

# **Preliminary Economic Analysis of the Draft Plan for the Lake Champlain Basin Program - Part 2**



**Lake Champlain  
Basin Program**

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for  
Lake Champlain Management Conference

November 1995

This technical report is the fourteenth in a series of reports prepared under the Lake Champlain Basin Program. Those in print are listed below.

#### Lake Champlain Basin Program Technical Reports

1. *A Research and Monitoring Agenda for Lake Champlain.* Proceedings of a Workshop, December 17-19, 1991, Burlington, VT. Lake Champlain Research Consortium. May, 1992.
2. *Design and Initial Implementation of a Comprehensive Agricultural Monitoring and Evaluation Network for the Lake Champlain Basin.* NY-VT Strategic Core Group. February, 1993.
3. (A) *GIS Management Plan for the Lake Champlain Basin Program.* Vermont Center for Geographic Information, Inc., and Associates in Rural Development. March, 1993.  
  
(B) *Handbook of GIS Standards and Procedures for the Lake Champlain Basin Program.* Vermont Center for Geographic Information, Inc. March, 1993.  
  
(C) *GIS Data Inventory for the Lake Champlain Basin Program.* Vermont Center for Geographic Information, Inc. March, 1993.
4. (A) *Lake Champlain Economic Database Project. Executive Summary.* Holmes & Associates. March 1993.  
  
(B) *Socio-Economic Profile, Database, and Description of the Tourism Economy for the Lake Champlain Basin.* Holmes & Associates. March 1993  
  
(B) *Socio-Economic Profile, Database, and Description of the Tourism Economy for the Lake Champlain Basin. Appendices.* Holmes & Associates. March 1993  
  
(C) *Potential Applications of Economic Instruments for Environmental Protection in the Lake Champlain Basin.* Anthony Artuso. March 1993.  
  
(D) *Conceptual Framework for Evaluation of Pollution Control Strategies and Water Quality Standards for Lake Champlain.* Anthony Artuso. March 1993.
5. *Lake Champlain Sediment Toxics Assessment Program. An Assessment of Sediment - Associated Contaminants in Lake Champlain - Phase 1.* Alan McIntosh, Editor, UVM School of Natural Resources. February 1994.  
  
*Lake Champlain Sediment Toxics Assessment Program. An Assessment of Sediment - Associated Contaminants in Lake Champlain - Phase 1. Executive Summary.* Alan McIntosh, Editor, UVM School of Natural Resources. February 1994.
6. (A) *Lake Champlain Nonpoint Source Pollution Assessment.* Lenore Budd, Associates in Rural Development Inc. and Donald Meals, UVM School of Natural Resources. February 1994.  
  
(B) *Lake Champlain Nonpoint Source Pollution Assessment. Appendices A-J.* Lenore Budd, Associates in Rural Development Inc. and Donald Meals, UVM School of Natural Resources. February 1994.

7. *Internal Phosphorus Loading Studies of St. Albans Bay. Executive Summary.* VT Dept of Environmental Conservation. March 1994.  
  
(A) *Dynamic Mass Balance Model of Internal Phosphorus Loading in St. Albans Bay, Lake Champlain.* Eric Smeltzer, Neil Kamman, Karen Hyde and John C. Drake. March 1994.  
  
(B) *History of Phosphorus Loading to St. Albans Bay, 1850 - 1990.* Karen Hyde, Neil Kamman and Eric Smeltzer. March 1994.  
  
(C) *Assessment of Sediment Phosphorus Distribution and Long-Term Recycling in St. Albans Bay, Lake Champlain.* Scott Martin, Youngstown State University. March 1994.
8. *Lake Champlain Wetlands Acquisition Study.* Jon Binhammer, VT Nature Conservancy. June 1994.
9. *A Study of the Feasibility of Restoring Lake Sturgeon to Lake Champlain.* Deborah A. Moreau and Donna L. Parrish, VT Cooperative Fish & Wildlife Research Unit, University of Vermont. June 1994.
10. *Population Biology and Management of Lake Champlain Walleye.* Kathleen L. Newbrough, Donna L. Parrish, and Matthew G. Mitro, Fish & Wildlife Research Unit, University of Vermont. June 1994.
11. (A) *Report on Institutional Arrangements for Watershed Management of the Lake Champlain Basin. Executive Summary.* Yellow Wood Associates, Inc. January 1995.  
  
(B) *Report on Institutional Arrangements for Watershed Management of the Lake Champlain Basin.* Yellow Wood Associates, Inc. January 1995.  
  
(C) *Report on Institutional Arrangements for Watershed Management of the Lake Champlain Basin. Appendices.* Yellow Wood Associates, Inc. January 1995.
12. (A) *Preliminary Economic Analysis of the Draft Plan for the Lake Champlain Basin Program. Executive Summary.* Holmes & Associates and Anthony Artuso. March 1995  
  
(B) *Preliminary Economic Analysis of the Draft Plan for the Lake Champlain Basin Program.* Holmes & Associates and Anthony Artuso. March 1995
13. *Patterns of Harvest and Consumption of Lake Champlain Fish and Angler Awareness of Health Advisories.* Nancy A. Connelly and Barbara A. Knuth. September 1995.
14. (A) *Preliminary Economic Analysis of the Draft Plan for the Lake Champlain Basin Program. Executive Summary - Part 2.* Holmes & Associates and Anthony Artuso. November 1995  
  
(B) *Preliminary Economic Analysis of the Draft Plan for the Lake Champlain Basin Program - Part 2.* Holmes & Associates and Anthony Artuso. November 1995

This report was funded and prepared under the authority of the Lake Champlain Special Designation Act of 1990, P.L. 101-596, through the U.S. Environmental Protection Agency (EPA grant #EPA X 001840-01). Publication of this report does not signify that the contents necessarily reflect the views of the States of New York and Vermont, the Lake Champlain Basin Program, or the U.S. Environmental Protection Agency.

**PRELIMINARY ECONOMIC ANALYSIS OF THE DRAFT PLAN  
FOR THE LAKE CHAMPLAIN BASIN PROGRAM, PART 2**

**Submitted to  
THE LAKE CHAMPLAIN MANAGEMENT CONFERENCE**

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**November 1995**



## **NOTICE**

The dollar amounts used in this report represent the best available data at the time of this research. The process of refining the benefits and costs of Lake Champlain restoration and protection activities is on-going. A major purpose of this work was to develop economic analysis tools that are responsive to incremental changes in any of the benefit or cost estimates, and that can be easily up-dated with new data, information, and scenarios as they become available through the work of the Lake Champlain Management Conference and the Lake Champlain Basin Program.

# Acknowledgments

The study team appreciates the assistance of the individuals who are members of the Lake Champlain Management Conference (LCMC), the Technical Advisory Committee (TAC), and the Economics Subcommittee of the TAC in the successful completion of this project. The contributions and suggestions of the Project Review Panel also are greatly appreciated.

The staff of the Lake Champlain Management Conference and the Lake Champlain Basin Program were consistently generous with their time and information, most notably Jim Connolly, Lisa Borre, Eric Perkins, Ann Cousins, Elizabeth Soper, Stephanie Clement, Kathy Wolcott, Coleen Hickey, and Jane Potvin. We also appreciate the assistance of Lee Steppacher, Wendy Cohen, and Terry Faber at the U.S. Environmental Protection Agency, and Jennie Bridge at the New England Interstate Water Pollution Control Commission.

A special note of thanks goes to the 23 individuals, primarily involved in private business and industry around the basin, who took time out of their busy schedules to attend and actively participate in two economic focus group sessions. Their serious consideration of economic issues involved in Lake Champlain water quality restoration and improvement is presented in this report. The type of understanding and insights that they brought to the table are crucial to a successful Lake Champlain planning effort, as is their continued involvement in the process.

We would like to thank a few individuals who were especially helpful in providing detailed information to the study team, in organizing Technical Advisory Committee subcommittee meetings, or who reviewed early drafts of the Part 2 report. They include:

Susan Bulmer, VT Forests, Parks, and Recreation;  
David Clough, VT DEC Water Quality;  
Ann Cousins, Lake Champlain Basin Program;  
Kelly Dziekan, New York State Office of Parks, Recreation & Historic Preservation;  
Larry Gobrecht, NYS Office of Parks, Recreation & Historic Preservation;  
Michael Hauser, VT Agency of Natural Resources;  
Bob Inslerman, NYSDEC;  
William Johnston, Essex County NY Planning Office;  
Kenneth Kogut, NYSDEC;  
Bob Kort, USDA, NRCS;  
Alan McIntosh, UVM School of Natural Resources;  
Dave Tilton, US Fish & Wildlife; and,  
Mary Watzin, UVM School of Natural Resources;

We greatly appreciate their insights and suggestions, as well as the comments of many others who discussed economic issues with the study team.

Barry Lawson, of Barry Lawson Associates, facilitated the two economic focus group meetings, and advised the study team on carrying out that aspect of the research. Nadia Korths, of Crystal Clear Impressions in Saranac Lake, provided editing services.

## List of Abbreviations

BMP	Best Management Practices
CAST	Council for Agricultural Science and Technology
CSO	Combined sewer overflows
FTE	Full time equivalent
GIS	Geographic Information System
GLC	Great Lakes Consortium
HK	Human capital
LCBP	Lake Champlain Basin Program
LCMC	Lake Champlain Management Conference
mg/L or mg/l	Milligrams per liter. .01 mg/l = 10 µg/l.
NRCS	Natural Resources Conservation Service (formerly the Soil Conservation Service)
NYSDEC	New York State Department of Environmental Conservation
NYSOPRHP	New York State Office of Parks, Recreation & Historic Preservation
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
ppm	Parts per million
SDWA	Safe Drinking Water Act
TAC	Technical Advisory Committee
µg/L or µg/l	Micrograms per liter. 10 µg/l = .01 mg/l.
USEPA	U.S. Environmental Protection Agency
VTDEC	Vermont Department of Environmental Conservation
WTP	Willingness to pay
WWW	World Wide Web (Internet)

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# PRELIMINARY ECONOMIC ANALYSIS OF THE DRAFT PLAN FOR THE LAKE CHAMPLAIN BASIN PROGRAM, PART 2

## 1. Introduction and Summary of Major Findings

### 1.1 Introduction

The Lake Champlain Management Conference (LCMC) was established in 1990 by federal legislation and charged with creating a comprehensive plan for protecting and enhancing Lake Champlain and its watershed area. Early on, the LCMC expressed an interest in integrating protection of Lake Champlain with vital local economies. One of the LCMC goals has been to promote economic strategies for the long-range economic future of the watershed that are compatible with other goals contained in the Draft Pollution Prevention, Control and Restoration Plan for Lake Champlain (i.e., draft Plan), and to tailor pollution prevention and control strategies for economic efficiency as well as environmental effectiveness. The following excerpt from the LCMC *Vision Statement* summarizes that goal of integrating environmental protection and economic vitality, in that the plan:

*...supports multiple uses -- including commerce, a healthy drinking water supply, fish and wildlife habitat, and recreation such as swimming, fishing, and boating. These diverse uses will be balanced to minimize stresses on any part of the Lake system. The Management Conference recognizes that maintaining a vital economy which values the preservation of the agriculture sector is an integral part of the balanced management of Lake Champlain....*(Lake Champlain Basin Program 1994).

This is the second of two reports on a preliminary economic analysis of the draft Plan. Together, the two reports provide a preliminary assessment of the overall fiscal and economic implications of the draft Plan for Lake Champlain, published as the ***Opportunities for Action*** by the Lake Champlain Basin Program (LCBP) in October 1994. The Part 1 preliminary economic analysis addressed economic issues in six of the eleven Plans for Action. The Part 2 document provides a preliminary economic analysis for the five major Plans not covered in the Part 1 report: Toxics, Human Health, Wetlands, Non-Native Nuisance Aquatics, and Cultural Heritage. In addition, this report includes continuation of the preliminary economic analysis of the Action Plans for Reducing Nutrients and Managing Nonpoint Source Pollution, that was initiated in Part 1.

Now that the LCMC has put the draft Plan before the public for review and discussion, they have begun the difficult process of selecting and prioritizing the proposed actions into a final plan. The draft Plan contains 11 major "Plans for Action" and approximately 170 individual plan elements. In their deliberations and decision making, the LCMC will be evaluating each Plan element with a wide variety of criteria, including the effectiveness in meeting environmental goals, the reliability of possible funding sources, the degree of public support for the activity, and the cost effectiveness of the element in addressing a particular Lake Champlain issue. This report, and the previ-



ously published Part 1 document, provide information to the LCMC and the public on costs, benefits, and cost effectiveness of various plan elements.

This phase of the preliminary economic analysis also addressed three additional tasks requested by the Economics subcommittee of the Technical Advisory Committee. First, the study team organized and carried out two economic focus group sessions. Those sessions included participants representing a variety of organizations and businesses in both Vermont and New York. The main findings from the focus group sessions are presented in the report, and detailed summaries of the two sessions are presented as Appendices.

Second, the study team carried out economic discussion sessions with representatives from most of the subcommittees of the Technical Advisory Committee (TAC) to review and revise cost estimates provided in the draft Plan. The meetings proved very valuable to the study team for understanding the latest thinking on the draft Plan recommendations by those most involved in formulating those recommendations. Since there were concurrent efforts by the TAC subcommittees, the Plan Formulation Team (PFT), and LCMC in revising, prioritizing, and finalizing plan elements, the discussion sessions aided the study team in stay abreast of the current status of the final draft Plan. The economic discussion sessions also helped the study team to focus their efforts most efficiently. Although there was not a considerable amount of new economic data forthcoming from the sessions, each workshop resulted in the study team gaining new insights into the economic considerations within each chapter, and we obtained additional references and contacts for further information. The analysis presented in this report reflects the benefit of those insights and references.

Third, Anthony Artuso lead the study team in developing an economic analysis framework for prioritization and implementation of draft Plan elements. The framework is particularly focused on policy development and implementation in situations where costs and benefits are uncertain and new information can be generated over time. The framework draws upon basic concepts of decision theory, an analytic technique that is widely used in economics, policy analysis and business planning.

A complete benefit cost study requires that all probable economic costs and benefits of a given action be identified and quantified. That level of economic analysis is anticipated in the next phase of economic research, an economic analysis of the final plan. The goal for this work was to compile and analyze as much of the needed economic information as possible within the project time frame and budget. The study team perceived the present Lake Champlain planning effort as part of an ongoing process of scientific research, policy development, implementation, and adjustment. Therefore, a portion of our research efforts were devoted to creating economic analysis tools and frameworks that will continue to be useful to Lake Champlain planning and protection efforts. Illustrative of the utility of our approach is the *economic optimization model of phosphorus control*, developed and described in the Part 1 report, that continues to be up-dated and refined as part of the phosphorus reduction targeting procedure for the Lake Champlain basin.

