groups, 3) determining the procedural ground rules for subsequent negotiations, 4) setting an agenda for the range and order of issues to be considered, 5) identifying and allocating the resources to support subsequent negotiations, from technical assistance to travel funds, 6) initiating joint fact-finding by determining the types of information and analyses needed prior to or during negotiations, 7) training the ADR participants in negotiation skills, 8) generating initial statements of needs and concerns (not positions) of each interest group.

Where many issues and participants are involved, a team of mediators may be most effective at managing the ADR process. It's essential that mediators be perceived by all involved groups as non-partisan. In addition, any resulting agreements are more apt to be seen as fair and efficient by the general public if a mediator is well-known and widely respected. Mediators must be acceptable to all parties, capable of using ADR techniques, and capable of understanding the technical issues underlying the dispute. This last point is somewhat problematic; when mediators have personal expertise in the issues, they may rely on their own assumptions and values rather than learning those of the involved groups, and they may color the participants' communications with their own independent assessment of the "facts." Discussions may focus on technical issues rather than values, and any resulting agreement is more likely to result from mediators "leading" the groups, reducing group commitments to implementation. At the same time, an understanding of the technical issues enables mediators to keep discussions focused, prevent misrepresentation of facts, and generate alternative solutions. In some ADR settings, the generation of alternative solutions is an important role for mediators.

- **Negotiation**

During this phase of an ADR process, the disputing groups work to find a solution that is voluntarily acceptable to all. Key activities in this phase include: 1) identifying the underlying concerns of the interest groups, including their relative importance, 2) inventing and evaluating alternatives, 3) developing a negotiating text, and 4) preparing and signing a final agreement. In addition, joint fact-finding usually continues.

Where perceptions, values, and concerns coincide between groups, there is certainly potential for discovering alternatives to satisfy those groups. However, disagreement about them does not preclude eventual agreement on a solution. In fact, those differences make tradeoffs possible, because one group may see a specific component of an alternative as providing large benefits while another may see it as only costing a little. Some common differences in interests that make tradeoffs possible include economic vs. political considerations, internal vs. external considerations, symbolic vs. practical considerations, short-term vs. long-term time horizons, progress vs. tradition, precedent vs. concern for just this dispute, and the acceptability of monetary vs. non-monetary compensation. Differences among interest groups in their probability assessments of uncertain future conditions (e.g. economic, climatic) can be accommodated via contingency agreements; given their different projections of the future, each group can, in effect, "bet" so as to maximize their respective expected values. Differences in risk tolerance can lead to risk-sharing agreements, with the more risk-tolerant groups obtaining gains of some other type as compensation from risk-averse groups.

A negotiating text links all issues (or groups of separable issues) together in a package deal combining alternatives created during the

negotiation process. Throughout the evolution of alternatives and negotiating texts, each interest group must evaluate how each successive plan satisfies their needs and concerns (i.e., criteria) identified earlier in the ADR process. No attempt should be made to do a single evaluation for all groups; rather, each group must conduct its own evaluation based on its own criteria. However, even groups with identical criteria can view a single alternative differently when there are disagreements over data. Data disagreements can occur over base-line conditions or the probable impacts of an alternative, but groups may agree to use a common data base and models, or to accept those provided by independent, mutually respected experts. Alternatively, each group may be expected to share the information they intend to use to support their views; other groups may comment on the information and explain any potential objections to the validity of the data source, data collection techniques, or data interpretation.

o **Post-Negotiation**

An ADR process isn't finished with the signing of a written agreement. Like pre-negotiation efforts, post-negotiation typically requires more time than the negotiations and it's importance shouldn't be discounted. Post-negotiation includes activities to 1) bind groups to the agreement, 2) monitor implementation, 3) develop renegotiation contingencies (e.g. substantial political, economic, or climatic change), and 4) evaluate the process. The framework for the first step is generally developed during the negotiation phase, but the actions are initiated only after all groups have formalized their agreement. Stakeholder groups may have agreed to post performance bonds, make administrative rulings, provide compensation, or other actions; agencies may need to seek legislative approval to comply with specific provisions, or public votes may be needed to provide a mandate for action by governments. Influential individuals can be critical in convincing outsiders to go along with agreement provisions, especially if the outside groups must make sacrifices. Using negotiation participants in monitoring efforts can foster continued communication among the stakeholder groups and greater dedication to ensuring the success of the agreement.

ADR And The Water Levels Issue

Examination of the present Great Lakes institutional structure reveals that, even with the large number of diverse government organizations, there is no focused forum for ADR among interest groups (including government organizations). Regardless of incentives, the groups have little or no opportunity to explore options for trade-offs, compensations, or joint gains. Forums are required on several levels to manage issues involving different levels of government. Where binational or large-scale regional concerns are involved, a forum for ADR would be most appropriate within the IJC. The IJC is recognized as having a firm legal basis for managing boundary water conflicts, having a system-wide orientation, being able to provide for joint consideration of U.S. and Canadian concerns, being relatively impartial, having prestige and a positive public image, and having a solid technical capability within its staff, boards, and committees (Donahue,

1987). Use of ADR would not require any new authority for the IJC, since Title X of the Boundary Waters Treaty of 1909 empowers the IJC with a binding arbitration function in cases consented to by the U.S. Senate and the Governor General in Council in Canada.

While Title X has never been invoked to manage boundary waters conflicts, the use of ADR by the IJC does have precedent (Kirn and Marts, 1986). In resolving the decades old dispute over hydropower development and flooding in the Skagit River Valley of Washington and British Columbia, the IJC issued a Supplementary Order of Approval that made explicit the IJC's authority to determine the outcome of the dispute. The Orders also made clear the IJC's commitment to first allow the disputing parties to attempt to reach a negotiated, mutually acceptable agreement; the parties were clearly expected to forge an agreement among themselves. The willingness of the IJC to assert its authority to arbitrate the dispute, and then create a suitable forum for an ADR process was critical to the successful resolution of the dispute. Although not the original goal of the ADR process, the final agreement was culminated in a binational treaty between the U.S. and Canada, and additionally ratified by a province and a U.S. municipality.

Where concerns are restricted to a more local level (e.g. shore protection projects, localized dredging activities, development of shoreline zoning regulations), federal, state, or non-governmental forums for ADR may be more appropriate. Although a forum within the U.S. Army Corps of Engineers or Environment Canada may be suitable, the use of agency personnel as mediators would be inappropriate where decisions by those agencies are required (e.g. where they must approve agreements or where they control the means for implementation of any agreement, via funding or the issuing of permits). Rather, either agency should be considered as a separate interest group, or as the lead agency making a commitment to use ADR to settle a dispute among interest groups and proceed according to the agreement developed by the groups. In such cases, interest groups may accept a mediator from a government agency with no involvement in any potential decision making (e.g. the U.S. EPA or NOAA mediating ADR concerned with a joint USACE/state/municipality shore protection project). Where the dispute involves only state/municipal or provincial/municipal interests, a federal agency mediator (including the USACE or Environment Canada) may be appropriate. The role of non-governmental organizations (those with broad resource management interests capable of impartial and independent functions, not those with a narrow issue-oriented focus directed toward advocacy of their views) in providing a forum for ADR or acting a mediators should not be overlooked. Use of these organizations would be appropriate for disputes operating at federal, regional, state, and local levels.

ADR processes hold tremendous promise for dealing with levels issues in the Great Lakes - St. Lawrence River Basin. As Section 5 explains, there is strong consistency between U.S.and Canadian federal policies calling for informed private sector risk-taking and prohibition of cost-shifting to the environment or general taxpayers. However, that consistency is often overlooked by interests, and there are important differences in other policies

(e.g. support for hydropower, waterborne navigation, recreation) that affect Great Lakes management. In addition each federal government has concerns about preserving its sovereignty and the primacy of the federal level of government vis-a-vis the states and provinces. On the other hand, the state and provincial governments clearly play a critical role in Great Lakes levels issues; they have tremendous responsibilities (delegated and Constitutionally-derived) related to use of the lakes. The Great Lakes Charter and the Great Lakes Protection Fund illustrate that the state and provincial governments recognize that their commitment to collective action promises increased benefits for all, compared to independent actions that may provide short-term benefits to a single jurisdiction but promise long-term costs for all. However, the states and provinces also have concerns about program funding, their sovereignty, and their role vis-a-vis the federal governments.

A facilitated policy dialogue or collaborative problem solving process involving the federal, state, and provincial governments could serve to make clear the consistencies between policies among the jurisdictions, and their joint and separable obligations to implement programs consistent with those policies. Facilitated policy dialogues focus on building trust and establishing avenues of communication among groups with different views on public policies; a facilitator typically helps the groups exchange views, share information, and clarify their commonalities and differences. Collaborative problem solving is much the same, but with the additional goal of finding solutions to problems defined in terms of the interests of all involved groups (in this case the federal, state, and provincial governments); this joint problem definition helps the groups look beyond their own, more narrowly conceived, concerns.

An important product of either process would be a consensus statement concerning their common policies and joint and separable obligations. Such a statement could be embodied as a convention, agreement, charter, memorandum of understanding, joint communique, or as diplomatic notes, depending on the level of stature the participants would be willing to vest in their consensus statement. Recognizing the U.S. federal government's historical reluctance to allow the states an equal role at the policy-setting level, any ADR process may need to be conducted on several levels, with consensus statements developed at joint federal, federal/state, and federal/provincial levels. Even if the U.S. federal government were unwilling to involve the states in such a process, a consensus statement between the U.S. and Canadian federal governments would still provide a clearer understanding of the federal policies affecting Great Lakes interest groups.

ADR processes can also serve as a vehicle to inform specific interest groups about the Great Lakes system, its governance system, and the concerns of other interest groups. ADR fosters critical questioning of each group's assumptions and rationale for their positions, and can expose inconsistencies or inadequacies in their perceptions. As each group learns the merits of other groups' positions, they must reevaluate the adequacies of their own. This mutual learning on the part of the various interest groups can be best assured by using as interest group representatives those

individuals that are influential within their group, and by making use of a facilitator or mediator.

Considering the tremendous number of interest groups throughout the Great Lakes system, this application of ADR would be most effective when managing disagreements or resolving disputes on a more local level (e.g. related to shore protection projects, development of shoreline use regulations, determining the distribution of costs associated with a dredging program). Used in this manner, the success of ADR should be judged on the extent to which the process 1) helps the groups obtain a sound knowledge about the facts surrounding the decisions to be made, 2) helps the groups clearly understand the relevant formal and informal precedents affecting the decisions to be made, 3) helps the groups develop an accurate knowledge of the concerns and strategic options of all groups involved in the dispute, and 4) persuades the groups to act according to clear perceptions about the facts, precedents, and the concerns and options of all disputing interest groups. Success will be contingent upon lead agencies making the commitment to use ADR in their decision making and clearly defining the goals of the process. Without a clear goal, the process may founder as participants are uncertain whether they are expected to reach agreement or simply acknowledge the perspectives of other interest groups. (For more information on government organizations and the ADR process refer to documents listed in Appendix 4.)

SECTION 10

FINDINGS AND RECOMMENDATIONS

10.1 SUMMARY OF FINDINGS

This report has sought to highlight the key challenges and opportunities for more effectively managing the on-going water levels issue in the Great Lakes - St. Lawrence River Basin. Governments become particularly sensitized to the issue when interested parties petition governments for action. It is apparent that government agencies and other interests, and even groups and individuals within interests, do not share a common understanding of the physical and governance systems of the Basin, nor do they share a common opinion on the actions governments should initiate. There are further differences, among and within interests, in the values and philosophies which also contribute to forming the various positions taken by interested parties. These differences in perceptions and disagreements over government actions represent a central challenge to the management of the lake levels issue.

In this situation, where experiences, factual understanding and values vary so greatly, it is extremely difficult to establish a basis for evaluating the merit of interests' petitions and the appropriateness of alternative courses of action by governments. The approach taken in this investigation was not to develop some new and necessarily arbitrary criteria, but rather to identify those principles already established in government policy. Existing policies of governments were reviewed to isolate those themes, or principles or "ground rules" which define the onus of governmental responsibility and set the basis for government actions.

The analysis of federal and some provincial and state policies has indicated that common themes do exist between the two nations. Governments in both nations are committed to the development and dissemination of information so that individual or corporate interests can make "informed and responsible" investment decisions to utilize the various services of the Basin. Governments in both nations seek to enhance the resiliency of interests' activities, to reduce the shifting of costs by interests to others, to provide economic development subject to environmental protection, and to assure public involvement in decision making. These policy themes provide the foundation for interpreting the positions of the interests, and for isolating those instances where government action is warranted, given the policy.

These policy positions of governments are not explicitly articulated nor are they widely known or understood (as became apparent in the analysis of the positions of interests). The interests include riparians (shoreline property owners), environmental groups, electric power, transportation and commercial and industrial companies, recreationists, commercial fishing and agricultural interests, native nations, and agencies of government at many levels. Each member of these interest classes makes decisions to use the services of the lakes and channels to receive some social or economic benefit from the water location or other attribute of the system. These investment decisions are based on certain assumptions including assumptions about the lakes, the levels

and shore processes, and about governmental responsibilities and policies. These decisions also involve certain costs and risks, including risk associated with lake levels and shore processes and government policies. The consequences of changing levels for interests' investments, and their understanding of governments roles and responsibilities have promoted various interests to petition governments for action.

Analysis of the positions taken by interests indicates the considerable disagreement which exists between and within interests with respect to the effectiveness and desirability of different measures. Measures to regulate levels and flows (Type 1) receive the most attention, with support coming strongly from riparian groups and with opposition most pronounced in environmental interests. Those not seeking Type 1 measures petition for the status quo or more localized responses. Generally, there is limited knowledge of, and little widespread support for measures which directly restrict (Type 3) or indirectly influence (Type 4) the uses of land and water. However, there does appear to be general, if unfocused, support for measures enhancing information, particularly about the physical system.

Investigations into why the interests take their positions and how these concerns and motivations relate to the policies of governments proved revealing. A major factor in the formation of positions is the expectation on the part of many interests for perceived "rights" to the use of lakes and related land resources. There is also a concern for fairness, both between lakes and between interests. In comparing the basis for petitioning to the policy themes of government, a number of interpretations arise, including surprise, lack of resiliency, benefit enhancement, and cost shifting. These interpretations and their implications for government action are considered in turn.

Many of the interests were "surprised" by some element of the system, such as the levels, the degree of flooding or erosion, or the failure of governments to do something about these things. "Surprise" is relevant to governments because of their commitment to "informed and responsible" decision making. Some interests lack resiliency to the costs of natural hazards, also a concern to governments when this reflects a failure in promoting informed investment decision or when it threatens an economic sector or creates widespread hardship. Some petitioning seems to seek a shifting of costs associated with an investment to others, in particular the environment or the general taxpayer. Government policies discourage cost shifting and seek to protect the environment. Other interests support a measure which would enhance the benefits to their investment, something governments approve of, but not by modifying the physical system at public expense or at cost to the environment.

An overriding conclusion from the analysis of the positions of interests is that there is considerable imperfection in governments' understanding of interests' perceptions and concerns, and there is considerable imperfection in interests' understanding of levels, physical processes and government policies. The objective of informed and responsible decision making has not been uniformly achieved. There is an urgent need for improvement in information about the probabilistic nature of lake levels, the existing controls and constraints on regulation of levels and flows in the system, the

relationship between levels and storm events and shoreline erosion and inundation, and especially about the policies and authorities of governments.

In some instances the information is not available, but mostly the problem is with dissemination of information. Policies generally are not rigorously articulated and are often difficult to unearth and interpret. As well, a multiplicity of agencies and sources provide information which often is or appears to be contradictory or misleading.

This complexity of government and non-governmental organizations present a challenge for managing the issue. Authorities and responsibilities are diffused over a large number of organizations, at all levels of government. The absence of a clear authority for monitoring and managing the water levels issue is a source of confusion and frustration. Indeed, the mix of institutions suggests for some interests that there may be a conspiracy against their welfare favouring others who know how and where the decisions are made. Nonetheless, the complex institutional setting is a reality of the governance system, and it does not preclude significant improvements in information dissemination and decision making.

The current process for making resource use decisions is far more complex than it was in the past. The fiscal and environmental constraints on governments are more pronounced, and a more active public demands a place in decision process. Despite governments' commitment to public involvement, such participation is not served by the current decision making structures. Much of the disagreement over the issue can be traced to the current institutional arrangements which are not designed to facilitate mutual learning or resolution of disputes.

The standard procedures involving technical evaluations of hydrology, engineering, costs and benefits conducted within agencies, with some public review and internal decision making is not well suited to better inform interested parties nor to identify areas of agreement.

Alternative decision making processes are available, including those which promote improved understanding of positions of interests, the exchange of information by involvement of interest influentials, and the seeking of areas of agreement. These decision procedures represent new and innovative opportunities for enhancing the management of the water levels issue.

10.2 RECOMMENDATIONS

What should governments do? The answer to this question depends fundamentally on what governments are responsible for. Hence the recommendations presented here evolve from the preceding findings relating to policy themes of governments, positions of interests, and institutional organizations and decision making.

The recommendations are directed to the federal governments of Canada and the U.S.A., who through the IJC, represent the principle Study clients. The recommendations recognize the roles of other levels of government and their

constituents, but focus on the federal governments' authority and ability to manage the multi-faceted issue associated with water levels in the Great Lakes Basin.

In managing the issue, one option is essentially to ignore it or divert the problem, not respond to recommendations of IJC Studies, and perhaps commission another study when another crisis situation arises. On the other hand, if governments do wish to manage the issue as indicated in the Reference for this Study, then some quite specific actions should be undertaken. Some of these actions can be taken immediately, and others require further investigation or development prior to action. In all cases the recommendations are designed to contribute to governments' ability to manage the water levels issue over time.

The multiple recommendations of this report should be considered as a package. There are linkages among the recommendations which mean that each is more defensible and has a greater logic when seen as part of an action program rather than an isolated activity. The recommendations themselves reflect the central challenge for governments of managing disagreements and petitioning by interests over what, if anything, to do about fluctuating water levels. To facilitate the management of this issue, governments must improve their ability to inform, both about the nature of the physical system and also about the policies and programs intended to direct the uses of the land and water resources of the Basin. It is not suggested that implementation of these recommendations will end disagreements or petitioning, but rather that there will be a means of managing these activities and enhancing communications so that all parties have more complete and consistent information, and hence that many of the sources of disagreement and petitioning will be removed or reduced. Together, these recommendations represent a strategy for government action.

The recommendations are organized into six broad categories:

- clarify governmental responsibilities and policies;
- inform interests about the physical system;
- enhance communications and decision making;
- declare a position on Type 1 (flow control) measures;
- develop non-Type 1 measures;
- establish contingency plans for extreme events.

1. GOVERNMENTS CONFIRM ARTICULATE THEIR POLICIES AND RESPONSIBILITIES.

There is a poor awareness of the policies of governments which define those matters of concern to interests which governments consider "policy relevant", and which define and limit measures governments will undertake and which allocate decision making authority to different governmental institutions. The confusion about the goals of federal and non-federal governments perpetuates disagreements and impedes management. The broad compatibility of policy themes provides a substantial opportunity for demonstrating that governing institutions in the Basin share common goals, for improving the decision making of individuals, and for developing a greater singleness of government purpose.

This broad recommendation may be elaborated via three sub-recommendations:

1 a. There be a formal federal government response to the recommendations of this Study.

The LJC is empowered only to offer advice and recommendations to the two federal governments; there exists no reciprocal requirement for response to those recommendations. Historically, responses from governments have been sporadic. A response, through some public forum, is recommended to better inform all players of the issue and of the governments' position, and to increase the effect of LJC activities on public and private decision makers in the Basin.

1 b. Governments release a joint statement on federal policy goals regarding the water levels issue, including a clarification of the current status of rights to levels and flows and to private land use.

There are common policy themes which the two federal governments use to define both the problems which governments consider matters of concern and the acceptability of measures. However, many interests are not well informed about these policies or their implications.

Many of the policy themes of governments will limit governments response to the specific requests for action by interests. Policy defines government program goals. For the federal governments, programs of information development and distribution are intended to improve interests investments in capturing lake services. Policies seek to reduce the ability to shift hazard costs, to increase resiliency, to promote economic development, subject to environmental protection constraints, and to assure public involvement in decision making. However, because in practice these policies may conflict and because policy is changing over time and subject to interpretation for specific cases, instances where the policy themes are not served by actual program administration can be cited.

While both federal governments programs strive to achieve the goals stated above, neither country has shoreline management authority (primarily Type 3 measures for management of shoreline hazards) vested at the federal level. Instead the multiplicity of provincial, state and municipal governments on both sides have to develop and administer such programs with federal assistance limited to information and technical advice. In this complex governing setting there will arise differences in program philosophies and program administration.

The apparent inconsistency in goals and programs among federal and non-federal governments confuses the interests, makes achievement of an agreement on levels issues difficult, and makes administration of

shoreline management programs difficult for local governing authorities. Governments failure to communicate policy themes serve to perpetuate conflicts between governments and interests. The compatibility of policy goals presents a substantial, but presently untapped, opportunity for enhancing coordinated, system wide management of lake levels issues. This is true even accepting the differences and exceptions to policy which do exist. A missing element is a unifying statement for the Great Lakes - St. Lawrence River system. Such a statement, cooperatively derived and approved, would provide a common focus under which all programs or measures would be pursued. By clarifying the policies and divisions of responsibility among the Basin's governing institutions, it would also greatly facilitate planning and decision making by interests.

Of particular note, is that interests perceive that they have certain assurances from governments regarding levels and flows and rights to use of the Basin's water and related land resources. As a result, interests petition governments to assure certainty of such perceived rights.
For example, there are expectations for government programs (e.g. dredging of harbours and connecting channels), rights to levels or flows by existing regulations (e.g. Superior regulation and 1958D) and rights to use of private property. However, there are some misunderstandings about the nature and limitations of these rights. To illustrate, the extent of federal dredging commitments for recreational and commercial channels is ambiguous, and thus, misunderstood; the capabilities and operational rules of regulation plans are not understood; rights to private use of land are expected to be "responsible", by not shifting costs of a land use decision to the environment or to general taxpayers; and land use is rarely restricted except to inform interests of risk, to reduce cost shifting or to achieve public goals of access or environmental protection.

The nature and limitations of rights must be made clear to the interests, but in doing so the commitment in principle to common policy themes should be well articulated. Included in this effort should be, at a minimum, the terms and plans for compensation for losses if regulatory actions result in modifications to the limits on Superior regulation, the operating rules for 1958 D, federal budgetary commitments to dredging, and the environmental constraints on dredging that may exist.

Hence governments' joint statement of policy goals should include a clarification of the current status of rights to levels and flows and to private land use. Governments may request the IJC to facilitate this effort under current or new study authority.