Although this report is written so as to be assessable to the lay person, various economic terms and concepts may be unfamiliar to the reader. Attached to the full report is a **List of Abbreviations**, preceding the Table of Contents, and a **Glossary** preceding the Bibliography. In addition, the study team adhered to rigorous academic standards in referencing all sources of information and providing full citations in an extensive **Bibliography** located at the end of the report.

## **1.2 Summary of Major Findings**

### **1.2.1 Economic Benefits of Lake Champlain Water Quality Improvement, Revisited**

- 1. The study team created an evaluative chart as a technique for assessing the relevance of the benefit studies reviewed in the Part 1 Preliminary Economic Analysis (see Table 2-2).** Two of the per capita-based benefit studies appear to be most applicable to the Lake Champlain as a whole, especially since they are based on a random sample of households in New York (Montgomery & Needelman 1994) and New Hampshire (Needelman & Kealy 1994). As applied to Lake Champlain, there is a annual potential \$12.6 million benefit to the local basin population for the removal of the threat of toxic contamination in the lake, and a \$1.5 million benefit related to improved swimming from the removal of bacteria and eutrophication problems from the lake. That combined benefit of \$14.1 million would be in addition to any increased expenditures by anglers, swimmers, and boaters due to improved conditions, and does not include the benefit value accrued by lakeshore property owners, and by Lake Champlain users who reside outside the basin area.
- 2. Table 1-1 is a revised presentation of the available Lake Champlain data useful for transferring water quality improvement benefits to Lake Champlain.** Table 1-1 contains preliminary data on a number of the main lake user categories, such as state park beach users, anglers, boaters, etc. The information on use is not complete at this point, represented by blanks in the chart, and continues to be up-dated by on-going Lake Champlain research.

### **1.2.2 Action Plans for Reducing Nutrients and Managing Nonpoint Source Pollution**

- 1. Substantial work has been done in quantifying the costs of point and nonpoint source phosphorus control and of determining what facilities and watersheds should be targeted for implementation of treatment upgrades as well as agricultural and urban best management practices (BMP's).** Continuation of this work is being undertaken by the nutrient and nonpoint source subcommittees using the model developed by Artuso as part of the preliminary economic analysis of the draft Plan (Holmes & Associates and Artuso 1995).
- 2. The Artuso model can be used to identify individual treatment plants, watersheds and urban/suburban areas where additional controls would be most cost-effective in achieving established in-lake phosphorus concentration targets.** Nevertheless, further refinements in the model and in the nutrient management strategy are required. Much of the information in the model on the costs of point source controls and urban BMP's and the effectiveness of agricultural BMP's requires further refinement. The model also does not include the nonpoint source contribution that will result from new development. Moreover, the model is only useful in targeting specific point sources and establishing general targets for phosphorus control from nonpoint sources in critical lake segment watersheds. What is required now is an iterative planning, implementation, monitoring and reevaluation process, described in detail in this report.

**Table 1-1: Recreation Data Summary for Lake Champlain (Revised)**

Activity or Facility	Year	Area	Number of Facilities	Annual Count	Average Expenditure per Person, per Day	Estimated Annual Expenditure	One Day Count
<b>State Park*</b>							
Vermont State Parks Along Lake Champlain <sup>1,13</sup>	1994	Lake shore	9	195,426	\$17	\$3,322,242	
New York State Parks Along Lake Champlain <sup>2,13</sup>	1994	Lake shore	5	274,000	\$17	\$4,658,000	
<b>Fishing</b>							
Fishing License Purchases <sup>4</sup>	1991	Basin		168,000			
Number of Anglers: Lake Champlain, NY & VT <sup>12</sup>	1991	Lake		141,379			
Angler Days: Lake Champlain, NY & VT <sup>5</sup>	1990	Lake		1,608,486	\$20	\$32,169,720	
<b>Boating</b>							
Lake Champlain Boat Count <sup>3</sup>	7/25/92	Lake					12,425
Canadian Boat Border Crossings @ Rouses Pt <sup>4</sup>	Avg	Lake		7,318			
Slips & Moorings Count, Vermont <sup>6</sup>	1994	VT shore	2,901				
Slips & Moorings Count, New York <sup>6</sup>	1994	NY shore	2,994				
Boat Launch Sites, Vermont <sup>6</sup>	1994	VT shore	79				
Boat Launch Sites, New York <sup>6</sup>	1994	NY shore	28				
Commercial & Public Marinas, Vermont <sup>6</sup>	1994	VT shore	37				
Commercial & Public Marinas, New York <sup>6</sup>	1994	NY shore	26				
Lake Champlain Commercial Marina Employment <sup>12</sup>	1990	Lake shore	56	448			
<b>Other Activities, Expenditures per person/day*</b>							
Divers <sup>8</sup>	1992	Lake			\$110		
Transient marina users <sup>8</sup>	1992	Lake	64		\$44		
Park users <sup>6,8</sup>	1992	Lake shore	114		\$31		
Bicyclists <sup>9,10</sup>	1994	Basin			\$52		
Beach users <sup>6,12</sup>	1994	Lake shore	64		\$17		
Boaters <sup>13</sup>	1987	Lake			\$26		
<b>Employment, Demographics, Property Values</b>							
Annual Lake Related Tourism Employment <sup>4</sup>	1989	Lake shore		16,400			
Lake Champlain Basin Population <sup>4,12</sup>	1995	Basin		650,000			
Lake Champlain Basin Households <sup>4</sup>	1990	Basin		211,000			
Basin residents over the age of 18 <sup>4</sup>	1990	Basin		450,000			
Shoreland Town Property Values <sup>4</sup>	1991	Lake shore		\$8.8 billion			

Preliminary Total: \$40,149,962

Note: This is an update of a table presented in the Part 1, Preliminary Economic Analysis (Table 7-1, p 122).

\* Only includes State Parks with beaches on Lake Champlain.

Data sources: 1. Simino (1994), 2. NYOPRHP (1994b), 3. Bulmer (1993), 4. Holmes & Associates (1993), 5. Connelly and Brown (1990), 6. Farnum (1995), 7. Gilbert (1991), 8. Dzeikan (1995) and personal communication, 9. Holmes & Associates (1994), 10. Burgess (1994), 11. NYSDEC & USF&W (1990), 12. Holmes & Associates estimate from available data., 13. Brown, Tommy (personal communication 9/95).

3. The current watershed targeting procedure for phosphorus control indicates that Policy 2 combined with cost effective targeting of nonpoint source controls is the least cost of the three policy options outlined for achieving in-lake phosphorus concentrations (see draft Plan, Lake Champlain Basin Program, 1994). However, further cost reductions can be realized by targeting point source controls to achieve the greatest reduction in phosphorus discharge per dollar of control expenditure. The phosphorus control model described in the prior Part 1 *Preliminary Economic Analysis*, can assist in this targeting effort. It is also important to identify funding mechanisms that will ensure that control costs do not fall disproportionately on only a few communities.

### 1.2.3 Action Plan for Preventing Pollution from Toxic Substances

1. **The most well publicized indicator of toxic pollution in the Lake Champlain ecosystem is the presence of high levels of mercury and PCBs in certain species of lake fish.** Concurrently, one of the main direct economic costs of toxic pollution are the detrimental human health effects that can occur from excessive consumption of contaminated fish species. Toxic contamination of fish also can reduce the number of fishing trips anglers make to Lake Champlain and reduce the net benefits they receive from each trip. There may also be secondary effects on other recreational activities and expenditures due to public perceptions about toxic contamination.
2. **In a recent study, Montgomery and Needelman (1994) used a discrete choice, travel cost model to estimate the recreational fishing benefits that would result from elimination of toxic pollutants that are responsible for fish consumption advisories in New York State lakes.** They estimated that the combination of increases in fishing participation rates and increases in net benefits per fishing trip would result in total net benefits of \$28 per capita, per year to New York residents. To understand the implications of these findings for Lake Champlain, it is important to realize that there is no guarantee that implementation of the Action Plan for Preventing Pollution from Toxic Substances will permit the lifting of all fish consumption advisories. In addition, the Montgomery and Needelman study estimated the benefits that the average New York State resident would receive from the opportunity to fish in any lake in the state without worrying about toxic contamination of fish. The annual benefit of \$28 per person should therefore be viewed as an estimate of the upper limit of the direct recreational benefits to basin residents of the draft Action Plan for Preventing Pollution from Toxic Substances.
3. **Economic analysis of the benefits of remediation of contaminated sites requires information generated from risk assessment studies and engineering analyses of remediation costs and effectiveness.** Risk assessments of contaminated sites are normally summarized in the form of increased probabilities that members of the affected population will develop various illnesses or health impairments as a result of direct contact with or movement of toxics from the site via physical or biological processes. Risk assessments have not yet been completed for all of the three priority sites of concern identified in the draft Plan, nor have the costs and effectiveness of potential remediation measures been completely determined.
4. **Economic analysis of remediation efforts for sites of concern must also consider potential effects on property values.** A recent study by Mendelsohn et al. (1992) provides relevant information for considering the property value impacts of PCB pollution in Cumberland Bay. The Mendelsohn et al. study used panel data (i.e. before and after sales of the same houses) to estimate the negative effect of PCB contamination in the harbor of New Bedford, Massachusetts. The results of the study showed that after 1982, knowledge of PCB contamination in the most polluted parts of the harbor had depressed property values in adjacent neighborhoods by approximately 8% or \$7,000 to \$10,000 in 1989 dollars. PCB pollution in the somewhat less contaminated outer harbor was estimated to have depressed adjacent property values by 3% to 7%. These negative effects on property values were estimated for neighborhoods as much as a mile from the harbor. Whether PCB contamination of Cumberland Bay will have similar effects on property values in nearby neighborhoods will depend on several factors, including: the proximity of the neighborhoods to the contaminated site, the degree and extent of contamination relative to New Bedford Harbor, and expectations about remediation of the site.
5. **The draft Plan recognizes that in addition to the direct public health risks and recreational costs of contaminated fish species, toxic pollution may create indirect economic**

**costs as a result of more widespread ecosystem effects.** Preliminary tests of microorganisms, freshwater shrimp, and fish species in Lake Champlain indicate that elevated levels of toxic pollutants at certain sites may already be having some detrimental ecological effects. While, these findings are cause for concern, further research is needed on trends in levels of contamination as well as fate and effects of contaminants of concern before any estimates can be made of the potential economic costs of indirect ecological effects of toxic pollution in the lake.

- 6. Although the draft Action Plan prioritizes sites and substances on the basis of the risks they pose to public health and the Lake Champlain ecosystem, the Toxics Action Plan could be more explicit in outlining how this risk based approach affects the sequence of research and remedial actions that are proposed.** Given the current uncertainty over sources, fate, effects and remediation options for toxic substances in the Lake Champlain basin, expenditures on toxic pollution prevention and control should be made in a sequential fashion contingent on the results of continued research, risk assessments and source identification efforts. There also appears to be some overlap and duplication between items in this action plan and between parts of this and other action plans, particularly Fish and Wildlife, indicating that cooperation between agencies and among research efforts could lead to significant cost savings.

#### **1.2.4 Action Plan for Protecting Human Health**

- 1. There are approximately 137,803 residents of Vermont who are served by 25 municipal and 6 private drinking water supply systems that draw their source water from Lake Champlain, indicating that at least one quarter (24%) of Vermont's population relies on Lake Champlain for drinking water.<sup>1</sup>**
- 2. Overall, Lake Champlain compares very favorably to surface drinking water sources throughout the nation, and the lake seems to be a more cost effective source of water than alternative sources.** Water withdrawn from Lake Champlain has nutrient levels and turbidity that are below national averages for surface water sources of drinking water; however, there are direct economic implications for drinking water suppliers should there be an increase in nutrient levels in Lake Champlain.
- 3. Using the data gathered for this study, Lake Champlain drinking water could be partially valued at \$3.2 million, considering only its wholesale value, and accounting only for those individuals served by the 11 municipalities in the Champlain Water District.** Using the same wholesale value for the other one third of Lake Champlain drinking water users outside the 11 municipal water districts, the wholesale value of Lake Champlain water would be in the range of \$8 million. An economic analysis of the net value of Lake Champlain as a water source would need to consider the cost of an alternative water source for those estimated 156,400 users. The analysis would also examine the economic implications on water treatment costs of improvement, as well as decline, in the lake's water quality.
- 4. Between September 1, 1992 and August 31, 1993, 66% of anglers who fished Lake Champlain ate some of the fish they caught, averaging 26.2 meals per year (Connelly and Knuth 1995).** About 5% of anglers indicated they ate species for which health advisories exist at levels beyond those recommended by the advisories. The New York advisory is more

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<sup>1</sup> An estimated 156,426 people use Lake Champlain for drinking water. This a correction of the 189,000 figure presented in the Socio-Economic Database report (Holmes & Associates (1993). In addition to the Vermont water systems, there are 3 municipal systems and 2 private systems in New York drawing drinking water from Lake Champlain, serving 5,236 New York residents. Another 5,149 households (13,387 people) in New York and Vermont are estimated to draw Lake Champlain water for use by their individual households.

strict than Vermont's advisory for children under 15 years of age and women of childbearing age. As a result, 9% of New York anglers exceeded the New York advisories, while only 1% of anglers exceeded the Vermont advisories. Another 18% ate species for which advisories exist but stayed within the recommended consumption advisories. Of the 5% who exceeded the advisories, nearly all (90%) were New York women of childbearing age, for whom eating any fish for which advisories exist constituted exceeding the New York recommended limits. A plurality of these women (48%) indicated they did not know what the advisories were for women of childbearing age.

5. **Reinert et al. (1991) point out that while disclosure to anglers and the public at large of the risks of consuming fish containing contaminants is important and essential, the public needs an improved framework for evaluating the information.** Citing other studies, they place the lifetime risk of contracting an environmentally-related cancer in the 2% to 5% range. These authors cite studies that have estimated the lifetime cancer risk of drinking one pint of milk per day, eating 4 tablespoons of peanut butter per day, and drinking one diet soda per day containing saccharin. In addition to cancer-related risks, they point out the risk associated with driving to and from the fishing site, and the risk of boating while fishing. Thus, in addition to improving the visibility of health advisories related to fish consumption, it is important to provide the public comparative data on other risks and an improved framework for deciding which risks to accept or reject.
6. **Beach closings result in lost income to local businesses.** In his 1984 research involving Cumberland Bay Park, NY on Lake Champlain, Tommy Brown found that most users were primarily interested in swimming, and spent on average \$12.18 per person. By subtracting out the entrance fee, and converting the expenditure to 1995 dollars, the average Lake Champlain beach user spends approximately \$16.60 per person per day. Without a detailed analysis of beach attendance and beach closings by date, it is difficult to estimate the economic impact of beach closings. Just by example, if a beach with an average use of 500 people on a weekend day were closed on a Saturday, using the \$16.60 figure, the direct economic loss would be \$8,300 per closed day, not including entrance fees or lodging fees.
7. **The economic impact of beach closings would appear to go far beyond the one day impact in the example given above.** For some, when a beach is closed once, they chose not to return to that beach for the rest of the year. Similarly, when a "Beach Closed" sign appears repeatedly, another percentage of the user group will chose to travel to a beach that is open more consistently. On a broader, public perception level, beach closing notices give the impression that the lake is somehow polluted, regardless of the localized nature of the problem. For that segment of the population, use of any beach on the lake, and lake use in general, may be curtailed.
8. **In the case of both drinking water and fish consumption advisory messages, further education and communication efforts appear to be justified.** The cost associated with these efforts will be closely related to the number of messages and how they are delivered. As discussed in this section, including positive aspects of Lake Champlain water quality and fisheries might be appropriate in some cases to help to re-direct use, rather than simply discourage it. In addition, risk should be put in some type of context, such as in relation to risk related to other common activities.

### 1.2.5 Action Plan for Protecting Wetlands

1. **There are over 300,000 acres of wetlands in the Lake Champlain basin that provide a wide variety of ecological functions, including:** improving water quality by filtering sediments, pollutants, and nutrients; protecting groundwater and drinking water; contributing to

overall biological diversity; providing habitat for fish and wildlife; and, providing habitat for some rare and endangered species and natural communities. Wetlands also help stabilize shorelines and prevent erosion, provide recreational and educational opportunities, and contribute to the aesthetics of the region.

2. **Wetlands also provide critical temporary habitat for many migratory bird species and migratory bird hunting generates significant levels of expenditures that benefit local economies.** These hunting expenditures are not known for the Champlain basin, but in Vermont, slightly over half of which lies within the basin (55%) and likely contains the majority of Vermont's prime duck hunting habitat, approximately 7,300 migratory bird hunters spent \$383 each in 1991, for a total of \$2.8 million (US Fish and Wildlife Service 1993). Better data are needed to determine expenditures made within the basin, what portion of those expenditures represent new dollars coming into the basin, and the secondary economic impacts of that spending. In addition it is important to determine how migratory bird species are affected by incremental changes in the quantity and quality of wetlands.
3. **Respondents to a recent survey of New England residents were willing to pay an average of between \$74 and \$80 per year (over a five-year period) for wetlands providing flood protection, water supply, and water pollution control.** They were will to pay between \$81 and \$96 per year for wetlands containing rare species of plants. The authors concluded that the survey results suggest that most of this value is nonuse value, and that failure to consider nonuse values in decision making can understate the value of wetland preservation by a substantial margin (Stevens et al. 1995).
4. **From the perspective of the basin as a whole there is no shortage of undeveloped land and limiting development in wetland areas is unlikely to restrain growth in the near future.** If only a fraction of the developable land is defined as wetlands the effect on general land prices will be quite small. Given reasonable estimates of the numerous benefits that wetlands provide, this aggregate, regional perspective would argue for strong wetlands protection. However, for some landowners and communities, the costs of wetlands regulation may be quite high. This raises a second policy issue which is whether the benefits that wetlands provide are public property which private landowners have no right to impair, or whether the costs of wetlands protection should be shared between private landowners and the public. This issue has implications for the appropriate mix of acquisition programs, financial incentives, and market mechanisms to use in wetlands protection programs.
5. **One of the most promising market mechanisms for minimizing wetlands loss is mitigation banking.** Mitigation banking refers to a wide range of public programs and private business ventures that involve the creation, restoration or enhancement of wetlands as an advance offset for degradation or conversion of wetlands elsewhere (Silverstein 1994). For example, a developer might receive mitigation credits for restoring a previously drained agricultural wetland. The developer could bank these credits and exchange them at some future time for the right to convert a similar or smaller area of wetlands as part of a separate development. Reppert (1992) indicated that at least 37 mitigation banks are operating in the U.S. and at least 64 others are in the planning stage. One of the principal benefits of mitigation banking are that it can reduce the cost of adhering to a no net loss policy. Mitigation banks can also ease the burden of wetlands regulation on individual landowners and communities by providing them with additional opportunities for development. In addition, mitigation banking permits regulators and conservation organizations to take a landscape approach and focus on a larger wetland system for creation, restoration, or enhancement. Ecologists and resource managers now realize that the cumulative effects of habitat loss at a landscape level may prove significantly more harmful to biodiversity than the sum of the individual habitat losses. Mitigation banking can help ensure a coordinated approach that avoids "postage stamp" wetlands.

6. **In the midst of wetlands protection controversy, there are at least two points of general agreement.** First all parties to the debate seem to agree that the confusing and duplicative mix of current wetlands regulatory programs and responsibilities unnecessarily increase costs and create uncertainty for landowners and developers. Second, there is broad agreement that certain types of wetlands provide very substantial public benefits and should be protected. Building upon these areas of agreement and the impressive degree of public/private and intergovernmental cooperation already underway within the basin, the Lake Champlain Basin Program has an opportunity to fashion an integrated set of regulation, acquisition programs, and economic incentives that strike an appropriate balance between public benefits and private costs.

### **1.2.6 Action Plan for Managing Non-Native Nuisance Aquatic Plants and Animals**

1. **On Lake Champlain, the Vermont Coalition of Water Suppliers has been intently studying the economic impacts of zebra mussels on their eleven water suppliers.** Presently, they are estimating a total of \$1.6 million dollars in capital costs over the next few years for those eleven facilities. Cost estimates per facility range from \$60,000 to \$334,000. At least three systems now have chlorination control in operation (personal communication: John Coate, Champlain Water District, October 1995).
2. **The Town of Willsboro NY has been studying the possible impacts of zebra mussels on their community water system for two years, and recently budgeted \$60,000 to address the problem using a chlorine infuser.** The necessary work has an estimated cost of \$120,000, however they anticipate cost savings by doing some of work with current staff (personal communication: Teresa Sayward, Town of Willsboro, October 1995).
3. **Lake Champlain is the source of drinking water for approximately 60,000 households (156,426 people), with 55,015 households receiving their water through community drinking water systems, and an estimated 5,149 households drawing drinking water directly from the lake.** Zebra mussels will affect each of these households directly or indirectly. For those households on community systems, they will likely see an increase in their water bills reflecting the costs of deterring or removing zebra mussels from in-take pipes. Households that draw drinking water from the lake through personal systems will have direct costs related to keeping their water pipe clear of zebra mussels, with an estimated initial cost of \$300 to \$1,500 (personal communication: John Choate, Champlain Water District, October 1995).
4. **In terms of recreational related expenditures related to zebra mussels, Lake Erie research found that 13% of 109 responding boat owners reported expenditures for protective paints, with an average cost of \$94.** Four percent reported additional boat maintenance at an average cost of \$171, 3% reported increased insurance costs averaging \$207, and one respondent reported \$50 in boat motor damages directly attributable to the zebra mussel (Vilaplana and Hushak 1994:8). In addition to some increased costs related to boating, the impacts of zebra mussels on recreational boaters require behavioral changes, such as storing their boat out of the water, painting or aggressively cleaning the bottom, and flushing the motor. Other costs of zebra mussels relate to beach clean-up when large quantities of zebra mussels wash up on shore. The mussels have to be dumped in a land fill, so hauling costs and tipping fees, as well as labor, are all economic concerns.
5. **There are mixed blessings related to zebra mussels and underwater historic resources.** On one hand, the zebra mussel has contributed to a significant increase in water clarity in



some lakes. Parts of Lake Erie went from four foot visibility to 40 feet. Increased water clarity has had a positive effect on the Great Lakes diving industry in terms of increased visibility and enjoyment of ship wrecks on the bottom of the lake. Unfortunately, zebra mussels are attracted to any hard surface, and will readily attach themselves to the wrecks. Some of the historic resources at the bottom of Lake Champlain are already being covered by zebra mussels. In addition, there is a danger that the weight of accumulating mussels will collapse the 200 year old wooden vessels. Art Cohn, of Champlain Maritime Museum, predicts that shipwrecks in 80 ft of water or less will be covered by zebra mussels. A detailed report on the overall impacts on underwater historic resources in Lake Champlain is in currently in progress (personal communication: Art Cohn, November 1995).

6. **There needs to be an explicit link between the studies and information gathered in this action, and the decision-making process on when, where, what type, and how much effort is going to be devoted to a particular nuisance problem.** All of these actions are difficult to assess economically, without illuminating the links between a defined problem (e.g., recreational, ecological, environmental) and the resulting information gathering, monitoring, and action. The sea lamprey eradication program provides an example of an aggressive effort to address one nuisance problem. Efforts like this seem to be most cost effective when the program is directed at a specific problem, in that case, to control the sea lamprey in order to improve sport fishing, among other goals.

### **1.2.7 Action Plan for Protecting Cultural Heritage Resources**

1. **A recent report on the economics of historic preservation defines historic preservation as the careful management of a community's historic resources, avoidance of wasted resources by careful planning and use, and the thrifty use of those resources.** Historic preservation also includes the concepts of using or managing those historic resources with thrift or prudence, avoiding their waste or needless expenditure, and reducing expenses through the use of those historic resources (Rypkema 1994). As defined, the essence of historic preservation is economizing and avoiding waste. In addition to being fiscally responsible, the benefits of historic preservation and protecting cultural heritage include improved quality of life, increased sense of community, and improved economies due to tourism expenditures.
2. **A 1986 survey of Great Lakes divers found a number of interesting characteristics indicating the economic opportunity for diving to submerged cultural heritage resources in Lake Champlain.** For example, the average diver took 6 trips in 1986, while participating in 31 individual dives. Each diver had an average investment of \$2,500 in their diving gear, and spent an average of \$141 per person, per trip while in the vicinity of the underwater preserve. Total trip expenditures were \$245. Of their local expenditures, 12% were for dive shop services, 12% were charter fees, 8% were boat related expenditures, and 3% were in marina fees and boat rentals. So at least 35% of the \$141, or \$49, was in direct lake-related expenditures. The remaining \$92 was spent in the vicinity of the lake area (Peterson et al. 1987b).
3. **Among the more crucial attributes influencing the selection of a diving location by divers in the Great Lakes were: dive shop services, information about diving sites, availability of diving charters, quality of shipwrecks, and well marked diving sites (Peterson et al. 1987b).** Close to 60% of first time divers and 46% of seasoned divers prefer to use charter diving services. About two-thirds of Great Lakes divers participate in the activity in July or August (Peterson et al. 1987a). These findings seem to indicate that there is significant economic opportunity in an expanded underwater preserve system on Lake Champlain, especially if promotion and services are expanded concurrently.

4. **A recent study of divers who visited Lake Champlain found that their average trip expenditures while at Lake Champlain were \$209, with divers having average daily expenditures of \$110 per person.** An additional \$100 was spent in preparation for the trip and while in transit. Of the \$209 spent in the vicinity of Lake Champlain, 43%, or \$90, was in direct lake-related expenditures for diving rentals, boat supplies, launching fees, etc. The most popular diving areas appear to be in the vicinity of Plattsburgh and Willsboro, NY and Burlington, VT. Three quarters of respondents indicated that they dive at designated Vermont underwater historic preserve sites on Lake Champlain, and that the average diver visited those sites about 5 times per year. A majority of divers indicated the need for more diving sites, and indicated a willingness to pay an average of \$5 per dive for the development and maintenance of underwater sites (Dziekan 1995).
5. **According to a Michigan State University Sea Grant Agent who has studied shipwreck diving since the creation of Michigan's first underwater preserve, diving to shipwrecks in the Great Lakes is a very popular activity that appears to be seeing increasing numbers of users each year.** One example is that some of the remote sites on Lake Superior that were explored by only a few divers a year prior to receiving underwater preserve status, now are visited by 1,000 or more divers annually (personal communication: Ronald Kinnunen, Michigan State University Extension).

### **1.2.8 Economic Focus Group and Technical Advisory Committee Economic Discussion Sessions**

As requested, the study team organized and facilitated two economic focus group sessions, the first on July 17, 1995 at Clinton County College south of Plattsburgh, NY, and the other on September 8, at Champlain College in Burlington, VT. The sessions were designed as 3.5 hour morning sessions, to facilitate participation among the private sector. Twenty industry, business, and local government officials attended the first session, and nine participated in the second. Six individuals attended both sessions, so a total of 23 individuals representing economic interests around the basin became involved in these formal discussions on the economic issues involved in the Lake Champlain planning effort. While somewhat limited in the numbers, those in attendance represented a very wide cross-section of economic interests around the lake, including: marinas, the paper industry, City of Burlington, Plattsburgh Chamber of Commerce, local government, agriculture, forestry, recreation, banking, watershed associations, and others. Both meetings were attended by six staff, consultants, and resource persons, who answered questions and took notes.

The first session involved a certain degree of disagreement, and there was lively discussion on a number of basic economic issues, including the following:

1. **Disagreement on the use and interpretation of economic benefits of Plan items.** Some felt that the benefits have to be area specific and should not reflect the value of the lake to greater basin population, many of whom may not receive any direct economic benefit from the lake; while other felt that since this is a Plan for the future, a wide variety of possible present and future benefits should be considered. One aspect of the basin-wide benefits of a clean lake was expressed in terms of the lake as asset to local industry in attracting higher caliber employees.
2. **Disagreement on the allocation of costs.** Some felt that primary, secondary, and tertiary costs should be quantified for specific areas around the lake and that the estimated benefits should only be accounted for in relation to those specific areas. Others pointed out that rec-

reational benefits of cleaner water could occur throughout the lake, so it will difficult to reconcile costs and benefits for a particular bay or other location on the lake.

3. **Concern expressed over the timing, budget, and time-frame for the economic analysis.** Can an accurate economic analysis be completed in the time allotted, can it be integrated into the planning process, and if it has errors, will there be time to correct them and to incorporate the corrections into the final plan? Concern expressed that the economic analysis to date is primarily a fiscal analysis. Some expressed the notion that many times decisions are made with little or no economic analysis, and that the economic analysis should focus on recommendations with obvious economic impact, making the timeframe and budget more realistic.

A related concern centered on the methodologies being used by the economics consultants, and what role cost-benefit analysis, risk assessment, discounting, and other research techniques should play in the analysis of each action item.

A portion of the session was devoted to identifying those plan items that appear to have adverse economic impact in the basin. Another part of the session focused on identifying those plan items that are beneficial to the short and long term interests of the basin economy. A third area of discussion was on remaining information gaps, in terms of economics.

While there was no organized attempt to reach consensus during the session, there seemed to be general agreement around a few points. One participant made the following comment on the over-all approach to Lake Champlain planning. It seems to summarize views of many around the table.