1 c. States and Provinces be made part of such a joint statement of policy goals and responsibilities.

The effectiveness of a joint statement will be limited unless non-federal governments are included. The Canadian federal government is the only level which can make a bilateral agreement with the U.S. federal government. But, in Canada, it is the provinces that have legal jurisdiction over many of the lake and coastal resources and their use. Thus, the Canadian federal government cannot implement an agreement, without making a federal/provincial agreement separate from, and subsequent to, a U.S./Canadian agreement. This makes it difficult for the Canadian federal government to initiate bilateral policies which require action in Canada. While the role of the U.S. states in Great Lakes levels-related issues is significant, their standing vis-a-vis federal interests has historically been poorly defined. The states presently lack a direct voice in negotiation of binational agreements, but have large financial and statutory responsibilities. Explicit specification of state roles would assist in assessment of budgetary needs , provide a benchmark for evaluating efforts, and guide the development of interstate arrangements to meet expectations embodied in the statement of principles.

The participation of the states and provinces in a joint statement could be by some U.S. and Canadian federal/state/provincial agreement, or by a U.S. - Canadian federal agreement developed concurrently with federal-state and federal-provincial agreements (e.g., present Canada-Ontario agreements). Governments may request the IJC to facilitate this cooperation under current or new reference authority.

2. GOVERNMENTS DETERMINE SPECIFIC INFORMATION NEEDS ABOUT THE GREAT LAKES BASIN SYSTEM AND DEVELOP APPROPRIATE INFORMATION BASES.

Governments ability to manage the lake levels issue depends upon its own understanding of the physical, policy and decision making setting. If information on these matters is confused or ambiguous, then interests ability to make informed and responsible decisions is compromised and the capacity of governments to better inform interests is limited.

Some interests have not anticipated the full range of possible water level changes and associated consequences, are not aware of physical processes involved, and are not resilient in response to level fluctuations and shoreline processes. As a result of this lack of awareness, misinformation, or misunderstanding, the policy of "informed and responsible decision making" by interests has not been achieved uniformly.

Many, but not all, riparian, and some commercial, recreational, and municipal interests appear to be genuinely surprised by the fluctuations in levels and shoreline processes. Members of these interests also expect programs of governments to assure resiliency to consequences they bear from these

fluctuations. Furthermore, there is evidence that these interests continue to be misinformed about the lakes and government programs. This is a major cause of the petitioning to governments.

In contrast, interests with large investments, such as power, transportation, industrial interests, as well as agencies of federal, provincial and state governments, are better informed. These interests have made investment decisions based on this understanding in order to be resilient to the changing physical conditions in the Basin. At times both the levels of information and resiliency are enhanced by government assistance. These interests have not petitioned governments for more levels regulation. However, because they have made investments for the currently expected levels and policy regimes, proposals to change either, (for example to modify 1958D regulation) may cause their objection.

Effective issue management requires that governments better understand the conceptual basis and data used in interest decision making. Certain information needs are sufficiently apparent to justify the following sub-recommendations:

2a. Governments gain an improved understanding of the interests, their knowledge of physical processes and policies, and their use of that knowledge in their decisions.

Government agencies are not well informed about the interests, clearly a difficulty in developing effective information programs. Notwithstanding the efforts of this study, there is limited knowledge about the nature and location of the interests and about how the interests make decisions given their understanding of levels' probabilities, shoreline processes and government policies.

2b. Governments develop improved information on the probabilistic nature of levels and storms, and related shoreline processes, and hazard mapping.

There remains a limited ability of governments to adequately describe in probabilistic terms the physical conditions and their implications for interests' investments in the Basin. Understanding the risks of these investments can not be equally achieved by all interests, especially if governments themselves do not have the basic analytical procedures, data and resulting studies to describe these risks.

2c. Governments should continuously review the basic state of knowledge about technical and policy matters related to lake level issue management.

3. GOVERNMENTS ESTABLISH VEHICLES FOR, AND COMMIT TO THE USE OF COMMUNICATIONS.

Management of the levels issue is hampered by governments' incomplete knowledge of the positions of interests and by interests' incomplete knowledge of the Basin's physical and governance systems. This situation arises, in large part, from institutional impediments to the involvement of interests in issue definition and investigation, and in decision making. Neither a new "super agency" nor an amendment to the Boundary Waters Treaty are required for a commitment to this process. Alternative dispute resolution (ADR) procedures should be used to foster mutual learning among interests and agencies of government.

This broad recommendation to improve information dissemination and communications requires attention to governmental organization, the processes for interest involvement, and the nature of information programs. Each of these mutually supporting items is elaborated on under the following sub-recommendations:

3a. Governments consider institutional reform to improve intergovernmental communication and articulation of policy position, and to enhance public involvement and the informing of interests.

The challenge to management of the lake levels issue results partly from the complexity of government organization. A large number of basin organizations have authority over some aspect of the levels issue. These are at all levels of government and at the regional and international level. Governments' authorities and responsibilities are diffused. The absence of a clear authority for monitoring and managing lake levels issues is a source of recurrent conflict in this issue. Indeed, the confusion of institutions creates in some interests minds the possibility that there is a conspiracy against their welfare favouring others who "know how and where decisions are made". Nonetheless, a complex institutional setting is the reality for the Great Lakes governance system. Any proposed institutional response must accommodate this situation. Any shortcomings will not be corrected simply by creating a new, omnipotent agency.

Institutional reform is needed, but such reforms should stress i) improved intergovernmental communication and articulation of joint policy positions where ever possible, and ii) innovative public involvement processes to better inform the interests. The core of coordination is communication, not authority. Rather than a single super agency, there should be forums for inter-jurisdictional information sharing, program coordination, and development of basin policies.

Governments may request an IJC review of, and recommendations for organizational reforms needed to assure program and goal coordination and issue management.

3b. Governments establish the authority to investigate, design and initiate a process to improve the involvement of interest leadership and governments in the management of the levels issue (e.g. with the IJC under the existing or new reference).

Governments' commitments to communication and public involvement are also impeded by current approaches to basin planning. The current planning model is largely a "fact-finding" exercise, whereby technical experts define alternatives and evaluate these for technical feasibility and reliability. This approach is appropriate for designing specific projects but is not well suited for addressing the broad scope of the water levels issue.

Basin-wide planning needs to utilize an alternative model of the decision process, and should secure information in accord with the needs of that process. A process of planning modeled after the alternative dispute resolution (ADR) procedure should be used to foster mutual learning among interest groups. For disputes with a strong technical dimension, ADR uniquely offers the potential for groups to change their positions based on learning that occurs through dialogue with other groups, including government agencies. Negotiations foster critical questioning of each group's assumptions and rationale for their positions, and expose inconsistencies or inadequacies in their perceptions. As each group learns the merits of other groups' positions, they must reevaluate the adequacies of their own. While this learning process doesn't guarantee that groups will change their position, it does offer an opportunity for it to occur.

Because governments, their agencies (Environment Canada and the Corps of Engineers), and their policies are a basic source of misunderstanding and disagreement, governments and their agencies should <u>not</u> be charged with facilitating this process. Instead, governments should charter the IJC to design and initiate an ADR-style process, involving representatives of interests and governments at all levels. Amendment of the Boundary Waters Treaty of 1909 is <u>not</u> required for commitment to an ADR-style process as a first approach for managing disagreements; existing provisions of the Treaty provide the necessary basis for primary commitment to use of such a process.

3c. Governments should establish a responsible bi-national authority for the co-ordination of information programs.

As noted earlier, an important impediment to managing the water levels issue is the distribution and use of information, about both physical systems and policy. During periods of normalcy, the lake levels issue receives little governmental attention and governments general information programs lapse, resulting in poorly informed

investments by some interests. The information efforts of government during high and low water extremes will be more intense. However, when major facilities are planned by certain interests, governments do work cooperatively to assure that the best available information is utilized in investment decision making. Overall, however, levels studies and information programs fluctuate inversely with lake levels. This "issue-attention cycle" problem results from governments failure to charge and support an institutional entity with information programming and management responsibility over time. Instead, a multiplicity of agencies and information sources provide information which is often apparently contradictory or misleading (by its simplification).

Not only do governments need to improve the information available, but there also needs to be attention to what information and to how to communicate the information. Different types of information will require different types of communication. For example, what is the best way to have interests come to understand the probabilities of flooding at a particular location? As another example, what is the best way to have interests understand shoreline processes? The communication strategies for answers to these two questions may differ not only by the type of information, but also by the communication purpose. Communicating with a single landowner may require a different strategy from that when informing interests' representatives in an ADR-style process.

A key ingredient in improving information programming is the establishment of a bi-national body to co-ordinate the information development programs of the multiple existing agencies.

Governments should seek ways to provide financial support to such an effort. Governments should charge such a body with identifying information needs and encouraging the development of that information. This may be accomplished by having such a body advise budget authorities who must allocate funds to existing study organizations.

In support of the bi-national body, governments should ask the IJC to extend its science advisory board concept to the role of passing judgement on matters of apparent scientific uncertainty (such as erosion processes) in order to achieve a statement of the scientific consensus on key matters.

In support of the bi-national body, governments should ask the IJC to conceive and maintain a policy advisory board with a similar mission as the science board. A policy board would be responsible for monitoring and compiling and inventory of governments policy and programs germane to the lake levels issue. Such an inventory is essential to the continuing process of levels issue management, to encouraging policy clarification and to informing individual decision making.

Governments should request that the coordinating body initially emphasize certain information development efforts. These include: probabilistic descriptions of levels and storm events, shore processes, hazard mapping, measures explanation, and policy articulation.

Governments should request that the coordinating body review and recommend how present information services programs can be improved. They should focus on providing information consistent with the U.S. and Canadian federal policies. The information must be communicated for specific interest groups, not simply provided as you would to agencies or other "hydrologically educated" users or those already familiar with the governance system.

4. GOVERNMENTS MAKE CLEAR THAT NEW TYPE 1 MEASURES ARE EXTREMELY UNLIKELY TO BE IMPLEMENTED IN THE FORESEEABLE FUTURE.

There is a broad and powerful series of obstacles to the implementation of structural works to regulate levels and flows. These relate to policy support, technical merit, environmental and socio-economic rationale and the decision making environment for major control projects. Failure to clearly articulate this position lies at the core of continued disagreements and helps explain the limited efforts in the design and implementation of other measures.

There is an expectation among some interests that governments might soon implement additional structures to regulate lake levels. This view is found among both those who favour such (Type 1) measures and those who oppose them, and is a source of much disagreement and petitioning. Yet this expectation seems poorly founded given the significant obstacles to imminent implementation of further regulatory works. These obstacles include:

Human influence on the Basin hydrology is limited. Interests who are surprised by changes in lake levels are victimized by poor or mis-information rather than by the actions of others. The response of governments to petitions for action are likely to focus on improving understanding of the system rather than attempting to make the lakes conform to an image of the system held by some interests.

There are technical limits on the feasible extent of regulation and its impact on the welfare of interests. There are restrictions on the ability to control levels without exaggerating flows in other parts of the system. Additionally, if levels were controlled, there would be limited effect on erosion, primarily a change in timing but not degree of erosion, and this varies by shoreline. Flooding levels are often storm driven and levels control will reduce flood heights in only limited areas and not at all times. Operation of a regulation plan to achieve levels' goals is difficult due to the stochastic nature of basin supplies and lag times for system response to management action. Controls for low water levels may be employed but this may require importing water into the Basin and a source is uncertain.