The Plan starts to look at a sub-basin approach, and that is good and should be expanded. It results in a more ecologically sensitive approach, is more efficient, and is more cost effective. The Basin Program people deserve a great deal of credit for introducing the sub-basin concept, but do not take it nearly far enough. It is long over-due in dealing with this lake. There are many hot spots around the Lake, such as Wilcox Bay (toxics) and Malletts Bay (boat traffic, recreation), but Malletts Bay is not Rouses Point. So you need to look at specific areas. Not one size fits all. In many areas of the lake, state and federal involvement or funding is not necessary (comment by a Lake Champlain economic focus group participant).

During the second session, the main discussion centered on specific measures to boost economy and business while protecting Lake Champlain, and at least 11 distinct proposals were offered and discussed. Most seemed to be heartily supported by the group present, although there was no attempt at a group consensus. Some of the main themes running through the ideas include the following:

1. **Innovation, ideas, creativity -- all need to be encouraged in the private sector and supported by government.** This is how economically efficient and equitable environmental change comes about. There are already numerous examples at the state and national levels. The EPA's "Golden Carrot Award" and the NYSDEC Governor's Award are two examples, whereby government recognizes and rewards innovation in business in terms of protecting the environment. One problem is that while government sponsors these awards, they do not seem to participate themselves. Would like to see an award program for innovation and efficiency for government employees and departments.
2. **Pollution prevention is key to cleaning up the lake, and prevention is tied to the encouragement of innovation, as noted in the previous idea.** Prevention is good for business, and industry continues to develop new ideas for pollution prevention. Industry knows that it is less expensive to prevent pollution at the source, than it is to remove it after it leaves the end

of the pipe. The organization of retired engineers (REAP) and other organizations are already working in the basin to facilitate the move towards pollution prevention. In addition, solving pollution problems can directly help the local economy. One example is Living Technologies in VT, recently awarded a \$1 million contract in the UK. Pollution prevention also involves revising our approach to regulation. There are pilot projects in Addison County, where performance based septic systems, rather than design based, are being installed. Design based regulations can result in bigger lots, rather than addressing the real problem of controlling waste.

3. **There is a role for government in protecting local economies while preventing pollution of Lake Champlain.** Government has helped start loan programs, such as the Northern Community Investment Corporation, that has helped numerous businesses in northern VT and NH. The City of Burlington has been involved in developing the new wood-chip gasifier plant and the Lake Champlain Science Center on the waterfront. Marketing, tax issues, and identifying business opportunities are other areas where government can play a positive role. From an economic viewpoint, government can be more effective as a catalyst, than as a regulator.
4. **On-going Lake Champlain planning efforts must facilitate and accommodate the participation of economic interests.** There does not seem to be that much disagreement between economic and environmental concerns, but problems inevitably arise when economic interests are not invited to the table. However, a number of barriers effectively prevent the business community from participating, including: too many meetings already; the business person cannot afford to be away from the business; small business people often do not have paid staff who attend meetings for them; and, there is an intimidation factor for the small business person. Implementation plans need to address how to facilitate the participation of economic interests, given these barriers to involvement.

### **1.2.9 A Prioritization and Implementation Framework for the Lake Champlain Basin Program**

To take advantage of new information as it becomes available, the Lake Champlain Basin Program must incorporate periodic review procedures into the process established for implementation of the Plan. As new information becomes available, the benefits, costs and remaining uncertainties involved in taking action should be reevaluated. Similarly, for programs and other actions involving continued public expenditures or other costs over time, monitoring and evaluation efforts should be implemented to periodically determine whether these programs, regulations, etc. should continue unchanged, be revised, or eliminated altogether.

Although there is some danger of oversimplification, the framework outlined above can be summarized in the form of a checklist.

- Do expected benefits exceed expected costs?
- Can financing arrangements be implemented that will ensure an equitable distribution of costs and benefits?
- Is there a high level of uncertainty in benefit and/or cost estimates?
- Can this uncertainty be reduced at relatively low cost through further study or pilot projects?
- Could taking little or no action cause irreversible damage, greatly increase costs, or significantly reduce benefits?
- Have institutional arrangements been established to ensure periodic reevaluation of the benefits and costs of taking action or revising ongoing programs?

The numeric examples presented in the report are intended only to illustrate the types of judgments that can and should be made in considering the priority and timing of various action items. Costs and benefits should be understood in the broadest sense. Included should be direct public expenditures, administrative costs, and additional private sector costs as well as direct public health, recreational, and aesthetic benefits. Also important are indirect benefits in the form of increased business profits and employment, and maintenance of ecological health.

For many of the environmental protection and restoration efforts outlined in the draft Plan, costs and benefits cannot be completely quantified. Qualitative judgments must be made about net benefits of each action item to society. This does not affect the basic conclusions or reduce the importance of the proposed decision framework. On the contrary, the framework and accompanying outline of benefit cost analysis categories are useful because they are effective tools for identifying and re-evaluating what is known and unknown.

If there is little confidence in cost or benefit estimates but a significant probability that benefits or avoided costs could be substantial, then gathering further information and establishing a formal process of review and reevaluation in light of this new information probably makes sense. If pilot or provisional programs can be implemented at relatively low cost, they may be the most effective means of gathering additional information, given clear guidelines for program review and reevaluation. In situations where the most likely estimate of benefits exceeds anticipated costs and delay in taking action would cause irreversible damage or significantly increase costs, then immediate action is likely to be the best choice.

## **1.2.10 Conclusion and Recommendations**

In conclusion, priority action items should continue to be examined and revised to generate improved estimates of costs, benefits, and remaining levels of uncertainty. As this new information becomes available, the net benefit of taking further action needs to be reevaluated. Similarly, for action items involving continued public expenditures or other costs over time, monitoring and evaluation efforts should be implemented to periodically determine whether these programs, regulations, etc. should continue unchanged, be revised, or eliminated altogether. In situations where delay or inaction could significantly increase costs, reduce benefits, or result in irreversible changes, immediate implementation of targeted actions is likely justified.

From a local economic perspective, as gleaned from the two Lake Champlain Economic Focus Group sessions, the following four points seem necessary to a successful Lake Champlain protection and restoration program:

- 1. The LCBP must encourage strong support from local communities.** Representation on a basin-level committee alone is insufficient to ensure that all the various interests are included in the process. Many communities are already involved in lake protection activities, such as up-grades to waste water treatment plants, and others would like to do more. Local communities should be allowed to adapt proposed land use and lake use recommendations to their own circumstances, and to have expertise available to assist them in their efforts.
- 2. Local communities, economic interests, and residents need to be active participants in the LCBP projects and programs.** The priority issues and programs need to be generated at the grass-roots, from the bottom up, as well as at the state and federal agency level. People recognize the benefits of a clean lake more clearly if they see it

having an effect in their own communities. Similarly, they respond more positively to information and education programs, than to regulation and enforcement. The Lake Champlain Partnership Program is an excellent example of this approach, and appears to be a very successful aspect of the Lake Champlain Basin Program.

3. **Existing local watershed organizations need to be supported and new ones need to be encouraged.** While a lake wide LCBP is necessary to communicate and coordinate activities between Vermont, New York, and Quebec, the real change in peoples attitudes and activities related to water is occurring at the local level. The Boquet River Association in New York, Friends of the Mad River in Vermont, and others have a successful track record that should be built upon. Attempts should be made to avoid competition for funding, and some procedure should be developed whereby a certain percentage of LCBP funding is distributed to citizen-based river and lake associations within the basin.
4. **The state governments in Vermont and New York must provide adequate operating funds for the LCBP.** Vermont state legislators recognize more readily the importance of Lake Champlain to their state's economy, while the New York North Country delegation could be more effective than they have in the past in encouraging legislative approval of Lake Champlain related funding. By any measure, the New York counties along Lake Champlain are among the most economically troubled in the state; concurrently, Lake Champlain is shown to be an important component of local economies. The counties are unable to support the LCBP on their own. With adequate operating funds provided by New York and Vermont, the LCBP should be able to leverage additional project funds from donations, grants, and other fund raising efforts.

The Lake Champlain planning effort has involved a number of economic studies and community case studies. An additional economic analysis of the final Plan will be undertaken before the planning process is complete. There are few simple answers in economic analysis, just as there are few easy solutions to the environmental issues of concern around Lake Champlain. A major goal of this preliminary economic analysis, including the previously published Part 1 analysis, has been to incorporate economic and socio-economic considerations into the Lake Champlain planning effort. The approach has included: presenting summaries of relevant scientific literature, creating models for cost optimization, establishing baseline data for future evaluation, and developing economic decision-making frameworks that are all understandable and useable by anyone involved in Lake Champlain study and planning. At the same time, most of these Lake Champlain-specific economic tools and datasets can be easily up-dated and modified as necessary to account for changing characteristics and issues within the basin. As was repeatedly expressed in the economic forums organized for this study, flexibility is key to addressing environmental problems and developing effective, equitable solutions.



## **2. Economic Benefits of Lake Champlain Water Quality Improvement, Revisited**

### **2.1 Estimating Water Quality Benefits**

The Part 1 Preliminary Economic Analysis document includes a chapter devoted to the economic benefits of Lake Champlain water quality improvement. The discussion relied in large part on the findings from studies done on water bodies in a variety of locations around the country. The study team made some attempt to relate the situation in those study areas to that of Lake Champlain, however, there was no systematic evaluation of pertinent characteristics such as water quality issues, size of basin, population, per capita income, etc. In this chapter, the study team has taken the next step in the process of transferring benefits studies from other areas, by analyzing in more detail how the other study areas relate to the Lake Champlain basin. The following paragraph, reprinted from the Part 1 report, introduces that discussion.

Over the past several years, the Lake Champlain Management Conference has initiated several projects to determine the relationships between phosphorus discharges and land use patterns and phosphorus concentrations in various parts of the lake. However, even with a well developed understanding of the relationship between pollutant discharges and water quality indicators, an important set of information necessary for development of appropriate pollution control programs is still missing; namely the value that affected parties place on improvements in environmental quality. The techniques that have been developed to estimate these values require detailed statistical data on recreational use, property values, tourist expenditures and the preferences of residents of affected communities. Conducting those types surveys and other primary research efforts necessary to collecting and analyzing such data for the Lake Champlain basin is outside the scope of this project. Consequently, we have concentrated our efforts on reviewing the literature for previously completed estimates of the benefits of water quality improvements in the Lake Champlain basin and elsewhere in the US and Canada.

Table 2-1 presents a summary of some of the major characteristics of 17 water quality benefits studies reviewed in the Part 1, Preliminary Economic Analysis report (originally displayed as Table 4-2, page 59). The studies are displayed in Table 2-1 in alphabetical order, by author. The studies marked with an ' \* ' are those determined to be most relevant to Lake Champlain, as described below.

In the Part 1 report, the study team used some of the benefit studies to compute a rough estimate of possible economic benefits to water quality improvement in Lake Champlain. That approach was criticized by reviewers for inadequately evaluating the applicability of the other research locations to Lake Champlain. For example, that the water quality problems and socio-economic characteristics of Galveston Bay would appear to be dissimilar enough from Lake Champlain to negate its relevance to the Lake Champlain planning effort. In response to those concerns, the study team has created a evaluative chart as a technique for assessing the relevance of the benefit studies reviewed in Part 1, presented below as Table 2-2. For comparison, the Lake Champlain variables are indicated in the first row of the table.



**Table 2-1: Summary of Research on Valuing Water Quality Benefits**

<u>Location</u>	<u>Type of Water Quality Benefit</u>	<u>Type of Measurement</u>	<u>Individual or Household</u>	<u>Dollar Amount per Year or Trip<sup>1</sup></u>	<u>Other Benefit Information</u>	<u>Dollar Year</u>	<u>Source</u>
Boston-Cape Cod area	Recreational beach use	Travel cost	Households	\$12.00	Per year, all area households	1974	Bockstael et al. (1987)
Chesapeake Bay	Improved to acceptable level	Contingent valuation	Individual, Users	\$121.00	Boating, fishing, &	1984	Bockstael et al. (1989)
Chesapeake Bay	Improved to acceptable level	Contingent valuation	Individual, Non-users	\$38.00	swimming related to	1984	Bockstael et al. (1989)
Chesapeake Bay	Improved to acceptable level	Travel cost	Individual, Boat owners	\$49 - \$100	phosphorus & nitrogen	1984	Bockstael et al. (1989)
Pennsylvania	Boatable to fishable	Willingness to pay	Individual, Non-users	\$10.80		1981	Desvousges et al. (1987)
Pennsylvania	Boatable to fishable	Willingness to pay	Individual, Users	\$18.90 - \$58.10		1981	Desvousges et al. (1987)
Pennsylvania	Fishable to swimmable	Willingness to pay	Individual, Non-users	\$7.20 - \$11.60	Declining marginal benefit	1981	Desvousges et al. (1987)
Pennsylvania	Fishable to swimmable	Willingness to pay	Individual, Users	\$11.80 - \$33.10	as water quality improves.	1981	Desvousges et al. (1987)
Orange County Florida	Decrease in Trophic Status Index from 60 to 40	Hedonic valuation	Vacant land values	25% Increase	Effect on land prices as much as a mile from the lake	1992?	Feather et al. (1992)
Colorado	Ensure high water quality	Willingness to pay	Households	\$39 - \$149	\$\$ amount depended on use, household location, and method of payment	1981	Greenley et al. (1981)
North Carolina coast	Reduced point & nonpoint source pollution (nitrogen)	Household production function	Boat party, per fishing trip	\$1.27 - \$6.52	Evidence supports higher estimate	1982	Kaoru et al. (1995)
Lake Michigan	Net benefits of fishing trips	Travel cost	Individual, per fishing trip	\$19.54	Used maximum likelihood	1984	Kealy & Bishop (1986)
New York State lakes	Annual cost of toxic contamination & Eliminating eutrophication & bacteria at 51 priority lakes	Travel cost	Individual, State residents	\$28 per capita	Acidity an additional \$9	1989	Montgomery & Needelman (1994)
New Hampshire lakes	Eliminating algae	Travel cost	Individual, State residents	\$3.29 per capita	Swimming day trips only	1989	Needelman & Kealy (1994)
2 South Dakota lakes	Improved water quality for fishing from poor to acceptable	Travel cost	Individual, Users	\$106.00	Per year benefits value	1987?	Piper et al. (1987)
U.S.	Reduced nutrients	Travel cost (?)	Individual, per person of fishing age population	\$20.00	Avg. 3.7% increase in fishing participation	1984	Ribaudo & Piper (1991)
St. Albans Bay, VT	Reduced nutrients	Travel cost	Individual, current users	\$123.00	\$336,036 aggregate benefit	1984	Ribaudo et al. (1984)
St. Albans Bay, VT	Reduced nutrients	Travel cost	Individual, former users	\$93.00	\$192,417 aggregate benefit	1984	Ribaudo et al. (1984)
Colorado	Protect various rivers in state	Willingness to pay	Households	\$39.80	For the 3 most valuable rivers	1983	Sanders et al. (1990)
U.S.	Boatable to fishable	Travel cost	Individual, per trip	\$9.35 - \$86.34	Compared 44 sites	1977	Smith & Desvousges (1985)
U.S.	Continued opportunity to swim	Willingness to pay	Individual, Swimming	\$22.97	Aggregate of many studies	1987	Walsh et al. (1992)
Galveston TX	Implement Galveston Bay Management Plan	Willingness to pay	Households, Users	\$156 - \$253	Measured as "amount of increase to utility bill"	1993?	Whittington et al. (1994)
Galveston TX	Implement Galveston Bay Management Plan	Willingness to pay	Households, Non-users	\$60 - \$168	Measured as "amount of increase to utility bill"	1993?	Whittington et al. (1994)
St. Albans Bay, VT	Reduced nutrients	Hedonic valuation	Property values	20% increase	Average impact of \$4,000 per property, total of \$2 million	1981	Young & Teti (1984)

1. Most amounts are per year. The few studies that report dollar amounts per trip are: Smith & Desvousges, Kaoru et al., and Kealy & Bishop.  
 \* Study team determined these studies to be most applicable to Lake Champlain. Studies are listed alphabetically.