Initial costs for lake level control, even crudely estimated, are extremely high and would be further increased by the need for compensatory works on the St. Lawrence River and on connecting channels. On the scale some interests are promoting, the management of the lakes would be one of the largest public works project undertaken in North America. This in a time when fiscal restraint is the theme of policies in both nations, and tight government budgets are being allocated to other purposes and away from water resources development. Indeed, federal budgets for water project construction have been and remain small in Canada, and have decreased in real dollars since the 1970's in the United States.

Governments' policies and the current decision environment result in long lead times for the implementation of Type 1 measures. Strict economic and environmental assessment requirements for projects of this scale can take several years. Several policies will increase costs and restrict the likelihood of a favorable evaluation. Environmental costs will need to be fully mitigated. Policy opposition to out- of- basin diversions, and environmental opposition to into-basin diversions will severely limit the design of Type I measures, reducing potential benefits and increasing costs for compensation works in the St. Lawrence River and in connecting channels. Benefit claims which warrant federal involvement are limited as both nations consider shore erosion control for private lands to be outside federal responsibility. Recreation benefits may be claimed, but may not be used to assure project economic justification in the United States. Thus two benefit categories which might support Type 1 measures are not considered relevant by governments. Federal budget policy in the U.S. and Canada calls for substantial recovery of costs from project beneficiaries. This recent policy reform in the U.S. has been shown to severely dampen non federal enthusiasm for large water development projects.

Benefits among the interests for lake level regulation are unclear in some cases and limited in others. Power interests might benefit or be harmed, depending upon how the measure changes the reliable flows. Because of the scale of the likely changes in flows, benefits or costs imposed will be modest. Commercial navigation would not benefit as long as dredging programs were maintained and might be harmed if lake highs were capped or channel flows exaggerated. Benefits from saved dredging costs for low frequency low water events would be small. Benefits for municipal, residential, agricultural and commercial shoreline interests will be limited because of the limited technical ability to control levels, the limited extent to which reduced levels will substantially reduce storm related flood and erosion damages and the numerous areas of the lakes where flood damages are not realized. Recreation benefits would seem to be limited to avoided damages to boats and implications for docking facilities, but these are modest in extent, only occur sporadically, and are often a result of the boat operator's lack of recognition of level changes, rather than the levels themselves. For national economies as a whole, there is little evidence that aggregate economic growth benefits will be foregone if levels are not regulated.

Governments wish to reduce conflict and Type 1 measures have the potential for instigating protracted disagreements and conflict. Within the riparians alone there is disagreement (particularly by geographic location) on the

desirability of Type 1 measures. Power and many commercial and industrial interests are, at best, indifferent to Type 1 measures, while navigation interests appear to be opposed. Policies of governments put them in a position of being party to a conflict if Type I measures are "on the table". Finally, recognize that environmental opposition is vigorous. In recent years environmental interests have shifted the burden of proof for water projects to making proponents show why they should be built, as opposed to them showing why they should not.

These findings demonstrate, as have previous studies, that making the case for Type 1 measures will be difficult. Obstacles to the implementation of such measures are broader than the often speculative numerical estimates of benefit-cost analyses; indeed a favourable benefit cost result would not assure the implementation of Type 1 measures. Governments should articulate the reasons why there is little likelihood that Type 1 measures will be implemented under current conditions. This articulation should be part of a joint statement from governments clarifying their position on the levels issue. Furthermore, if Type 1 measures are recognized as unlikely to be implemented in the foreseeable future, then measures other then Type 1, which have little need for international agreements, can and should be vigorously pursued in study and implementation.

5. GOVERNMENTS COMMIT APPROPRIATE RESOURCES TO THE DESIGN AND DEVELOPMENT OF MEASURES OTHER THAN REGULATORY WORKS.

Given the disproportionate expenditures on the investigation of Type 1 measures, other types of measures have been poorly developed and face impediments for implementation. With equivalent resources committed to study and development of these other measures, significant progress could be made in developing model programs and sharing of experiences and successes at various levels of government.

The expenditures in levels studies have been strongly biased toward the design of regulatory works while other measures have received little attention. As a result, study conclusions are often made which suggest obstacles, in particular, to Type 3 and Type 4 measures. This makes their implementation difficult, yet the implementation problem is returned to non-federal governments for solution.

The review of measures and their characteristics indicates that few measures have significant international linkages. Lake level regulation, maintenance of channel depths, and linkages in power grid systems are places where international interdependences are most obvious and agreements may be required. Otherwise, individual governments have the authority to implement most other measures. Some environmental issues, such as water quality or habitat loss, may have international spillovers, although in many cases relevant agreements already exist. It is only these instances of transboundary linkages that there may be international concern over the details of other nations' shoreline land use policies. Nonetheless, there may be substantial gains from cooperative investigation of other than Type 1 measures, in order to gain insight from the joint experiences of the two nations.

If study and development resources, equivalent to those committed to Type 1 measures, were allocated to other measures, then significant progress could be made in developing model programs, and in sharing of experiences and successes at various levels of government, (refer, as example, to File Document on Type 4 Measures). Specific suggestions to facilitate and direct this recommendation include, but are not limited to:

- o Based upon an assessment of the benefits and risks to current development and using their own policy criteria, governments (federal and non-federal) should make case by case decisions on public investments in, and public financing of, shore protection works, dredging programs and other Type 2 measures.

- o Governments should review and, as appropriate for their own policy goals, enhance technical and financial assistance programs for community and individual shore protection works. There should be special attention to enhancing institutional capability to provide financial assistance, through such mechanisms as revolving loan funds, perhaps initially capitalized with general revenues.

- o Governments should review and,if appropriate for their own policy goals, consider technical and financial assistance for shoreline purchase programs which result in public benefits, such as access enhancement, habitat protection, or hazard reduction.

- o Resiliency of interests can be enhanced via insurance and disaster aid programs. However, such programs need to be designed with care to ensure responsible decision making and to avoid cost shifting. To this end, insurance programs should be actuarially sound and aid programs should be available only in instances where interests' investment decision were made in a manner deemed informed and responsible, in accord with governments' policy. Design of disaster aid and insurance programs to meet these criteria should be a priority area of future study.

- o Governments should review and, if appropriate for their policy goals, promote strategies for disclosure of risks. The governments can assist by better defining hazards in probability terms and by clarifying the consequences of shore processes and storm events versus levels. Effective disclosure of risks will also involve information generation and dissemination, including to and by non-federal authorities.

- o Governments should work with implementing authorities to develop policy goals and program design for shoreline management. Such programs may take quite different forms. For example, in cases where no public value is threatened, the program may focus on informing (e.g. via denotation of flood or erosion likelihoods) rather than prohibition. In other cases, perhaps where policy warrants environmental protection or pubic access, regulation of shore use with compensation may by appropriate. In other cases, such as preventing encroachment in connecting channels, controls may be appropriate without compensation.

6. GOVERNMENTS ESTABLISH CONTINGENCY PLANS FOR EXTREME EVENTS.

Conditions may arise to prompt governments to change the wide responsibilities they accept and to deviate from policy "ground rules" because of larger social consequences. It is now known that conditions, such as levels higher or lower than known extremes, are possible. Hence, there is no need to wait until such events occur before giving consideration to either the nature and magnitude of an event necessary to prompt changes in the rules or the courses of action governments will follow given the occurrence of such an event.

Some interests (such as power or navigation) are "satisfied" that they have made prudent and well informed investments. These interests, even when well informed, may make investments which under extremes are acknowledged to result in basin wide adverse consequences for themselves, for customers, for the taxpayers and/or for the environment. Often these decisions are based upon investment incentives in governments' policies and the concurrence of governments' agencies which regulate investment (e.g. U.S. power) or make investments (e.g. Canadian power). Governments may not have adequately considered the larger adverse consequences or appropriate response to very low probability extremes.

Governments need to address the strategies and procedures they will employ today to deal with future uncertainties, both those which can be reasonably anticipated and those which will be truly "surprise".

Governments should review the position of some interests to determine whether the interests' acceptance of the status quo (acceptable risk) will result in costs which will be unacceptable to governments. At the same time, there is a need to clarify the intentions and limitations of government actions to permit cost shifting as a matter of public policy. In the interest of exercising their responsibilities for maintaining prospects for economic growth and the general welfare, governments should:

- o Develop a process for joint contingency planning for high and low water short term, including demand management re: power, transport, etc. Governments should endorse recommendations 2 and 5 in the Interim Report from this Study.

- o Develop an organizational process and decision rules for joint contingency planning for long term shifts in the meteorological related hydrological shifts recognizing that high or low levels may occur.

- o Government should grant the IJC a "standing" or "open" reference to provide for on-going, long-term anticipatory and contingency planning related to lake level issues. The IJC is the regional institution best suited, structurally and politically, to undertake such planning. A progress report in the planning process should be prepared periodically by appropriate boards or committee, in addition to the development of planning documents themselves. Of course, these planning functions should complement and be coordinated with those of other agencies. This flexibility is essential if governments are to embrace proactive, anticipatory, and contingency planning.

APPENDICES

APPENDIX 1

RIPARIAN SURVEY

TITLE: SURVEY ASSESSMENT OF RIPARIAN SENSITIVITIES TO WATER LEVEL FLUCTUATIONS.

PURPOSE:

To assess the sensitivitiy of riparians to fluctuating water levels. Identification of the riparian interest and its sub-classes. To relate characteristics of the shoreline and shore processes to the interest. To determine how the riparians are impacted by fluctuations and how they perceive these fluctuations. To determine the perceptions of the interest class to selected measures. To explain the variations in perceptions, responses and sensitivities with respect to the characteristics of the people, the property and the shoreline. To input socio-economic data into the Geographic Information System (GIS).

RELEVANCE/NEED:

There is a need for a better understanding of interests, their view of the problem, and their expectations of governments. The inforamtion which could be gained from such a survey would serve to extend work begun in FG3 and, in so doing, enhance the prospects for managing the issue. The very act of a survey, which provides riparians with an opportunity for input, is itself part of the management or resolution.

OBJECTIVES/WORK COMPONENTS:

The survey should attempt to gain a greater understanding of who and where the riparians are, their positions regarding fluctuations and measures to address them, and why it is that they hold these views. The survey would document variations in the nature of riparian land and water use, in their sensitiviteis to levels, and in their positions according to thier location within the Basin.

1. STUDY AREA:

The study area is the Canadian side of the Great Lakes St. Lawrence Basin, (a similar survey will be conducted on the U.S. side).

When the Basin-wide properties list has been assembled for the Canadian portion of the Basin the survey will be conducted on a stratified random sample of the full population of Canadian shore property owners. This sample will be stratified by lake, connecting channel, and St. Lawrence River and by shoreline segment. The number of shoreline segments sampled will be contingent on funds available. The U.S. will be using similar questionnaire to survey the American shorelines. The U.S. and Canadian surveys should produce compatible results throughout the entire Basin.

2. SAMPLING:

The sample will be stratified by lake, connecting channels, and the St. Lawrence River. Within this division the sample will be divided into shoreline segments. From each shoreline segment a random sample will be drawn.

For a sample to be random it must be statistically significant. The size of the sample required does not increase proportionately with increases in the size of the population to be surveyed. The number of interviews will, therefore, be disproportionate between the various segments being surveyed and will be contingent on the size of the population within the particular segment chosen.

For most segments of the basin we do not now have a reliable population list. A census of properties along the shoreline is presently underway which will create a population list from which to draw the sample. Our best guess would be that when the entire basin is considered an average of 300 interviews per shoreline segment would be required (this is likely an overestimate). If we estimate approximately 50 segments for the entire stretch of shoreline then we could estimate 15,000 interviews as a maximum.

3. STRUCTURE OF QUESTIONS:

The format of the questionnaire and the style of questions will be decided on the basis of their effectiveness for meeting the goals of the survey. The questionnaire will be prepared by Environment Canada (the similar questionnaire will be used in a survey being undertaken on the U.S. side.)

4. INFORMATION:

The type of information desired in the questionnaire is as follows: (NOTE: not all of the following will be covered and the questions might not be in this order on the actual questionnaire).

A: CHARACTERISTICS OF PROPERTY

Group A identifies specific characteristics of the interest and allows determination of physical sensitivities.

-physical location on lake or connecting channel
-length of lake frontage & depth of property
-structures & their distance from water
-structure size & type
-type of shoreline (ie: bluff, beach, etc.)
-estimate of property value - a range

B: CHARACTERISTICS OF OCCUPANTS/OCCUPANCY

Group B profiles the interest helping thereby to relate these attributes to their perceptions.

-age
-education
-approximate income range
-occupation
-# of occupants & age
-affiliations
-length of occupancy

C: PERCEPTIONS OF FLUCTUATIONS

Group C gives indications of interests' interpretations of fluctuations on the Great Lakes.

-perceived problems of fluctuations
-perceived causes of fluctuations
-perceived range of fluctuations
-perceived future levels

D: EXPERIENCES

Group D indicates how historic levels are remembered and perceived. Also identifies sensitivities to highs, lows, & storms.

-history of experience with levels
ie:memory of range of levels
-impacts of erosion
-impacts of flooding
-impacts of storms

E: PERSONAL RESPONSES/ADAPTATIONS

Group E highlights perceived options in dealing with fluctuations and indexes the attachment of the interest to their property.

-shore protection
-shore management
-political response
-information & education response

F: PERCEPTIONS OF GOVERNMENT RESPONSES

Group F investigates the interests' perception of past government initiatives, possible government alternatives and locus of government responsibility for dealing with fluctuations.

-awareness of governments actions
-perception of desired solution
-perception of responsibility & jurisdiction
-who should pay

G: PERCEIVED IMPACTS OF MEASURES & Willingness To Support

Group G specifies interests knowledge of measures; what they perceive the probable impacts of measures to be and their willingness to support and/or implement measures.

-awareness of range of measures
-structural regulation ie: SON
-land-use regulation ie: zoning
-willingness to pay

APPENDIX 2

GLOSSARY OF TERMS

Agreements: Joint statements among two or more governmental units on (i) goals and purposes which should guide basin decision-making, (ii) processes of decision-making and (iii) authorities of governments to act. Agreements are an attempt to remedy a shared problem, and they serve to define the boundaries and constraints on choice of measures.

Alternative Dispute Resolution (ADR): A process aimed at reaching a consensus agreement in order to end a dispute or reduce conflict among interest groups that have some stake in and can influence the outcome of decisions or actions related to the water level issue. The distinguishing characteristics of ADR are that 1) interest groups are actively included in developing and assessing alternatives and making tradeoffs between alternatives, and 2) issues are decided on their merits rather than on the interests access to the decision making process. Policy dialogues and negotiation are types of ADR processes.

Associated Costs: Costs incurred as a result of implementing a measure. There are two types of assoicated costs. (1) Cash costs are expenditures required of an interest in order to take advantage of a measure. (2) Opportunity costs are a change in the welfare of an interest as a result of a measure.

Authority: The right to enforce laws and regulations or to create policy.

Basin (Great Lakes - St. Lawrence River): The surface area contributing runoff to all of the Great Lakes and the St lawrence River downstream to Trois Riviere, Quebec.

Climate: The sum total of meteorological phenomena over a period of time which combine to characterize the average and extreme condition of the atmosphere at any place on the earth's surface.

Connecting Channels: A natural or artificial waterway of perceptible extent, which either periodically or continuously contains moving water, or which forms a connecting link between two bodies of water. The Detroit River, Lake St. Clair and the St. Clair River comprise the connecting channel between Lake Huron and Lake Erie. Between Lake Superior and Lake Huron, the connecting channel is the St. Marys River.

Control Works: Hydraulic structures (channel improvements, locks, powerhouses, or dams) built to control outflows and levels of a lake or lake system.

Diversions: A transfer of water either into the Great Lakes watershed from an adjacent watershed, or vice versa, or from the watershed of one of the Great Lakes into that of another.

Dike: A wall or earth mound built around a low lying area to prevent flooding.

Drainage Basin: The area that contributes runoff to a stream, river, or lake.

Environment: Air, land or water; plant and animal life including man; and the social, economic, cultural, physical, biological and other conditions that may act on an organism or community to influence its development or existence.

Erosion: The wearing away of the shoreline and lake or river bed by the action of waves and currents, and other natural processes.

Evaluation: The application of data, analytical procedures and assessment related to criteria to establish a judgment on the relative merit of a measure, policy or institution. Evaluation is a process which can be conducted both within formal studies and by separate interests, although different data, procedures and criteria may be employed in the evaluation by different interests.

Flooding: The inundation of low lying areas by water.

Fluctuation: A period of rise and succeeding period of decline of water level. Fluctuations occur seasonally with higher levels in late spring to mid-summer and lower levels in winter. Fluctuations occur over the years due to precipitation and climatic variability. As well, fluctuations can occur on a short-term basis due to the effects of periodic events such as storms, surges, ice jams, etc.

Governance System: The complex, dynamic mosaic of governmental and non-governmental entities having some authority to manage, or the ability to influence the management of, Basin resources.

Group Depth Interviews (GDI's): A tool borrowed from marketing to gather perceptual data from a small group of representatives of local interests and governments on the following: the problems caused by different lake levels; the opportunities presented by different Measures; the factors involved in decision making about adopting Measures; and the consequences of Measures. It should be noted the GDI's reflect accurately the perceptions of the attendees but do not necessarily reflect the perceptions of all individuals within an interest.

Implementability: The ability to put into effect a measure considering factors of engineering, economic, environmental, social, political and institutional feasibility.

Implementing Authority: Any governmental agency at any level having appropriate authority to authorize and execute the implementation of any particular action and the jurisdiction to enforce an action.

Implementing Costs: There are three costs that governments must assume when implementing any action. (1) the initial capital cost of implementation, (2) costs associated with operation and maintenance of an action, and (3) any compensatory costs.

Institution: An organization of governmental units which have the authority and ability to facilitate and/or make decisions affecting the water levels issue.

Interests: Any identifiable group, including specialized mission agencies of governments which (1) perceive that their constituents/members welfare is influenced by lake level fluctuation or policies and measures to address lake level fluctuation, and which (2) are willing and able to enter the decision making process to protect the welfare of their constituents/members (See Section 3 for definitions of individual interest classes).

International Joint Commission (IJC): A binational Commission created under authority of the 1909 Boundary Water Treaty. The IJC has three primary functions: 1) quasi-judicial, with responsibility for approving applications to affect natural flows or levels of boundary waters; 2) investigation of matters at the request of the two governments, with the limitation that resulting recommendations are not binding on the governments, and can be modified or ignored; 3) surveillance/coordination, through monitoring or coordinating the implementation of recommendations, at the request of the governments.

Investment: Any expenditure (e.g. financial, time) made by an interest to capture benefits. The investment decision reflects available information and understanding about the system, government responsibilities and risks.

Jurisdiction: The extent or territory over which authority may be legally exercised.

Lake Service: Uses of the lakes and the associated resources represent services which are employed by the interest. These services include habitat for fish and wildlife populations, a medium for transportation, a good for human consumption, a coolant, a consumable product for industrial and commercial purposes, a medium for receiving wastes, a source of power, and services associated with shoreline location and access, and with aesthetic and recreational activities.

Location Benefit: Positive effect on the welfare of an interest derived from shore location and water level situation.

Location Cost: Negative effect on the welfare of an interest derived from shore location and water level situation.

Measure: Any action, initiated by a level(s) of government to address the issue of lake level fluctuations, including the decision to do nothing.

Negotiation: The process of seeking accommodation and agreement on measures and policies among two or more interests or agencies having initially conflicting positions by a "voluntary" or "non-legal" approach. This is often considered a part of an ADR process.

Operating Plan: A list of procedures to be followed in making changes to the lake levels or their outflows for a specific purpose or to achieve certain objectives. Operation of regulatory facilities on the Great Lakes are carried out by their owners and operators under the supervision of the IJC and in accordance with Plan 1977 (Lake Superior) and Plan 1958D (Lake Ontario).

Policy: The position adopted by a government on an issue which is expected to structure and guide the decision making process.

Position of Interests: The perceptions, beliefs and preferences of interests regarding fluctuating water levels, implications of those levels, and acceptability of a measure or policy to an interest. Positions may be directly stated or may be inferred from supporting or opposing activities taken by the interest in the decision making process.

Predictability: The ability to foretell an event on the basis of observation, experience, or scientific reason.

Probability: The ratio of the number of outcomes of a given event to the total number of all possible outcomes; the chance that a given event will occur.

Regulation: Artificial changes to the lake levels or their outflows for specific purpose or to achieve certain objectives.

Riparians: Persons residing on the banks of a body of water (see Interests, Residential Property Owner, Section 3).

Stakeholder: An individual, group, or institution with an interest or concern, either economic, societal or environmental, that is affected by fluctuating water levels or by measures proposed to respond to fluctuating water levels within the Great Lakes-St. Lawrence River Basin.

APPENDIX 3

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APPENDIX 4

SOURCES OF INFORMATION

Some of this Report is based on information contained in Annexes and file documents completed during the course of the Study. Annexes are available through the IJC, while file documents are available from individual authors.

Information on the Physical Setting (Section 2) is based on the findings of Functional Groups 1 and 2. These groups annexes are as follows:

International Joint Commission, 1989. Past and Future Water Level Fluctuations. Annex A. Report to the International Joint Commission prepared by Functional Group 1, April 1989.

International Joint Commission, 1989. Environmental Features, Processes and Impacts: An Ecosystem Perspective on the Great Lakes - St. Lawrence River System. Annex B. Report to the International Joint Commission prepared by Functional Group 2, April 1989.

The following sources discuss in more detail measures governments may implement to deal with the fluctuating water levels issue:

International Joint Commission, 1989. Potential Actions to Deal with the Adverse Consequences of Fluctuating Water Levels. Annex F. Report to the International Joint Commission prepared by the Sub-Group on Measures (Karsten, J., Stewart, C., Shoots, W. and Yee, P.), March 1989.

International Joint Commission, 1989. Type IV Measures. File Document. Prepared for Functional Group 3 by the Measures Work Group (Hartmann, H.C., Karsten, J. and Shoots, W.), September, 1988.

For an elaboration of government organizations and the ADR process (Section 9) readers can refer to the following file documents:

Reducing Great Lakes Levels Conflicts via Alternative Dispute Resolution by H.C. Hartmann.

Institutions for Great Lakes Decision Making: An Assessment by H.C. Hartmann and M.J. Donahue.

A major objective of this report was to identify interests' positions in light of government policies. Much of Section 7 is based on information contained in 9 file documents available at Environment Canada in Burlington, Ontario and at the U.S. Army Corp District Offices in Buffalo, Chicago and Detroit. The file documents provide an assessment of the positions and sensitivities of each interest class to fluctuating lake levels and measures. Each document includes:

1) a description of the interest class, and the significance of the interest to the region

2) an assessment of the sensitivity of the interest to fluctuating water levels

3) a discussion of the impacts of selected measures on interests

and 4) a summary of the needs for and methods of assessing impacts.