**Table 2-2. Comparison of Lake Champlain Attributes with that of the Water Bodies in Seventeen Water Quality Benefits Studies from Around the U.S.**

Source	Geographic Location	Population of the Region	Median Income	Type of Water Body	Size of Water Body	Major Water Quality Problems	Recreational Uses		Commercial Uses		Length of Swimming Season		Length of Boating Season		Applicability Factor (0 to 1)
							Boating, Fishing, Swimming	Uses	Commercial Uses	Uses	Swimming Season	Boating Season	Swimming Season	Boating Season	
	<b>Lake Champlain</b>														
Bockstael et al. (1987)	Boston-Cape Cod area	700,000	\$15,000 per capita \$30,000 per household	Large Lake	435 sq miles	Eutrophication, Toxics oil, turbidity, fecal coliform	Boating, Fishing, Swimming	Fishing (minor)			2 months	6 months			
Bockstael et al. (1989)	Chesapeake Bay	higher	higher	Coastal	larger	oil, turbidity, fecal coliform	similar	many more			similar	similar	0.2		
Desvousges et al. (1987)	Pennsylvania	higher	higher	Coastal, Bay	larger	oil, turbidity, fecal coliform	similar	many more			similar	longer	0.2		
Feather et al. (1992)	Orange County Florida	higher	similar	River	n/a	numerous	similar	not a factor			similar	longer	0.4		
Greenley et al. (1981)		higher	higher	Small lakes	n/a	Eutrophication	similar	none			longer	longer	0.4		
Kaoru et al. (1995)	Colorado	higher	similar	River	n/a	Eutrophication	similar	none			similar	similar	0.3		
Kealy & Bishop (1986)	North Carolina coast	higher	similar	Coastal	larger	Eutrophication	similar	not a factor			similar	longer	0.5		*
Montgomery & Needelman (1994)	Lake Michigan	higher	similar	Large Lake	larger	Nitrogen loading	similar	not a factor			similar	similar	0.7		*
Needelman & Kealy (1994)	New York State lakes	higher	similar	Small lakes	many lakes	similar	similar	not a factor			similar	similar	0.8		*
Piper et al. (1987)	New Hampshire lakes	similar	similar	Small lakes	many lakes	similar	similar	not a factor			similar	similar	0.7		*
Ribaudo et al. (1991)	2 South Dakota lakes	lower	similar	Lakes	n/a	algae	similar	not a factor			similar	similar	0.5		*
Ribaudo et al. (1991)	U.S., nationwide	higher	similar	Small lakes	many lakes	Eutrophication	similar	not a factor			varies	varies	0.4		*
Ribaudo et al. (1994)	Lake Champlain	same	same	same	same	same	same	same			same	same	1.0		*
Sanders et al. (1990)	Colorado	higher	similar	Rivers	many rivers	Eutrophication	similar	similar			similar	similar	0.3		
Smith & Desvousges (1985)	U.S., 44 lakes	n/a	similar	Lakes	many lakes	similar	similar	not a factor			varies	varies	0.4		
Walsh et al. (1992)	U.S., many locations	n/a	similar	varies	varies	n/a	n/a	n/a			varies	varies	0.5		*
Whittington et al. (1994)	Galveston TX	higher	higher	Coastal	larger	oil, toxics	similar	considerable			longer	longer	0.1		*
Young & Teti (1994)	Lake Champlain	same	same	same	same	same	same	same			same	same	1.0		*

\* Study team determined these studies to be most applicable to Lake Champlain. Studies are listed alphabetically.  
Note: The adjective descriptors (e.g., higher, larger, longer) refer to the study waterbody's characteristics as compared to Lake Champlain.

The study team determined an "applicability factor" for each study listed, based on a scale of 0 to 1; zero indicating no applicability to the Lake Champlain basin, and "1" indicating close correspondence to the situation around Lake Champlain. In making the judgments, the study team considered all the variables listed in Table 2-2, as well as "The Type of Water Quality Benefit" listed in the second column of Table 2-1. That variable served as another indicator of the extent of water quality problems in the study lakes in comparison to water quality issues on Lake Champlain.

As illustrated in Table 2-2, only Lake Champlain-based studies received a "1", while a few lake studies in the Northeast and on Lake Michigan received .7 or .8. Studies in coastal areas, especially where significant commercial use of the water body occurs, were given the lowest applicability factors. For example the Galveston Bay study received a .1, while studies in the Chesapeake Bay area received .2. The water quality benefit studies involving rivers were also given a lower factor. Climatic conditions also played a role in the selection process, with the Florida and Texas studies receiving lower scores because their lakes have much longer swimming and boating seasons than does Lake Champlain.

As a first cut in selecting benefit studies from other areas of most relevance to Lake Champlain, the study team recommends selecting those studies with a 0.5 applicability factor or higher. The eight studies that conform to that selection process are marked with an '\*' in Table 2-2.

In order to re-assess the predicted economic benefit of Lake Champlain restoration and protection, as transferred from other relevant water quality benefit studies, one more table of data is necessary. Table 2-3 presents the available Lake Champlain data useful for transferring water quality improvement benefits to Lake Champlain. Table 2-3 contains preliminary data on a number of the main lake user categories, such as state park beach users, anglers, boaters, etc. The information on use is not complete at this point, represented by blanks in the chart, and continues to be up-dated by on-going Lake Champlain research.

Table 2-3 also contains preliminary estimates on the current value of direct Lake Champlain related recreational expenditures. At this point, the estimated total Lake Champlain recreation expenditure of over \$40 million is heavily weighted by estimated fishing related expenditures (i.e., \$32 million). An estimate for boating related expenditures would raise the value of present recreational use on Lake Champlain significantly. A goal of the continuing economic analysis will be to complete the present recreational expenditure estimates and to project possible increases in recreational use related to actions recommended in the draft Plan. For example, the sea lamprey control program projected recreation benefit of 65,000 additional fishing trips, resulting in \$2.4 million in additional angler expenditures (NYSDEC & USFWS 1990:52).

Transferring user-based benefits to Lake Champlain is hindered by the availability of accurate user data, with the exception of angler day data. For example we are as yet unsure how many beach visits, boat launches, and other uses annually occur on Lake Champlain. In Table 2-4 we have substituted VT and NY State Park visits on Lake Champlain, factored in at 80% lake users based on the survey work of Dziekan (1995). The total of 375,540 annual lake users is undoubtedly a low estimate of lake wide use.

As distinct from recreational expenditures, Table 2-4 illustrates how the relevant water quality studies on indirect benefits from other areas can be applied to Lake Champlain. Estimates of the indirect benefit of water quality improvement are presented using the appropriate Lake Champlain measure, listed in column 2. The Lake Champlain economic benefits shown in column three of Table 2-4 represent the value of maintaining or improving water quality to users and basin residents, over and above the actual expenditures of lake users. For example, the average beach

**Table 2-3: Recreation Data Summary for Lake Champlain (Revised)**

Activity or Facility	Year	Area	Number of Facilities	Annual Count	Average Expenditure per Person, per Day	Estimated Annual Expenditure	One Day Count
<b>State Park*</b>							
Vermont State Parks Along Lake Champlain <sup>1,13</sup>	1994	Lake shore	9	195,426	\$17	\$3,322,242	
New York State Parks Along Lake Champlain <sup>2,13</sup>	1994	Lake shore	5	274,000	\$17	\$4,658,000	
<b>Fishing</b>							
Fishing License Purchases <sup>4</sup>	1991	Basin		168,000			
Number of Anglers: Lake Champlain, NY & VT <sup>12</sup>	1991	Lake		141,379			
Angler Days: Lake Champlain, NY & VT <sup>5</sup>	1990	Lake		1,608,486	\$20	\$32,169,720	
<b>Boating</b>							
Lake Champlain Boat Count <sup>3</sup>	7/25/92	Lake					12,425
Canadian Boat Border Crossings @ Rouses Pt <sup>4</sup>	Avg	Lake		7,318			
Slips & Moorings Count, Vermont <sup>5</sup>	1994	VT shore	2,901				
Slips & Moorings Count, New York <sup>6</sup>	1994	NY shore	2,994				
Boat Launch Sites, Vermont <sup>5</sup>	1994	VT shore	79				
Boat Launch Sites, New York <sup>6</sup>	1994	NY shore	28				
Commercial & Public Marinas, Vermont <sup>5</sup>	1994	VT shore	37				
Commercial & Public Marinas, New York <sup>6</sup>	1994	NY shore	26				
Lake Champlain Commercial Marina Employment <sup>12</sup>	1990	Lake shore	56	448			
<b>Other Activities, Expenditures per person/day*</b>							
Divers <sup>5</sup>	1992	Lake			\$110		
Transient marina users <sup>8</sup>	1992	Lake	64		\$44		
Park users <sup>5,8</sup>	1992	Lake shore	114		\$31		
Bicyclists <sup>9,10</sup>	1994	Basin			\$52		
Beach users <sup>5,12</sup>	1994	Lake shore	64		\$17		
Boaters <sup>13</sup>	1987	Lake			\$26		
<b>Employment, Demographics, Property Values</b>							
Annual Lake Related Tourism Employment <sup>4</sup>	1989	Lake shore		16,400			
Lake Champlain Basin Population <sup>4,12</sup>	1995	Basin		650,000			
Lake Champlain Basin Households <sup>4</sup>	1990	Basin		211,000			
Basin residents over the age of 18 <sup>4</sup>	1990	Basin		450,000			
Shoreland Town Property Values <sup>4</sup>	1991	Lake shore		\$8.8 billion			

Preliminary Total: \$40,149,962

Note: This is an update of a table presented in the Part 1, Preliminary Economic Analysis (Table 7-1, p 122).

\* Only includes State Parks with beaches on Lake Champlain.

Data sources: 1. Simino (1994), 2. NYOPRHP (1994b), 3. Bulmer (1993), 4. Holmes & Associates (1993), 5. Connelly and Brown (1990), 6. Farnum (1995), 7. Gilbert (1991), 8. Dzeikan (1995) and personal communication, 9. Holmes & Associates (1994), 10. Burgess (1994), 11. NYSDEC & USF&W (1990), 12. Holmes & Associates estimate from available data., 13. Brown, Tommy (personal communication 9/95).

user visiting Lake Champlain spends \$17 per trip. Those are actual dollars spent during a visit to the lake. In addition, relevant research has found an average benefit of \$3.29 per resident for the opportunity for a high quality swimming experience (Needelman & Kealy 1994).

While not capturing completely the option, existence, and bequest values of maintaining and improving the water quality of Lake Champlain, the preliminary \$18.6 million in annual benefits begins to approximate the value of Lake Champlain to users and residents. At this point, the estimated benefit value is heavily weighted by the threat of toxics (i.e., \$12.6 million). Whether or not that value is inflated may be determined in subsequent research; however, it is almost certain that the benefit values related to reduced nutrients and the control of macrophyte will increase once estimates are developed for the South Lake and Missisquoi Bay areas of Lake Champlain.

The benefit and expenditure data presented in the prior series of tables demonstrate a refinement over earlier work on the estimated benefits Lake Champlain water quality improvement. The study team's approach has been to further clarify both the expenditure value (i.e., market value)

**Table 2-4: Summary of Benefit Transfer Values Applied to Lake Champlain**

Water Quality Improvement Benefit Value Transferred	Lake Champlain Measure	Estimated Lake Champlain Benefit per Year (\$ millions)	Dollar Year	Source
\$1.27 - \$6.52 per fishing trip, reduce point & non-point source pollution (nitrogen)	1,608,486 angler days	\$2.0 to \$10.5*	1982	Kaoru et al. (1995)
\$28 per capita, removal of toxics	450,000 Basin residents > age 18	\$12.6**	1989	Montgomery & Needelman (1994)
\$3.29 per resident, eliminating eutrophication & bacteria	450,000 Basin residents > age 18	\$1.5	1989	Needelman & Kealy (1994)
\$123 current users, \$93 former; from reduced nutrients and macrophytes	St. Albans Bay specific; other lake areas affected to be determined	\$0.5	1984	Ribaudo et al. (1984)
20% increase in property values, from reduced nutrients	St. Albans Bay specific; other lake areas affected to be determined	\$2.0	1981	Young & Teti (1984)
Preliminary Total:		\$18.6		

NOTE: This table provides preliminary estimates on the economic benefit of improved Lake Champlain water quality. Research is on-going to refine the benefits and costs of Lake Champlain protection and restoration efforts. This table is an update of a similar table presented in the Part 1, Preliminary Economic Analysis (Table 4-3, p 62).

\* The low end (\$2.0 million) is used in computing the preliminary total (\$18.6 million).

\*\*The \$12.6 million estimate for annual benefits related to removing the threat of toxics should be viewed as the upper limit of this expected benefit measure. The report provides discussion and caveats on applying benefit measures from other areas to Lake Champlain.

See Tables 2-1 and 2-2 for descriptions of the source studies.

Source: Holmes & Associates (1995), data compiled for this study.

and the benefit value (i.e., nonmarket value) of Lake Champlain. Some economic analysts prefer the market based or input/output approach to benefit cost research. As indicated by preliminary data presented above, the market value accounts for a majority of the present economic impact of Lake Champlain in the region and will likely account for a majority of the economic impact of water quality improvement.