The file documents were written and compiled by Work Groups (WGs) of Functional Group 3 consisting of at least one Canadian and one U.S. technical specialist. The WGs compiled information for documents through a review of relevant literature and through contacts with various representatives of their interest class. A point was made to contact interests in order that their positions regarding fluctuating lake levels and measures could be articulated. This exercise was undertaken in varying degrees. Nevertheless, all WGs made some attempts at contacting interests to acquire information pertaining to their positions. This information from interests was collected in a number of ways. Some work groups directly involved interest representatives in their groups. The Riparian WG, for example, involved Sharon Hazen, the president of the Canadian Coalition for Great Lakes Regulation. Ms. Hazen was given the opportunity to review and comment on the work of the Riparian WG and played and active role in providing information. The Electric Power WG also included members of the interest. They invited representatives of the power entities, such as Ontario Hydro, Quebec Hydro, and the New York Power authority to sit on their WG and provide input.

Other WGs contacted interest directly, through telephone interviews, or by sending out questionnaires. The transportation interest group, for example, hired a contractor to interview the majority of representatives of their interest class in both the U.S. and Canada to include input from shipping companies, docks, vessel owners and port authorities. Likewise, the environmental WG had a contractor help interview representatives of their interest. Representatives of over 100 environmental interest groups in the Great Lakes Basin and elsewhere were interviewed.

Another major method by which WGs acquired information from interests, was through a process known as Group Depth Interviews (GDI). From July 17th to July 22nd, 1988, twenty-two GDIs were held in six locations around the Great Lakes Basin. These GDIs were run by one of two contracted facilitators. The interviews, having generally 8 - 10 people participating, ran 2 hours in length. The first hour was dedicated to determining the types of problems and impacts the interest experienced in the past due to fluctuating water levels. The second hour was spent looking at possible government actions or measures to deal with those impacts. Four work groups took part in this exercise. They included, commercial/industrial, riparian, recreation, and government interests, as well as two native people representatives. For a detailed review of these interviews refer to Walsh and Weidman, 1988.

As evident from the above discussion, the approach used by each work group

As evident from the above discussion, the approach used by each work group varies slightly. The following sub-sections provide a more detailed description of the approaches adopted by each WG.

Work Group #3 - Transportation Interests by Michael Pelone (U.S. Army Corp of Engineers, Buffalo District); Tom Muir (Water Planning and Management Branch, Environment Canada, Burlington, Ontario); and John O. Greenwood (Transportation Consultant, Cleveland, Ohio).

During the Phase 1 study, the transportation work group identified the components of the interest class, user characteristics, effects of fluctuating water levels on each component and areas for future investigation.

Components of the interest class were identified based upon the functional inter-relationships observed between and among the individual elements within the transportation sector. In addition, a literature search was initiated early in the Phase 1 study.

The classification system used in this study is shown below:

* vessel operators
* docks and terminal operators
* port authorities and associations
* shipyards
* railroads

Each group was asked to describe its use of the lakes and how fluctuations in levels would affect their existing operations. Specific considerations on the following topics were explicitly requested.

1. What are the effects of fluctuating water levels
2. How have they adapted or responded to historical highs and lows
3. What were their perceptions of measures
4. Any other relevant opinions on our study

Their assessment of types of measures was also solicited. Information collected during the period July 1988 to October 1988 was used primarily to describe the sensitivity of the interest class to water level changes. In general, more concerns were expressed in terms of extreme low water conditions than for extreme high water levels. Fleet efficiency, increased dredging needs and subsequent containment of dredged materials, were associated with low levels. Storm damages and wave attack plus the increased potential for induced damages caused by ship wakes were identified as potential problems for high water conditions.

In support of these early efforts of WG3, a contract was awarded to a Great Lakes transportation consultant familiar with all the major corporations within the Great Lakes. A list of target firms was initially provided to this person, but over the course of the study, the list was supplemented and revised. This consultant made contact with 61 corporations and more than 75

individuals participated in the problem identification process. Interview documents were prepared after each contact was made.

The distribution of field interviews were as follow:

Interest Sub-Class	Number
Vessel operators	16
Dock Terminals	25
Railroads	5
Port Associations	12
Ship yards	3
TOTAL	61

The topical outline of discussion items and field contacts made are provided in Appendix 1 of the Transportation Interest Working Paper.

Very little detailed information on impacts of measures was obtained. Detailed impact assessments by each transportation component for each type of measure would require a level of study which was considered to be outside the scope of the Phase 1 study.

A review of the literature indicated an extensive amount of past research on transportation and marketing issues had been completed for Great Lakes maritime interests. However, water level fluctuations were not explicitly considered in these prior studies as a variable. Further study of the impacts of water levels on traffic volumes, ship movement and other financial parameters should be completed before an evaluation of measures can be made.

The work group attempted to maintain close contact with the interest class by personal contacts, attendance at a regional grain export conference in Thunder Bay, Ont. and monitoring trade publications and journals which profiled the Great Lakes maritime community. Many references were found to the changing nature of water levels over the period 1988 to 1989.

Financial estimates of loss were published for individual fleet operators on major trade routes. However, all of these impacts were related to the largest sizes of ships operating on the lakes or referenced to the recent high water levels of 1986 to 1987. Therefore, these changes included "losses" as measured against temporarily high water levels. As such, these annual losses may not be true (or sustained) annual losses due to the temporary nature of the previous high levels. Statements similar to these may be read by the general public as evidence of severe or sustained economic losses.

Work Group #4 Commercial and Industrial Interests by Christian J. Stewart (Environment Canada, Cornwall, Ontario) and Bob King (U.S. Army Corps of Engineers, Detroit District).

One of the first priorities of WG4 was to conduct an in depth review of the literature to search for information. The literature review did not limit

it's focus to Great Lakes related studies. Many comparisons and analogies were drawn from literature dealing in other areas, such as ocean shorelines, or small inland lake shorelines (eg. impacts of hurricanes, US Coastal Zone Management Programs, reservoir studies, etc.).

Communication with representatives who have expertise in the area of concern was a key factor in accomplishing the requirements of WG4. These contacts were broken down into two distinct groups. The first group, or Type A contacts, were those people who could provide information on previous studies of a similar nature (eg. academics), or who could provide an inventory of interest classes. In other words, they formed part of the literature review process. The second group, or Type B contacts, were comprised of representatives of the actual commercial and industrial interest classes. The people who were contacted, and who were Type B contacts, were drawn from prepared inventory lists, from previous contacts who stated they were concerned about the problem, and from Type A contacts, depending on their knowledge and degree of interest in the study.

In contacting Type A contacts, telephone contact and personal visitation was the easiest and most straightforward method. For the Type B contacts, two means of data collection were used. First, a telephone questionnaire was used to elicit information from the various commercial and industrial interest groups. Please note that every commercial and industrial property on the Great Lakes shoreline was not contacted. Rather about 20 representatives of the interest class were contacted. Furthermore, no statistical analysis of the questionnaire was undertaken. It should be noted however, that telephone contact of some type had to be established and the questionnaire approach was simply an organized way of gathering this data.

The second method of data collection was through the use of group depth interviews (see Walsh and Wiedman, 1988). These sessions were held in various locations around the Great Lakes and added a great deal of insight into the problems that have been experienced by commercial and industrial interests. Information from those meetings has been included in this draft, and transcripts of the commercial and industrial meetings are available from the authors.

One of the main tasks required from WG4 was the identification of the impacts of the various measures on the interest classes. As such, it was possible to provide initially, some information on the nature of the impacts (i.e. what particular aspect of the interest is going to be affected). Aspects included water supply, waste disposal, waterborne transportation, location, shoreline amenities, beaches, scenic vistas, infrastructure, net income and regional income. This was accomplished by preparing summary tables that outlined which aspect of the interest group was affected by the five types of measures. These tables and a brief description are available from the authors if desired.

Using the information in the group depth interview reports and through continued contact with representatives, a more detailed list of the types of impacts for each measure (or representative measure), for each interest class was produced. Where possible, impacts were expressed in quantitative terms.

However, many businesses were unwilling to divulge detailed economic details, especially in a group session, and hence the majority of impacts are expressed qualitatively. This information is contained in Section V of the Commercial and Industrial working paper.

Work Group #5 - Agriculture Interests by Al LeFeuvre (Environment Canada, Burlington, Ontario) and Gary Wickboldt (U.S. Corps of Engineers, NCD).

The Work Group started the Study by reviewing several previous Lake Level Studies. The next step was to contact the agricultural departments at the Federal, State and Provincial levels. These agencies, especially at the State and Provincial level, have extensive field programs to work with individual farmers and farm organizations. They understand the perception of the agricultural community on almost all issues. In addition, they were able to indicate the geographical extent of lake-level-sensitive farm land and the nature of potential impacts.

In Ontario there was considerable activity related to dyking through the Regional Conservation Authorities. Data on dike heights and acreage protected form these agencies will be used to build the effects model.

Work Group #6 - Commercial Fishing Interests by Jonathan Brown (U.S. Army Corps of Engineers, Buffalo District); Ted Cowan (Department of Fisheries and Oceans, Burlington, Ontario) and Mona Thomason (U.S. Army Corps of Engineers, Portland District).

o Literature Search and Review

The first step of the work group was to identify existing descriptive information on the Great Lakes commercial fishing industry and fishermen, and on alternative methods of quantifying the impacts of fluctuating water levels on the interest group. This was accomplished through an extensive literature search for reports, dissertations, and other documents which address relevant issues.

The descriptive information to be obtained from the literature search was comprehensive in nature. It included a history of the commercial fishing industry on the Great Lakes, showing how the fishery has changed and adapted to the changing nature of the lakes. Descriptions of the various interest group sub-classes were desired. More specific information such as the distribution and allocation of the resource (including catch quotas and long-term optimum yield levels); state, provincial, and federal regulations; market conditions; historical fish landings and ex-vessel values; harvesting methods and fleet operations; fleet characteristics, and an inventory of commercial fishing harbors was also needed.

The second objective of the search was to identify potential analytical methods which could be used to quantify the impacts of fluctuating water levels on the commercial fishing industry and related interest groups. The

intent was to find a number of methods which had been used in previous studies. After analyzing the various methods, the Work Group would select the most appropriate technique.

The literature search was a two phase process. First, a computer search was initiated with a database called DIALOG (DIALOG Information Services, Inc.). DIALOG consists of the most comprehensive listings of published and unpublished literature available in the English language, including government reports, academic papers, journal articles and books.

In addition to the main DIALOG search, an additional computer search was made of the reports published by the Sea Grant Institutes. (The National Sea Grant College Program was established by Congress in 1966 to improve the knowledge of the aquatic resources of the United States. The Great Lakes Sea Grant Institute were also individually contacted and asked for their publications lists and back issues of annual or biennial reports, if available.

Listings of documents which matched the search criteria were received from DIALOG Information Services and the Sea Grant Depository. The listings generally included an abstract of the document as well as necessary information such as title, author, and publisher. Based on the abstracts, copies of reports and articles which seemed relevant were obtained.

The second stage of the literature search consisted simply of perusing the bibliographies of the material on hand for additional sources. These additional sources were also obtained if they appeared relevant.

Although the DIALOG and Sea Grant computer searches resulted in long lists of potential sources, very few of the documents in the DIALOG and Sea Grant listings were germane. Once the documents were received, it was apparent that even fewer contained pertinent information.

Some descriptive information on the Great Lakes fishery was obtained from the University of Wisconsin Sea Grant Institute and the U.S. Fish and Wildlife Service (University of Wisconsin Sea Grant Institute, 1986 and Wilbur L. Hartman, 1988). Information on United States government agencies involved in the Great Lakes commercial fishery was obtained from the Department of Natural Resources.

Descriptions or examples of methodologies used to analyze impacts to commercial fishermen from changes in the lakes were even more scarce than general descriptive information. Only one study was found which addressed the issue of economic impacts to commercial fishermen of fluctuating water levels on the Great Lakes.

This study, Impacts of Lake Level Regulation on Commercial Fishing and Charter/Passenger Boat Operations: Lakes Erie and Ontario and Connecting Waterways (Midwest Research Institute, 1980), was completed for the International Joint Commission's Lake Erie Regulation Study (1977-1981).

o Telephone Contacts

Due to the lack of published information on the commercial fishing industry on the Great Lakes, a second avenue was taken to obtain the information necessary to complete this report. Telephone contacts were made with commercial and Indian fishermen, fish processors, other non-governmental agencies concerned with the commercial fishing industry on the Great Lakes, the U.S. Fish and Wildlife Service, and state departments of natural resources. A list of all telephone contacts is provided in Appendix B of the Work Group report.

The information to be gathered from these sources included the information that was not found through the literature search as well as information which could only be gathered from the members of the interest classes themselves. The following sections describe the information that was obtained from each source and how it was used in this report.

o Commercial and Indian Fishermen

Fifteen United States commercial fishermen were contacted to determine how they are impacted by fluctuating water levels, and their perceptions of the measures are. No Indian fishermen were contacted because we could not obtain names of the fishermen. It was assumed that since the Indian fishermen generally use the same fishing techniques, vessels, and gear that the commercial fishermen use, the impacts experienced by the Indian fishermen are similar to those experienced by the commercial fishermen who were contacted.

In general, the commercial fishermen who were contacted were willing to express their opinions. Since questioning each fisherman about all possible pieces of information would have resulted in lengthy discussions, selective interviews were conducted. Some fishermen were asked only about the impacts of fluctuating water levels while others were only asked about their perceptions of the measures. All contacts were asked three general questions about their fishing experience on the Great Lakes. The questions they were asked are:

1. Where do you usually fish (lake, area)? Have you ever fished anywhere else on the Great Lakes?
2. What types of fish do you catch, and what kind of gear do you use?
3. How long have you been fishing commercially (treaty fishing) on the Great Lakes?
4. Has your fishing operation, or the fishing operation of anyone you know, ever been affected by either high or low water levels? If the fluctuations were even greater than you have seen (up to three feet higher or lower) would your operation be impacted? If so, how?
5. Are any other types of impacts important to you as a commercial fisherman (eg. environmental, social, political, economic)? Which of these impacts are most important?
6. Would you like the impacts of the fluctuations of the lakes to be lessened?
7. Determine if the fisherman has 1) an understanding of any of the representative measures, 2) an opinion on any of them and why he holds that opinion, and 3) ideas of how the measures would impact him.

8. Are there any other potential measures that would directly affect your fishing operation?

o Fish Product Processors

Six United States fish product processors were contacted. The fish products processors were asked questions similar to those asked of the commercial fishermen. However, since the processors were contacted early in the study when there was practically no information on the measures, no information was gathered about their perceptions of the measures. After the information about the measures was obtained by the work group, it was decided to not contact the processors again because their input to the study should be gathered by the Commercial and Industrial Work Group.

Since no information about processors was obtained from the literature search or from other sources, the processors were also asked for general information about their operations. The questions they were asked are:

1. Where do you purchase fish caught by commercial fishermen on the Great Lakes?
2. Do you have any dockside operations?
3. Are purchases made from contract vessels or independent fishermen?
4. What species are purchased by your company? How much?
5. How are the fish processed for marketing?
6. Where are your markets?
7. Is your operation fully dependent upon fish caught in the Great Lakes? If not, what percentage?
8. What months of the year is your facility in operation?
9. How many people do you employ? What is your peak and low months and corresponding employment levels?
10. How long have your been in the fish products processing business?
11. Have your operations ever been affected by fluctuating water levels on the Great Lakes? If so, how?
12. If the fluctuations were much greater than they have been, for example up to three feet higher or lower, would your operations be impacted?
13. How severely could your operation be affected by fluctuating water levels?

o Other Nongovernmental Groups

United States commercial fishermen's associations were contacted because the lobbyists and officers of the organizations are very knowledgeable about all aspects of commercial fishing. They were asked for descriptive information about their associations, as well as their opinions on the measures and how commercial fishermen are impacted by fluctuations in the water levels.

o Government Agencies

The Great Lakes Fishery Lab, which is under the jurisdiction of the U.S. Fish and Wildlife Service, provided detailed information on historical catches and values for each lake and state.

The Great Lakes Fishery Commission, a U.S. - Canada joint commission, was contacted to find out about the regulatory aspects of the United States Great Lakes commercial fishing industry. A senior researcher there was asked the following questions:

1. How are catch quotas split up between each state and Canada?
2. What are the quotas dependent on?
3. What are the commercial fishing regulations in each state?
4. Are the regulations in any way impacted by they level of water in the Great Lakes? Could water level fluctuations impact regulations?

The Great Lakes Fishery Commission contact suggested that we contact each state's Department of Natural Resources for more information on state regulations.

The state departments of natural resources provided commercial fishing regulations, lists of names and addresses of licensed commercial fishermen, and general information on the industry such as fishing harbors and operating methods including types of boats and gear. They also were asked about the impacts of fluctuating water levels on commercial fishermen.

The commissions which regulate Indian fishing were also contacted and asked the same questions. They were also asked to provide general information about relevant treaties and agreements. In general, the states and Indian commissions were asked:

1. Is there a formal commercial fishing policy in your state? If so, what is it?
2. What are the regulations for commercial fishermen in your state?
3. How many commercial fishermen are licensed?
4. What is the duration of the commercial fishing season?
5. Describe the types of vessels and gear used for commercial fishing.
6. Describe a typical operating cycle during the fishing season.
7. Have the fishing operations ever been affected by either high or low water conditions? If the fluctuations were even greater that you have seen (up to three feet higher or lower) would the operations be impacted? If so, how?
8. What harbors do the fishermen use?

The agencies were also asked to send copies of the commercial fishing policies, regulations, and lists of licensed commercial fishermen. Although the regulatory agencies are also interest class members, they were not individually asked about the impacts of fluctuating water levels on their operations for a number of reasons. First, this portion of the IJC study focuses on the commercial fishing industry; a different work group is specifically studying the impacts of fluctuating water levels on governments. Also, it was thought that there would be difficulties in finding a spokesperson for the agencies who would have an opinion on this issue without doing further studies of their own. Finally, the complexities of how the industry is regulated (administrative regulations versus legislative regulations) precludes a simple answer for many of the states. Therefore, the

positions of the regulatory agencies were mainly gathered by inference from the existing rules.

Work Group #7 - Electric Power Interests by Bradford S. Price, Ronald J. Guido and Kim Irvine (U.S. Army Corps of Engineers, Buffalo District); Robert B. Chang (Ontario Ministry of Natural Resources, Toronto); and Thomas Muir (Environment Canada, Burlington, Ontario).

1. Identified primary hydropower interests to work as associates with the work group.
2. Held meetings with the work group associates to discuss the study, its objectives and tasks that the associates could perform. They were tasked to identify their sub-class interests. They also provided input to this paper, especially Sections 4,5,6, and 7.
3. Contacted the Department of Energy, Energy Information Office; Statistics Canada; individual utilities and the Electric Reliability Council Regions for information on power plants, including location, generating capacity, interconnections, type of fuel used, fuel origins, fuel destinations, and mode of fuel transport. This information is presented in Appendices C, D, and L.
4. Performed a literature search through the Buffalo District librarian of the available models to assess impacts of fluctuating water levels on the electric utility industry. The available models are reviewed in Section 4.5.
5. Performed a literature search through the Buffalo District librarian of the available studies of the impacts of fluctuating water levels on the electric utility industry. The literature is included in the references, Appendix B.
6. Attended meetings with representatives of the New York Power Pool (NYPP), Ontario Hydro and Hydro Quebec to discuss and determine the impacts of prolonged drought on electric reliability.
7. Contacted representative thermal interests to obtain perceptions of impacts. A copy of the questionnaire circulated to Ontario Hydro, New York State Electric and Gas Corp. and Niagara-Mohawk Power Corp. is presented in Appendix E of the Work Group Report.
8. Contacts were initiated with sub-class interests to obtain their views regarding impacts of fluctuating water levels and means of assessing measures.
9. Successive drafts of the working paper were prepared based on input from members, associates and other sources.

Work Group #8 - Residential Interests by Phil Berstein (U.S. Army Corps of Engineers, Chicago District); and Anne Sudar and Gary Jones (Environment Canada, Burlington, Ontario).

Members of this work group collected, interviewed and analyzed the riparian experience both as individual researchers and as members of a professional, analytic group. Each member was responsible for individual sections with the group being responsible for the whole. Conceptualization was conducted and confirmed through the following:

-interviews of various riparians on an ad hoc basis.
-liaison with coalitions.
-field trips to view impacts &/or interview.

-reading of newspapers, journals, books etc. - in short the available literature, past and present.
-Group Depth Interviews provided a comprehensive overview
    -while the interviews lacked representativeness they provided a spectrum of experiences. Further investigation will enumerate the incidence of experiences within this spectrum.
-consultation with co-chairs and work group co-ordinators.

Work Group #9 - Non-Riparian Recreation Interests by Jonathan Brown (U.S. Army Corps of Engineers, Buffalo District) and Ms. Anne Sudar and Gary Jones (Environment Canada, Burlington, Ontario).

Phase I of the Non-riparian Recreation Work Group has examined use characteristics of the Great Lakes for recreation, how various interest classes are affected by fluctuating water levels, the likely impacts of measures that would alter water levels or fluctuations on recreation interest classes, and methods for estimating quantitatively the benefits or disbenefits to recreationists of incremental changes in water levels. The approach to carrying out Phase I is further described below.

Available recreation use and inventory data were obtained by activity from state/provincial and federal agencies having a role in providing recreation on the Great Lakes. In addition, a literature search was undertaken for (1) additional published use and inventory data that would provide insight into growth trends in Great Lakes recreation; (2) impacts of fluctuating water levels on recreation use, and (3) methods for estimating costs or disbenefits of various types of environmental degradation to recreationists.

The data compilation and literature review efforts were supplemented by two types of interviews of selected interest class representatives to learn their primary concerns related to fluctuating water levels. Two Group Depth Interviews were held in Toledo, Ohio and Alexandria Bay, New York in which a professional moderator met with a number of preselected interest class representatives and elicited concerns via group discussion related to fluctuating water levels. In addition, 41 Key Informant telephone interviews were held throughout the Great Lakes of individuals (some of whom represent recreation interest organizations) who were knowledgeable about various recreation activities and how they are affected by fluctuating water levels.

A classification system was developed to highlight the recreation interests that make greatest use of the Great Lakes environment. These interest groups were initially dichotomized into water-dependent and water-related groups. Water dependent groups included all types of boating (including water skiing), boat fishing, swimming, and windsurfing. Water-related interest groups were further divided into sunbathing; shore and pier fishing; waterfowl hunting; birdwatching; hiking, beachcombing, and nature study; picnicking; camping; and coastal driving for pleasure.