The effort to determine nonmarket values for a large waterbody is not unique to this research effort. As discussed at the beginning of this chapter, many researchers, government agencies, and individuals recognize recreational and environmental amenities have value in addition to that which is accounted for in the market place. Those nonmarket and nonuse values of natural and cultural resources are especially significant when the area under study has the characteristics of Lake Champlain: an interstate, international body of water with significant environmental and historical features. A brief overview of the evolution of measuring such values was provided by Walsh, as follows:

Empirical research on the economic value of recreation has a relatively short history. Interest was stimulated by the authorization of Senate Document 97 in 1962, which established benefit cost methods to be used in planning water and related resource development by federal agencies. Supplement No. 1 to Senate Document 97 was signed by President Kennedy in 1964, authorizing use of the unit day value method. He also set up the Water Resources Council as an interagency committee to administer the guidelines. Subsequently, the Council revised the guidelines in 1973 under President Nixon to authorize use of the travel cost method. They were revised again in 1979, when use of the contingent valuation method was approved by President Carter. Authorization of the three methods were reaffirmed in a 1983 edition of the guidelines signed by President Reagan. It seems likely that future revisions in the guidelines will occur as improved methods are developed. The bipartisan political support for the guidelines in the past indicates their broad acceptability within and outside of government (1986:196).

More recently, the courts have upheld the Department of the Interior regulations supporting non-use values as among the losses that could be recovered when suing for damages to wetlands and other natural resources (Stevens et al. 1995).

Regardless of whether it is market or nonmarket benefits that are being considered, the public's understanding of benefits and costs of Lake Champlain activities would be enhanced by a clear definition of "costs" and "benefits." Anthony Artuso, Ph.D. economist on the study team, developed the following working definition of costs and benefits for use in analysis and dialogue on the economic aspects of the Lake Champlain planning effort.

In analyzing environmental protection and restoration programs the definitions of costs and benefits should be constructed both comprehensively and carefully. First, it is essential to be clear about the geographic perspective from which costs and benefits are defined. Federal funding for Lake Champlain environmental protection programs would be viewed as a cost at the national level, but should be counted as a benefit if the analysis is being conducted from a regional perspective. In addition, it is essential to use a consistent baseline in measuring costs and benefits. For example, if costs of environmental protection efforts are defined in relation to a no action alternative, then benefits must also be calculated in relation to the environmental and economic conditions that would have existed if no action were taken.

The following definitions are intended to define the categories of potential costs and benefits of the Lake Champlain Pollution Control and Environmental Restoration Plan from a national perspective in relation to a no action alternative.

### **COSTS**

Direct costs of environmental protection or restoration efforts include capital, operating maintenance and administrative expenditures by both the public and private sector. Indirect costs include any reduction in profits in excess of the direct costs of pollution control as well as a portion of lost wages due to any increase in unemployment. Only a portion of lost wages represents a true cost since unemployed workers will find other productive, although not necessarily equally valuable, uses for their time such as continuing their education or providing additional care to family members. In estimating indirect costs or multiplier effects it is important to recognize that environmental protection efforts may reduce output or employment in one industry while increasing it in others. These partially or fully offsetting gains in other sectors of the economy must therefore be subtracted from indirect costs or included as benefits.

### **BENEFITS**

The direct benefits or avoided costs of environmental restoration and protection efforts can include increased recreational enjoyment and aesthetic appreciation, reduced public health risks, and increased profits or consumer benefits from direct commercial uses of environmental resources (e.g. sale of fish caught on the lake). Direct recreational and aesthetic benefits of environmental programs are often capitalized in the form of increases (or avoided reductions) in property values in the affected area. Benefits of pollution control or remediation efforts that enhance public health can be quantified in the form of reduced medical costs and increased productivity. However, the benefits of water pollution control efforts that protect or restore public water supplies should be measured by the avoided or reduced costs of water treatment.

In addition to these direct use benefits of environmental protection, there are potential non-use benefits related to changes in option, existence and bequest values. Option value is simply the value to the individual of preserving the opportunity to use a clean environment and is therefore closely related to, but nevertheless conceptually distinct from, direct use benefits. Bequest values are based on the satisfaction that individuals derive from knowing their children, or future generations in general, will be able to enjoy a clean environment. Existence

value is any additional satisfaction, apart from direct use, option, or bequest values, that individuals receive simply from knowing that an important ecosystem, natural area, or endangered species has been protected.

Environmental protection efforts will also generate beneficial multiplier effects. Purchases of pollution control equipment and operation of pollution control programs will increase output and employment in certain sectors of the economy. Multiplier effects should also be taken into account if environmental programs are expected to lead to increases, or avoid reductions, in tourism and recreational expenditures. The benefit of these multiplier effects should be measured by the increase in before-tax profits of local businesses, as well as the portion of increased wages in excess of the value of leisure time. As noted above, beneficial multiplier effects for some sectors of the economy must be considered in relation to negative multiplier effects that environmental regulation and pollution control costs may create for other sectors.

It is expected that the definition of costs and benefits will be clarified and refined during the on-going efforts to restore and protect Lake Champlain.

### **3. Action Plans for Reducing Nutrients and Managing Nonpoint Source Pollution**

Substantial work has been done in quantifying the costs of point and nonpoint source phosphorus control and of determining what facilities and watersheds should be targeted for implementation of treatment upgrades as well as agricultural and urban best management practices (BMP's). Continuation of this work is being undertaken by the nutrient and nonpoint source subcommittees using the model developed by Artuso as part of the preliminary economic analysis of the draft Plan (Holmes and Artuso 1995).

This model can be used to identify individual treatment plants, watersheds and urban/suburban areas where additional controls would be most cost-effective in achieving in-lake phosphorus concentration targets established for the lake. Nevertheless, further refinements in the model and in the nutrient management strategy are required. Much of the information in the model on the costs of point source controls and urban BMP's and the effectiveness of agricultural BMP's requires further refinement. The model also does not include the nonpoint source contribution that will result from new development. Moreover, the model is only useful in targeting specific point sources and establishing general targets for phosphorus control from nonpoint sources in critical lake segment watersheds.<sup>2</sup> What is required now is an iterative planning, implementation, monitoring and reevaluation process involving the following steps:

1. Use the model to target treatment plants for point source controls as well as cost effective urban and agricultural reductions in each lake segment watershed.
2. Refine estimates of current loadings and control costs at the targeted treatment plants. This may involve engineering studies as well as pilot or demonstration projects.
3. Complete community and farm scale planning processes in the critical lake segment watersheds to refine estimates of costs and effectiveness of agricultural and urban BMP's. This may involve engineering studies as well as pilot or demonstration projects.
4. Develop estimates of phosphorus loading from new development given increasingly stringent requirements for use of BMP's.
5. Refine economic impact assessments of phosphorus controls on targeted communities and farmers in light of new cost estimates and available funding sources.
6. Reevaluate and develop new cost estimates for phosphorus control strategy in light of new information on costs, effectiveness, economic impacts and funding sources.
7. Begin implementing point and nonpoint source controls for targeted facilities, communities and farms.
8. Continue monitoring phosphorus levels and water quality indicators in streams and in the lake.
9. Periodically reevaluate the phosphorus control strategy in light of trends in phosphorus concentrations, water quality data, technological developments and economic conditions.

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<sup>2</sup> Critical lake segments are defined as those lake segment watersheds in which a significant reductions in point and nonpoint source phosphorus loadings will be needed to achieve the in-lake phosphorus standards. These critical lake segments include South Lake A and South Lake B, Otter Creek, Main Lake and Mississquoi Bay.



One aspect of nutrient and nonpoint source pollution control that received very little attention in the draft Plan is the effect of new development. To the degree that forested or other low phosphorus generation land uses are converted to residential subdivisions or other urban/suburban uses, there will be an increase in nonpoint source phosphorus loadings. In the context of the framework outlined above, this is a situation where no action would significantly increase costs. Incorporating nonpoint source phosphorus control measures into new developments as they are built is considerably less expensive than trying to do so after streets have been constructed, homes have been built, and stormwater drainage facilities have been constructed. The final plan should therefore include stronger recommendations on control of nonpoint source pollution from new developments.

Several unresolved issues have been raised in relation to the benefits of phosphorus controls. First, there is continued uncertainty over the degree to which on farm controls will yield measurable reductions in phosphorus concentrations in the lake. It is likely there will be some delay in seeing the effects of agricultural BMP's due to phosphorus attenuation on land and in streams after it is off the farm. There may also be some delay in achieving in-lake phosphorus reductions due to significant levels of phosphorus stored in lake bottom sediments. Apparently some of this stored phosphorus is resuspended into the water column when in-lake phosphorus concentrations start to drop. It may take several years of lower phosphorus inputs to the lake for the phosphorus stored in sediment to be sufficiently depleted that a new significantly lower in-lake phosphorus equilibrium is reached.

It is possible to argue that since the full benefits from phosphorus reduction may not be realized for as much as a decade, the present value of these benefits will not exceed the costs which must be incurred much earlier. However, in light of the framework outlined above it is also possible to argue that continued excessive inputs of phosphorus to the lake will only increase phosphorus storage in sediments, thereby increasing the potential time delay and reducing the present value of benefits if and when additional phosphorus controls are implemented. In this context consideration must be given to the ethics of leaving future generations with a lake that will be significantly more expensive and time consuming to restore to a non-eutrophic state.

Further study is warranted on both the effectiveness of on-farm phosphorus controls in reducing in-stream phosphorus loadings and on the time it will take for lake segments to respond to reductions in external phosphorus loads. But this should not prevent continued implementation of targeted point and nonpoint source control measures. Preliminary results of the phosphorus control model discussed above target only a subset of treatment plants and only a portion of the basin for additional nonpoint source control measures. By concentrating existing federal and state funding for point and nonpoint source pollution control on targeted facilities and watersheds, it may be possible to achieve something very close to the established in-lake phosphorus standards with little or no increase in funding.

The invasion of zebra mussels into Lake Champlain has led to a different set of concerns about the net benefits of implementing more stringent point source and nonpoint source phosphorus control measures. Some have argued that the mussels will filter and absorb phosphorus from lake water to such a degree that additional controls on point and nonpoint sources of phosphorus will not be needed. Perhaps a lakewide infestation of the mussels would store sufficient phosphorus in biomass to cause an initial period of readjustment within the system. Over time, however, the phosphorus contained in the biomass of the mussels will end up in lake sediments after they die and from there it will find its way back into the water column. Without a reduction in

phosphorus entering the lake phosphorus concentrations in the lake would eventually return to where they were prior to the zebra mussel invasion.<sup>3</sup>

The potential effects of zebra mussels on phosphorus concentrations does highlight the importance of monitoring and evaluation. To ensure efficient use of phosphorus control funds there is a need for continued monitoring of phosphorus levels and for continued research on the effects of phosphorus levels on recreational uses including swimming, boating and fishing. Essential research includes distinguishing short term fluctuations from long term trends, and identifying the causes of both short and long term phosphorus fluctuations. Revising control programs in light of this information will be necessary, as is an integrated monitoring and evaluation program that includes all major sources and sinks of phosphorus in the lake watershed.

The costs of an ongoing monitoring and evaluation effort can be kept to a minimum through the use of volunteers and collaborations with environmental education and research programs in the basin. The benefits of continued monitoring and evaluation programs include improved targeting of phosphorus controls, an early warning system for increases in phosphorus levels, and increased public awareness of environmental conditions in the lake.

## **3.1 Discussion of Individual Action Items**

### **3.1.1 Nutrients**

**A.1 Implement the International Phosphorus Agreement** - The in-lake phosphorus standards established in the 1993 water quality agreement were intended to be reviewed every three years. This tri-annual review process can and should serve as a focal point for monitoring and evaluation efforts. In-lake standards should be reevaluated and ongoing phosphorus control programs reviewed in light of new information on costs, benefits, and funding sources. Firm commitment to regular, high level review of phosphorus control efforts also makes it possible to overcome opposition to these programs stemming from concern that they will continue or be expanded regardless of their effectiveness or economic impacts. However, public input and involvement in the review process must be guaranteed in advance in order to appropriately weigh the costs and benefits of phosphorus control programs.

**B1 - B3 Point Source Reduction Policy Alternatives** - The phosphorus control model discussed above indicates that Policy 2 combined with cost effective targeting of nonpoint source controls is the least costly of the three policy options outlined for achieving in-lake phosphorus concentrations<sup>4</sup>. However, further cost reductions can be realized by targeting point source controls to achieve the greatest reduction in phosphorus discharge per dollar of control expenditure. As described above the phosphorus control model can assist in this targeting effort. It is also important to identify funding mechanisms that will ensure that control costs do not fall disproportionately on only a few communities.

**C.1 Target Phosphorus Load Reductions to Lake Segments** - The phosphorus control model clearly demonstrates that by concentrating phosphorus control efforts in a few lake segment

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<sup>3</sup> It is possible that there could be some reduction in phosphorus concentration if substantial phosphorus is bound up in zebra mussel shells which presumably would take longer to become bioavailable again.

<sup>4</sup> Phosphorus control research and modeling were in progress during the writing of this report. The final draft Plan should be reviewed for discussion of preferred phosphorus control policies.

watersheds the in-lake phosphorus criteria will be achieved in the other lake segments as well.

**D.1 Implement Phosphorus Reduction Strategies for Sub-basins** - Within each lake segment watershed targeting should not be focused on particular sub-basins or tributaries. Instead, the objective should be to identify the most cost effective opportunities for point and nonpoint sources of phosphorus reduction within the entire lake segment watershed. This requires updated information on control costs for all treatment plants in the lake segment watershed and more detailed assessments of costs and effectiveness of implementing BMP's on farms and communities in the lake segment watershed.

**E. 1 Research the Effectiveness of Nutrient Management Practices** - Continued research on costs and effectiveness of established and innovative phosphorus control practices is essential for the periodic review process discussed in relation to action item A.1.

**E. 1 Continue Lake and Phosphorus Tributary Monitoring** - Monitoring data are essential for the periodic review process discussed in relation to action item A.1.

### **3.1.2 Nonpoint Sources**

**A.1 Taking a Watershed Approach** - To achieve the in-lake phosphorus standards at least cost, nonpoint source Phosphorus control efforts should be concentrated primarily on the South Lake watersheds, the Main Lake and Mississquoi Bay. Within these watersheds control efforts should be targeted to the most cost effective sources of nonpoint source phosphorus reduction. Implementing phosphorus controls wherever the opportunity arises will increase the costs of achieving in-lake phosphorus concentrations in all lake segments.

**A.2 Develop and Implement Reduction Strategies for Priority Sub-basins** - As indicated above the focus should be on those lake segment watersheds where significant reductions in phosphorus loads are needed to achieve the in-lake standards. Targeting within each lake segment watershed should be based on where phosphorus reductions can be achieved most cost-effectively. The cost estimate for this action item is too low if it is intended to include full implementation costs. Given the cost of the phosphorus modeling effort now underway in the LaPlatte watershed, the cost estimate for this action item is probably too high if it is intended to include only modeling and strategy formulation.