Using information from the literature review on past recreational use of the Great Lakes coastline, supplemented with data from federal and state/provincial agencies, descriptions were prepared for each of the above

recreational interest groups (Section 2). To the degree that information was available, this section summarized the type of recreational experience sought from the coastal environment, numbers of users and trends for each type of use, and any available economic valuation or impact data related to these activities. For the activities of boating and fishing, available data were summarized in tables on a lake by lake basis.

Based on the information from the group depth and key informant interviews, Section 3 was prepared on the sensitivity of the interest classes to water fluctuations under current conditions (with no changes in measures). The following types of impacts of fluctuating water levels and measures on recreational interests were identified: habitat, access to site, restricted use, aesthetics, capacity, physical damages, and quality of recreational experience. Initially, concerns are summarized from the perspective of the interest classes. This is followed by a summary of the professional opinions of the authors on how the recreation interest classes are affected.

Five types of measures were identified for inclusion in the overall evaluation framework: (1) public investment in control and diversion works, (2) public investment to direct land and water use to adapt to shore fluctuating levels, (3) direct public regulation of land and water use, (4) public programs to indirectly influence land and water or the effects of fluctuating water levels, and (5) emergency response capacity. For each type of measure, specific consequences of fluctuating water levels that would be lessened via these general measures were outlined.

Using this measures framework, a qualitative appraisal was developed in Section 4 of the degree to which, and how the implementation of various measures would likely ameliorate or in some cases aggravate the concerns of the individual interest classes about water levels and fluctuations. This section is quite brief because only a skeletal outline of likely impacts can be assembled without conducting in-depth research.

From the literature review of available economic methods for estimating the benefits and disbenefits accruing to recreationists from environmental changes, a general recommended methodology was developed for designing and implementing Phase II studies. Thus, this Phase I effort in total provides the necessary preliminary understanding of the impacts of fluctuating water levels on non-riparian interest classes to permit the design and implementation of quantitative studies under Phase II.

Work Group #10 - Environmental Interests Groups by Don Williams (U.S. Army Corps of Engineers, Detroit District); Bill Bien and Rimi Kalinauskas (Environment Canada, Burlington, Ontario) and Timm Fisher (Consultant, Waterdown, Ontario).

The information supplied here was developed in several ways. Factual or scientific elements were taken from literature sources. Many of these were familiar to the authors, through their endeavors to understand the influence of water levels on Great Lake resources. Additional efforts were make to review literature particularly appropriate to the topic, e.g., water quality

effects of water levels. The literature was obtained by library research aimed at locating recent contributions and by canvassing colleagues familiar with these topics.

The views of the Environmental Interest group were a second source of information. These U.S. and Canadian sources were identified form mailing lists, personal knowledge, newspaper clippings, and compendiums of environmental interest groups. Literature evaluation focused on determining each group's mandate and appropriate topics that follow from their mandate. Subsequently, each group was interviewed by telephone (U.S.) or sent a questionnaire (Canadian). The U.S. interviews were conducted in two phases. A standard set of questions was asked in each phase. The second set of interviews was in a format nearly identical to the Canadian questionnaire. Each question focused on the charge of Functional group 3, and on the opinion or policy of the environmental organization with respect to the question. The telephone interviewer solicited answers and fully recorded the responses. Canadian responses were received in written form as well as over the telephone. The standardized, introductory statements, questions, and responses, as recorded by the interviewer, and the Canadian responses that have been received and processed, are found in an Appendix to the Work Group report. To date, (March, 1989) 46 U.S. and 57 Canadian interests group interview or questionnaires have been completed exclusive of anthropological groups.

Work Group #11 - Government Interests by Suzanne Gaines (U.S. Army Corp of Engineers, St. Paul District) and Al LeFeuvre (Environment Canada, Burlington, Ontario).

One of the initial approaches was to review earlier studies of Great Lakes water levels, and especially to note the response of governments to the study recommendations. Another initiative was to discover the attitudes and experiences of local politicians and bureaucrats by holding Group Depth Interviews at several locations around the Lakes. Although only a limited number of representatives were interviewed (63 representatives of governments), the format allowed the Work Group to develop a deeper understanding of the conflicts, concerns, and issues faced by the local governments.

APPENDIX 5

LIST OF PARTICIPANTS IN FG3

	NAME	AGENCY	PARTICIPATION
	Armour, A.	York Univ., Toronto, Ont.	Advisor
	Berczi, A.	Sir Wilfred Laurier Univ. Waterloo, Ont.	Multi-Criteria Workshop
	Bernstein, P.	USACE, Chicago, IL	Member of WG #8
	Bien, B.	IWD, EC, Burlington, Ont.	Member of WG #10
	Brown, J.	USACE, Buffalo, NY	Member of WGs #6 and #9
	Brown, T.	Cornell Univ., NY	Consultant
	Chang, R.	MNR, Ont.	Member of WG #7
	Cowan, T.	DFO, Burlington, Ont.	Member of WG #6
	Donahue, M.	Great Lake Commission Ann Arbor, MI	Advisor
	Fisher, T.		Consultant for WG #10
	Gaines, S.	USACE, St. Paul, MI	Member of WG #11
	Gilmor, M.		Consultant for WG #11
	Greenwood, J.		Consultant for WG #3
*	Hartmann, H.	GLERL, NOAA, Ann Arbor, MI	Member of WG #2
	Irvine, K.	USACE, Buffalo, NY	Member of WG #7
	Jones, G.	IWD, EC, Burlington, Ont.	Member of WGs #8 and #9
	Kalinauskas, R.	IWD, EC, Burlington, Ont.	Member of WG #10
	Karsten, J.	USACE, Buffalo, NY	Member of WG #2
	King, R.	USACE, Detroit, MI	Member of WG #4
	LeFeuvre, A.	IWD, EC, Burlington, Ont.	Member of WGs #5 and #11
	Lewis, M.	MNR, Ont.	Advisor for WG #11

*	Ludlow, L.	IWD, EC, Burlington, Ont.	WG Coordinator
	Mitchell, B.	Univ. of Waterloo, Ont.	Advisor
	Muir, T.	IWD, EC, Burlington, Ont.	Member of WGs #3 and #7
*	O'Grady, K.	Virg. Tech., Blacksburg, VA	Co-chair assistant
	Pelone, M.	USACE, Buffalo, NY	Member of WG #3
	Price, B.	USACE, Buffalo, NY	Member of WG #7
	Rivers, R.	IWD, EC, Burlington, Ont.	Multi-criteria Workshop
	Sauve, C.	QME, Ste-Foy, Quebec	Advisor
**	Shabman, L.	Virg. Tech., Blacksburg, VA	U.S. Co-chair
*	Shoots, W.	IWD, EC, Burlington, Ont.	FG3 Coordinator Member of WG #2
**	Smit, B.	Univ. of Guelph, Ont.	Canadian Co-chair
*	Stewart, C.	EC, Cornwall, Ont.	Member of WG #4
	Sudar, A.	IWD, EC, Burlington, Ont.	Member of WGs #8 and #9
	Thomason, M.	USACE, Portland, OR	Member of WG #6
	Thornburn, G.	LJC, Ottawa, Ont.	Multi-criteria Workshop
	Vansickle, T.		Consultant
	Wickboldt, G.	USACE, NCD, Chicago, IL	Member of WG #5
	Williams, D.	USACE, Detroit, MI	Member of WG #10

** FG3 Co-chairs who had lead responsibility in compiling and writing this Report.

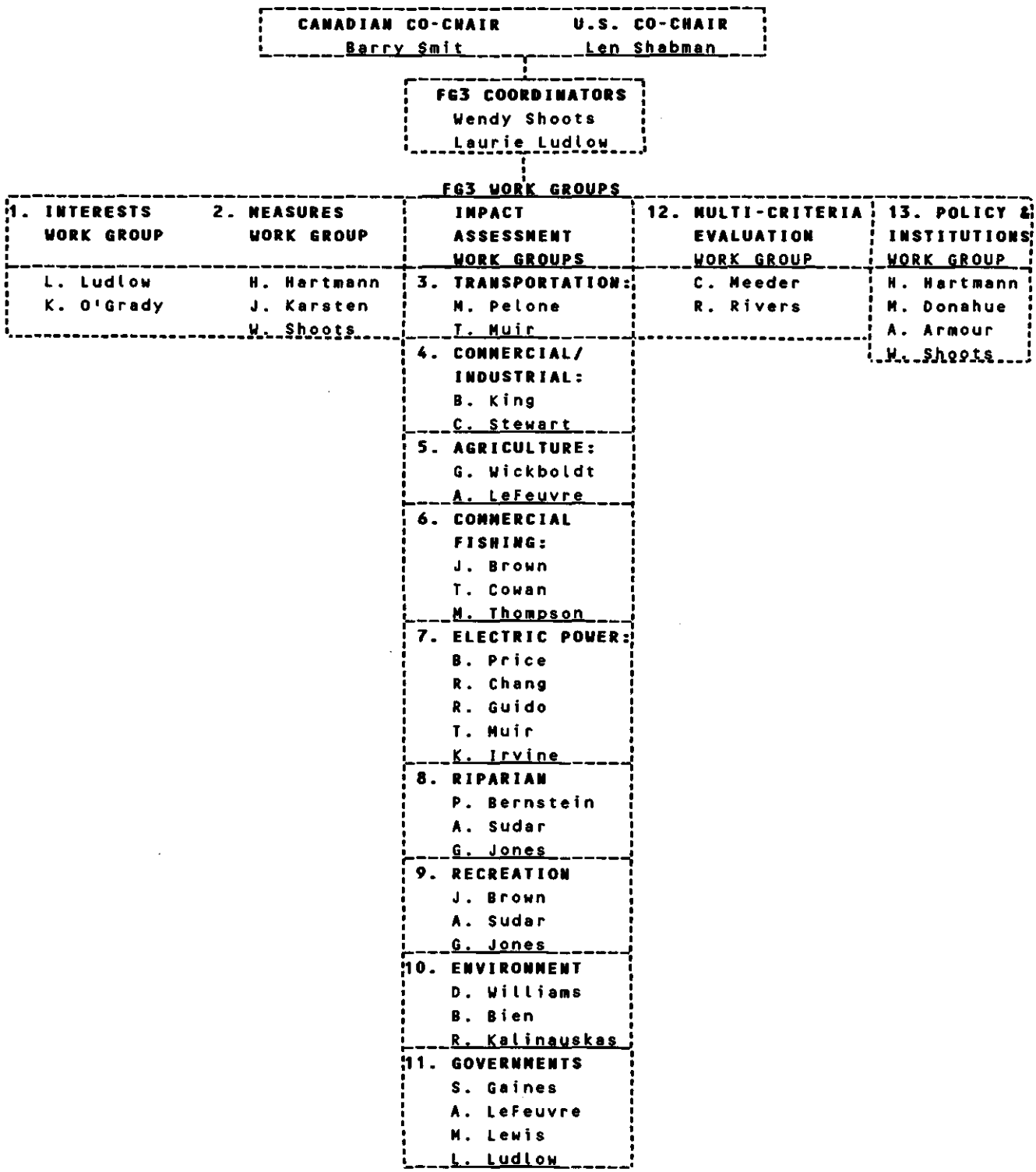
* Other members of FG3 responsible for compiling, researching and writing various sections of this Report.

WG #2: The Measures Work Group

WGs #3 to #11: The Impact Assessment Work Groups (described in detail in Appendix 3)

September, 1988

FUNCTIONAL GROUP 3 ORGANIZATION



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