**B.1 Expand/Accelerate Federal (Ag. Nonpoint) Programs** - The phosphorus control model indicates that significant agricultural phosphorus reductions will be required in a few lake segment watersheds in order to achieve in-lake phosphorus criteria. However, recent economic analyses show that best management practices will place a significant burden on many small and medium size farms. In order to utilize federal program funding in the most cost effective manner, funding should be targeted to priority lake segment watersheds. Higher levels of financial assistance for BMP implementation should be provided to small farmers in these watersheds.

**B.2 Support State Agricultural Nonpoint Source Programs** - See comments for action item B.1

**B.3 Pursue Specific Actions to Reduce Nonpoint Source Loads** - Nonpoint source control measures should be targeted to priority lake segments and implemented incrementally beginning with those that are most cost effective. Continued research, monitoring and evalua-

tion are needed to refine cost and effectiveness estimates. Funding priorities should be adjusted to reflect this new information as it becomes available.

**B.5 and B.6 Shoreland/Streambank Protection, Restoration and Buffer Strips** - It is not clear from the description, whether these action items are intended to respond to localized sedimentation problems or contribute to overall phosphorus reductions or both. Before expending significant resources on these programs it is important to identify the specific problems caused by shoreline/streambank erosion and target efforts to these areas. The cost-effectiveness of buffer strips as a phosphorus control measures should be evaluated relative to other phosphorus control options.

**C.1 Upgrade Requirements in State Stormwater Control Programs** - This action item raises several issues. The first involves stormwater pollution from new development. It is essential that strong BMP requirements are included in stormwater permit programs for new development. Costs increase sharply if stormwater BMP's are not included in the original design and construction process but must be implemented at some later time. For existing development, stormwater permits must consider both localized pollution problems such as pathogenic contamination of nearby beaches as well as the phosphorus contribution of stormwater discharges in targeted lake segment watersheds. Expenditures for stormwater treatment should be focused on the most cost effective sites in priority lake segments and in areas with localized water quality problems.

**C.3 Encourage Local Governments to Implement BMP's for New Development** - Implementation of BMP's for new development may be the most cost-effective means of reducing phosphorus loadings to the Lake. For this reason much stronger action and greater funding is justifiable on this issue than is outlined in the action item.

**C.4 Implement Retrofitted Stormwater Management Programs** - Expenditures for stormwater management should be focused on the most cost effective sites in lake segments where point source controls will be insufficient to achieve in-lake phosphorus standards. Stormwater treatment projects may also be necessary in some urban areas with localized water quality problems. Cost estimates for this action item should be revised in light of current estimates from the phosphorus control model.

**C.5 Separate and Provide Treatment for Combined Sewer Discharges** - Separation of combined sewers can be very expensive and counterproductive. Many older cities with combined sewers are now constructing CSO storage facilities and then routing this stored stormwater and sewage to treatment facilities at periods of low flow. This reduces costs relative to sewer separation and provides treatment for stormwater.

**C.8 Encourage Inspection and Maintenance of On-site Disposal Systems** - This action item should be targeted to local areas with known water quality problems.

**D. Reducing Phosphorus from Forestry Activities** - Forestry is not regarded as a significant contributor of phosphorus to the lake. Expenditure of significant funds on reducing phosphorus loads from forestry activities would therefore not be cost-effective. Forestry activities can create sedimentation problems in watersheds where substantial timber harvesting is occurring. To increase the public benefits received from implementation and monitoring of forestry best management practices, the focus should be on watersheds with existing or potential sedimentation problems.

**E.1 Implement CAMEN Research Recommendations** - This action item should be reviewed prior to completion of the final Plan. The first recommended item, a basin wide preliminary

identification of critical areas of agricultural nonpoint source pollution has largely been completed, although further work is needed in evaluating opportunities and costs for individual farms. It is not clear that the second research project will provide information that can be used to improve the cost-effectiveness of nonpoint source pollution control measures.

- E.2 Determine Phosphorus Budgets Within Sub-basins** - Work on this action item is already underway. The LaPlatte modeling project is intended to provide a generic model that can be applied basin wide. Application of the model to all watersheds in the basin is essential for developing phosphorus control strategies and evaluating their effectiveness. Once updated GIS land use data is available, a reasonable cost estimate would be approximately \$25,000 for each major tributary.
- F. Enhancing Education Efforts** - Education programs focused on pollution prevention can be highly cost effective. However, it is important to develop means of evaluating the results of these programs.

## **4. Action Plan for Preventing Pollution from Toxic Substances**

### **4.1 Introduction**

The draft Toxics Action Plan outlines a very useful set of priorities. However, the emphasis on substances and sites of concern is not consistently applied. Many of the proposed action items seem to apply indiscriminately to all toxic pollutants basin-wide. There also is little indication as to how proposed action items involving monitoring, site evaluation, pollution prevention, remediation, and research on fate and effects relate to one another. This creates some confusion about the proposed sequence in which the action items would be implemented and the effects of prior research on subsequent actions. There also appears to be some overlap and duplication between items in this action plan and between parts of this and other action plans, particularly Fish and Wildlife, indicating that cooperation between agencies and among research efforts could lead to significant cost savings.

### **4.2 Preliminary Benefit Estimates**

The most well publicized indicator of toxic pollution in the Lake Champlain ecosystem is the presence of high levels of mercury and PCBs in certain species of lake fish. Concurrently, one of the main direct economic costs of toxic pollution are the detrimental human health effects that can occur from excessive consumption of contaminated fish species<sup>5</sup>. The obvious intent of the fish consumption advisories issued by the states of New York and Vermont is to alter fish consumption patterns in ways that would minimize these public health risks. Evidence indicates that the advisories have been reasonably successful in achieving this objective (Connelly and Knuth 1994). But even if the consumption advisories were completely effective in preventing public health risks this would not eliminate other indirect costs imposed by toxic contamination of lake fish species. Toxic contamination of fish can reduce the number of fishing trips anglers make to Lake Champlain and reduce the net benefits they receive from each trip. There may also be secondary effects on other recreational activities and expenditures due to public perceptions about toxic contamination.

In a recent study, Montgomery and Needelman (1994) used a discrete choice, travel cost model to estimate the recreational fishing benefits that would result from elimination of toxic pollutants that are responsible for fish consumption advisories in New York State lakes. They estimated that the combination of increases in fishing participation rates and increases in net benefits per fishing trip would result in total net benefits of \$28 per capita, per year.

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<sup>5</sup> A new study of newborn behavior indicates that the combination of toxins found in Great Lakes fish affects the habituation response in babies, giving rise for the first time to the notion that human behaviour itself may be affected by a relatively small amount of toxins, like PCBs, dioxin, and other pollutants throughout the Great Lakes. An earlier study at Lake Michigan found that physical changes caused by these toxins increased as years went by, resulting in diminished mental capacity in the children (Plattsburgh Press-Republican 1995).

To understand the implications of these findings for Lake Champlain, it is important to realize that there is no guarantee that implementation of the Action Plan for Preventing Pollution from Toxic Substances will permit the lifting of all fish consumption advisories. In addition, the Montgomery and Needelman study estimated the benefits that the average New York State resident would receive from the opportunity to fish in any lake in the state without worrying about toxic contamination of fish. Basin residents would presumably receive a somewhat lower level of benefit from elimination of toxic contamination just in Lake Champlain. The annual benefit of \$28 per person should therefore be viewed as an estimate of the upper limit of the direct recreational benefits to basin residents of the draft Action Plan for Preventing Pollution from Toxic Substances.

Economic analysis of the benefits of remediation of contaminated sites requires information generated from risk assessment studies and engineering analyses of remediation costs and effectiveness. Risk assessments of contaminated sites are normally summarized in the form of increased probabilities that members of the affected population will develop various illnesses or health impairments as a result of direct contact with or movement of toxics from the site via physical or biological processes. Economic analysis of remediation efforts also must consider to what degree potential remediation alternatives will reduce the probability of negative health effects from the site. The estimated reduction in the probabilities of harm is then multiplied by the economic cost of the potential health effects to derive an estimate of the expected benefits (avoided costs) that would result from remediation. These avoided costs can include lost wages, reduced profits, medical expenses and the costs of pain and suffering. The expected benefits of each remediation option can then be compared with its costs.

Economic analysis of remediation efforts for sites of concern must also consider potential effects on property values. While there have been numerous studies of the impact of land based toxic waste sites on adjacent property values, the effect on property values of toxic contamination of water bodies has received less attention. However, a recent study by Mendelsohn et al. (1992) does provide relevant information in considering the property value impacts of PCB pollution in Cumberland Bay. The Mendelsohn et al. study used panel data (i.e. before and after sales of the same houses) to estimate the negative effect of PCB contamination in the harbor of New Bedford, Massachusetts. Use of repeat sales data avoids the problem of accounting for differences in housing characteristics. The study employed regression techniques to control for changes in other variables that affect property values such as income, interest rates, taxes and home improvements. For purposes of the property value analysis, the pollution of the harbor was assumed to have occurred in 1982 when residents in New Bedford became aware of the extent of the problem. The results of the study showed that after 1982, knowledge of PCB contamination in the most polluted parts of the harbor had depressed property values in adjacent neighborhoods by approximately 8% or \$7,000 to \$10,000 in 1989 dollars. PCB pollution in the somewhat less contaminated outer harbor was estimated to have depressed adjacent property values by 3% to 7%. These negative effects on property values were estimated for neighborhoods as much as a mile from the harbor. Whether PCB contamination of Cumberland Bay will have similar effects on property values in nearby neighborhoods will depend on several factors, including: the proximity of the neighborhoods to the contaminated site, the degree and extent of contamination relative to New Bedford Harbor, and expectations about remediation of the site.

The draft Plan recognizes that in addition to the direct public health risks and recreational costs of contaminated fish species, toxic pollution may create indirect economic costs as a result of more widespread ecosystem effects. Preliminary tests of microorganisms, freshwater shrimp, and fish species in Lake Champlain indicate that elevated levels of toxic pollutants at certain sites may already be having some detrimental ecological effects. While, these findings are cause for concern, further research is needed on trends in levels of contamination as well as fate and effects of contaminants of concern before any estimates can be made of the potential economic costs of indirect ecological effects of toxic pollution in the Lake.

### 4.3 Risk, Uncertainty, and the Value of Additional Information

Perhaps more than any other aspect of the draft Plan the Action Plan for Preventing Pollution from Toxic Substances raises considerations of risk and uncertainty. At present, very little is known about the sources, fate and effects of toxic pollutants in the Lake Champlain ecosystem. Experience from other ecosystems highlight the potentially significant and persistent risks to human and ecosystem health attributable to high levels of toxic contamination. However, the chronic public health and ecological effects of the relatively low levels of toxic contaminants found in Lake Champlain are less well understood. Prior monitoring efforts in the Lake Champlain basin have not been systematic enough to determine if trends in levels of toxic pollutants in lake water and sediment are increasing or decreasing. Human and ecosystem health risks posed by contaminated sites in the basin have also not yet been thoroughly evaluated, and estimates of the costs and effectiveness of site remediation options are not yet available.

Obviously, further information is needed before an effective and economically efficient toxic pollution prevention and remediation program can be developed. The first priority must therefore be to develop monitoring, research, and risk assessment programs that will generate valuable new information in the most cost-effective manner. As improved information becomes available it should be used to prioritize and target source reduction and remediation efforts. Unless substantial risks are identified that require immediate action, major program expenditures should be made only if there is a high probability that they will be effective in reducing risks associated with toxic pollution. Carefully designed pilot programs and demonstration projects may be the best way of determining the effectiveness of toxic pollution prevention, control and remediation options.

The draft Action Plan for Preventing Toxics Pollution already includes some targeting and prioritization. Three sites: Cumberland Bay, Burlington Harbor and Outer Mallets Bay, and two toxic substances: PCB's and mercury, have been identified as the first priority for action. Several other toxic pollutants, referred to as Group 2 substances, have also been identified as being of particular concern. However, these Group 2 substances such as arsenic, cadmium, lead, nickel, PAH's, silver and zinc, are not as widespread as mercury and PCB's.

Although the draft Action Plan prioritizes sites and substances on the basis of the risks they pose to public health and the Lake Champlain ecosystem, the Toxics Action Plan could be more explicit in outlining how this risk based approach affects the sequence of research and remedial actions that are proposed. Given the current uncertainty over sources, fate, effects and remediation options for toxic substances in the Lake Champlain basin, expenditures on toxic pollution prevention and control should be made in a sequential fashion contingent on the results of continued research, risk assessments and source identification efforts. The principal aspects of the Action Plan are discussed below in the context of gathering the information needed to develop a cost-effective approach to reducing risks posed by toxic pollutants in the Lake Champlain basin.

- For the three sites of concern a stepwise risk assessment and remediation evaluation should be undertaken (i.e., focusing on primary impacts). Relative to the other sites of concern, PCB contamination in Cumberland Bay appears to present the greatest risks to public health and the Lake Champlain ecosystem and more detailed risk assessments and engineering analyses are already being planned for that site. Decisions regarding remedial options will be based upon the results of these studies. However, full scale risk assessments and remediation studies of contaminated sites can be quite expensive. Given the lower level of contamination of Outer Mallets Bay and Burlington Harbor it would be appropriate



to begin with relatively low cost risk characterization efforts to determine if full scale risk assessment and engineering studies are warranted.

- For PCB's and mercury, which are accumulating in the Lake Champlain food chain and already exceed acceptable levels in some fish, there is sufficient justification for continued monitoring and evaluation efforts to determine whether there are any other controllable sources of these pollutants within the basin. This may require selective tributary monitoring, sediment sampling and evaluation of data on atmospheric deposition. However, it is important to utilize existing information on the location of elevated PCB and mercury levels, hydrodynamic models of the lake, and current and historic records of potential point sources to develop a systematic and cost-effective investigative effort for other sources of PCB's and mercury.
- Research on fate and effects of PCB's and mercury should be given high priority since these substances are both widespread and already impairing fishing and other recreational uses of the Lake. These pollutants have been the focus of research around the country for decades. To increase the benefits received from research that is specific to Lake Champlain it is important to compile, summarize and evaluate the results of existing published research. After this literature review, gaps in existing knowledge that are important for policy development relative to Lake Champlain can be determined, a research plan developed, and funding sources identified.
- A similar literature review of the fate and effects of Group 2 substances of concern should be initiated. The focus should be on defining possible ecosystem and human health effects and determining whether measured levels of any Group 2 substances pose significant risks.
- Until potential risks from Group 2 or Group 3 substances have been defined and evaluated it is difficult to estimate the benefits of expenditures focused solely on identifying sources of these pollutants. This does not mean these substances should be ignored. In most cases, it would require only modest additional cost to test for Group 2 substances in sediment or water samples that are taken primarily to test for PCB's and mercury. This would provide a means of continuing to gather information on the distribution and concentrations of Group 2 substances which could be drawn upon if and when any Group 2 substances are shown to be causing significant effects on human or ecosystem health.
- Pollution prevention and control efforts should focus on identified sources of Group 1 and Group 2 pollutants. Even then it is important to evaluate the costs of pollution prevention measures in relation to their potential contribution in reducing public health and ecosystem risks.

## 4.4 Implications for Individual Action Items

- A. 1 Adopt a Risk-based Strategy** - The proposed focus on sites and substances of concern is the correct approach, since it targets expenditures to where they are likely to have the greatest benefit for human and ecosystem health. Whether an additional \$50,000 per year for a coordinator is needed depends on responsibilities of existing regulatory staff at the state and federal level.
- B.1 Develop and Implement Pollution Prevention and Control Strategies for Group 1 and 2 Substances** - Pollution prevention and control strategies should be developed for mercury and PCB's if and when active, controllable sources of these pollutants, other than sites of concern, are identified. As described above, investigating potential sources and determining

fate and effects should draw first on existing knowledge and research. Items (c) and (d) of this task (evaluate and implement prevention and control alternatives) should be presented separately and indicated to be contingent on source identification efforts. There also seems to be some overlap with action items B.3, C.1 and C.2 (see comments below).

**B.2 Evaluate Management Alternatives for Sites of Concern** - This action item should highlight that stepwise, increasingly intensive assessment will be conducted based upon results of preliminary evaluations.

**B.3 Implement Low-Technology Pollution Prevention and Recycling Measures** - Pollution prevention should be targeted on the basis of information derived from the source identification efforts. This action item appears to be duplicated by action items C.2 through C.5.

**C.1 Target Watersheds for Accelerated Reductions** - Targeting should be on priority pollutants which have reached or are approaching levels that pose significant risk to human or ecosystem health. Targeting should also be on the basis of which sources of priority pollutants that are most cost-effective to control.

**C.2 to C.5 Prevention and Education Programs** - Reduction of toxic pollutants emanating from farms, households and industry may provide a wide range of environmental benefits. However, rather than taking a comprehensive approach to pollution prevention and control, it is important to target pollution prevention and control expenditures to yield the greatest reduction in pollutants that pose the most significant risks to human and ecosystem health.

**D.1 Continue Research on Fate and Effects Of Toxic Pollutants** - Research on fate and effects should draw on existing studies from around the country as well as the food chain and hydrodynamic models developed for Lake Champlain. From these preliminary analyses specific research needs and funding sources could be identified. At this point the focus should only be on Group 1 and Group 2 substances. Given these considerations, first year costs should be significantly lower than \$250,000. Whether increased funding will be needed in subsequent years depends upon the results of the literature reviews and preliminary modeling work. At least for Group 1 substances, there may be some overlap between this action item and risk assessments for sites of concern (B.2).

**D.2 to D.4 Improve Monitoring Programs** - Continued monitoring of toxic pollutants should be given high priority both as an early alarm system and to assist in identifying sources of toxic pollutants. However, the justification for a greatly expanded monitoring effort is not clear. For chemical monitoring, no justification is given for increased station density and an expanded list of pollutants. The focus should be on bioaccumulating substances that have reached or are approaching levels of concern. This could be supplemented by periodic, random sampling for other toxic pollutants of potential concern. Improving state and provincial coordination and data sharing should reduce the costs of a statistically sound chemical monitoring program.

Biological monitoring can provide an important early warning system. It can also serve to focus chemical monitoring efforts on those pollutants that are accumulating to dangerous levels in the Lake Champlain food chain. However, the proposed biological monitoring network appears to overlap substantially with action items D.1 through D.4 (Identifying and Monitoring Toxics) in the Fish and Wildlife Action Plan. The total cost of these Fish and Wildlife action items is estimated to be \$300,000 per year as opposed to \$400,000 to \$500,000 per year for the biological monitoring network.

It also appears there would be significant overlap between research on fate and effects (item D.1) and the various monitoring efforts proposed in items D.2 through D.4. Since chemical and biological monitoring programs already exist in both states and Quebec, modest increases in funding may be sufficient to expand or target these efforts to help identify sources of pollutants, as well as provide an early warning system and essential data with which to assess fate and effects of toxic pollutants of concern. It appears that the \$600,000 to \$900,000

annual cost estimate for toxic monitoring programs could be reduced by coordinating the proposed activities with other proposed and ongoing monitoring and evaluation programs outlined in the draft Plan.

- E. Identifying Sources and Quantifying Loads of Toxic Substances** - There appears to be some overlap between the four action items in this category, and the site evaluation and monitoring efforts outlined in B and D above. By coordinating these activities significant reductions in cost estimates seem possible.
- F. Evaluating and Improving Goals and Standards** - The establishment of goals and standards must be based upon the results of risk assessments and studies of fate and effects. In turn, appropriate goals and standards are necessary to guide remediation and pollution prevention efforts. Care should be taken in distinguishing between standards that represent long term goals and those which will define requirements for remediation and control measures. In some cases it may be useful to establish interim targets based on the costs and effectiveness of currently available remediation and pollution prevention techniques. These targets should be periodically revised on the basis of new technological and economic information.
- G. Enhancing Educational Efforts** - These action items appear to overlap with aspects of B.3, C.3 and D.4.

## **5. Action Plan for Protecting Human Health**

### **5.1 Introduction**

The principal health risks posed by water pollution in the Champlain basin involve drinking unhealthy water, consuming fish that have accumulated high levels of toxic substances in their tissues, and swimming in water that has been contaminated by pathogens. In terms of drinking water, approximately 188,000 people (32% of the population of the basin) depend on the Lake for their drinking water. Although the vast majority use public water systems that are monitored and regulated, approximately 4,000 people draw their water directly from the lake.

Toxic substances of greatest concern that may be ingested in certain fish species are PCBs and mercury -- both are classified as carcinogens -- and have been measured in Lake Champlain fish species, resulting in health advisories about consumption of these fish.

An accurate estimate of the number of swimmers who use the lake is not available, but we know that swimming is an important recreation activity at parks and beaches along the lake and at many private homes and cottages. Periodic high levels of fecal coliforms have caused previous public beach closings along the lake.

More background about these human health concerns can be found in the Action Plan. The following sections help place a perspective on the type and extent of concerns that have been considered in evaluating the likely economic consequences of the plan actions.

#### **5.1.1 Lake Champlain's Value as a Source of Drinking Water**

Providing safe drinking water is particularly a concern in small rural communities where treatment is less controlled and wells are often old, improperly sealed, and near contamination sources. Stukel et al. (1990) studied 15 rural water systems in New Hampshire and Vermont over a 12-month period and found that the odds of obtaining a positive coliform count increased by 2.6 for every inch of rainfall that occurred within the 2 days prior to sampling. Only 6 of the 15 systems were always free of coliforms. The authors also found that a system that was contaminated one week was more likely to be contaminated the following week. Systems using filtration or chlorination were less likely to be contaminated. These results were not statistically significant, probably because of small sample size.

Vermont has been shown to have much higher rates of symptomatic giardiasis than other states (45.7 cases per 100,000 population in 1983-1986). Birkhead and Vogt (1989) studied 1,211 total cases of giardiasis and concluded that beyond the fact that physicians and laboratories are sensitized to this pathogen and frequently test for it (and perhaps therefore detect it more frequently than their counterparts in other states would), there are several reasons why it is relatively common in Vermont. First, Vermont is a highly rural state, in which many residents obtain their drink-

ing water from nonmunicipal sources. Second, the prevalence of giardiasis is high in summer months, when people are recreating outdoors and waterborne transmission of the disease can more easily occur. Although some incidence of giardiasis is attributable to drinking water from mountain streams, moderately high levels were found in several towns within the northern part of the Lake Champlain basin. Nonmunicipal water system users had 2.2 times the rate of giardiasis of those on filtered, surface water municipal systems. Municipal surface water systems without filtration had almost twice the rate of those with filtration.

Crutchfield et al. (1995) recently reviewed a number of economic studies that ascertain willingness to pay to prevent contamination of ground water generally, and drinking water specifically, from contamination by nitrates, nitrites, agricultural fertilizers, and pesticides. These values varied widely, from a low of \$56 per household per year, to a high of \$1,452 per household per year. Several studies yielded values in the range of \$130 to \$180 per household per year.

The Champlain Water District provided the following information that further enhances our understanding of the use of Lake Champlain, and other large surface waters as sources of drinking water (James Fay, Champlain Water District, Water supply/Operations manager, personal communication 8/31/95; John Choate, Distribution manager, personal communication 10/25/95). Many of the points reflect economic implications for Lake Champlain protection and restoration:

1. There are approximately 137,803 residents of Vermont who are served by 25 municipal and 6 private drinking water supply systems that draw their source water from Lake Champlain, indicating that at least one quarter (24%) of Vermont's population relies on Lake Champlain for drinking water.<sup>6</sup>
2. The Champlain Water District wholesale rate is \$.988/1,000 gallons, and the water district pumps approximately 9,000,000 gallons of water per day from Lake Champlain. Groundwater systems are not normally feasible for Vermont municipal systems due to limited yields and secondary water quality issues.
3. The water industry practices the multiple barrier approach to treatment and the first barrier is source protection. It is generally more efficient to correct a problem at the source than to correct it through treatment at the plant. As an example, reducing nutrients would reduce disinfection-by-product precursors which keep disinfection-by-products below acceptable levels without costly upgrades in treatment.
4. Generally, when an intake is properly located, a larger and calmer body of water should have better water quality than a smaller, more active water body. Therefore, a properly located intake within Lake Champlain should be somewhat less costly to treat than a smaller inland Vermont lake or pond; and a proper Lake Champlain intake is definitely less costly to treat than a river or stream source.
5. Normally, Lake Champlain has approximately five times less particles than other surface water supplies in the nation. The particulate loading of a source is proportional to the cost of water plant construction and water treatment costs.
6. The trend nationally is toward increased testing and treatment of both groundwater and surface water. This trend is increasing faster for surface water sources than for uncontaminated groundwater sources. The water industry concurrently continues its own research, testing, and monitoring programs.

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<sup>6</sup> An estimated 138,026 people use Lake Champlain for drinking water. This a correction of the 189,000 figure presented in the Socio-Economic Database report (Holmes & Associates (1993). In addition to the Vermont water systems, there are 3 municipal systems and 2 private systems in New York drawing drinking water from Lake Champlain, serving 5,236 New York residents. Another 5,149 households (13,387 people) in New York and Vermont are estimated to draw Lake Champlain water for use by their individual households.

7. As mentioned in # 3 above, increased nutrients can lead to increased disinfection-by-products. In addition, increased turbidity is a surrogate of increased microbiological contamination which could cause increased treatment cost.

Overall, Lake Champlain compares very favorably to surface water sources throughout the nation, and the lake seems to be a more cost effective source of water than alternative sources. While nutrient levels and turbidity at the Champlain Water District water source in Lake Champlain are below national averages, points 3 and 7 above indicate that there are direct economic implications to increased nutrient levels in Lake Champlain.

Using the data supplied in point 2, above, Lake Champlain drinking water could be partially valued at \$3.2 million, considering only its wholesale value, and accounting only for those individuals served by the 11 municipal water districts. Using the same wholesale value for the other two thirds (62%) of Lake Champlain drinking water users unaccounted for by the 11 municipal water districts, the wholesale value of Lake Champlain water would be in the range of \$8 million. An economic analysis of the net value of Lake Champlain as a water source would need to consider the cost of an alternative water source for those estimated 156,426 users. The analysis would also examine the economic implications on water treatment costs of improvement, as well as decline, in the lake's water quality.

### **5.1.2 Economic Impacts of Toxic Substances and the Perceived Risk of Fish Consumption**

There are at least two types of economic impacts related to toxic contamination of fish species in Lake Champlain. One is the adverse economic impact on recreational businesses when participation in fishing declines because of perceived toxics problem in the lake. The other is the health costs related to ingestion of toxics and the possibly resulting cancers and other health problems. In neither case are the costs very easily quantified. The following discussion relates the findings from recent research on risk assessment, cancer rates, and costs related to toxic contamination of fish. It is important to note that our knowledge of toxics in Lake Champlain is too limited at this point to make any direct connection between consumption of Lake Champlain fish and cancer rates or other health problems in the basin. Therefore, the following information does not imply that eating Lake Champlain fish causes cancer, rather, it is presented in the interest of highlighting the type of information that is necessary to a benefit cost analysis of this Action Plan.

Toxics in Lake Champlain would have direct adverse economic impacts on local economies if users and potential users decided against visiting and fishing Lake Champlain. The following studies report on how anglers respond to toxic advisories, and specifically, how advisories affect their fishing behavior.

Recent surveys of Lake Champlain users found that fish consumption advisories deter a certain percentage of anglers. When various user groups (e.g., marina users, lock users, public access users) were asked about how fish consumption advisories affected their participation in fishing, close to one third of any given user group reported that the advisories discouraged them from fishing while at Lake Champlain. The only group of anglers that were surveyed were ice anglers, and only 15% of the anglers reported that fish consumption advisories discourage their fishing Lake Champlain (Dzeikan and Smith 1995). Interpretations of that finding could be that anglers are less easily deterred from fishing than other recreationists who only fishing occasionally; or, that the species ice anglers are targeting are less likely to be contaminated with toxics.

It should be noted that the advisories did not discourage any of the sample from visiting Lake Champlain, since they were surveyed during their use of the lake. So what remains unclear is what percentage of the potential user population elected not to visit Lake Champlain at all because of the perception of toxic contamination. The economic impact of that type of deterrence of use was researched in New York by Montgomery and Needelman (1994), who found that over all cost of toxic contamination of New York's lakes and ponds generated an annual cost of \$28 per capita.

The problem of toxics in fish is also of concern to the Lake Champlain Charter Boat Association. According to conversations with one of their members, they feel that the health advisories are directly impacting their business. They are seeing predominantly repeat business at this point, and perceive that the "bad news" on fish consumption is limiting new business.

Between September 1, 1992 and August 31, 1993, 66% of anglers who fished Lake Champlain ate some of the fish they caught, averaging 26.2 meals per year (Connelly and Knuth 1995). About 5% of anglers indicated they ate species for which health advisories exist at levels beyond those recommended by the advisories. Another 18% ate species for which advisories exist but stayed within the recommended consumption advisories. Of the 5% who exceeded the advisories, nearly all (90%) were New York women of childbearing age, for whom eating any fish for which advisories exist constituted exceeding the recommended limits. A plurality of these women (48%) indicated they did not know what the advisories were for women of childbearing age. The New York advisory differs from the Vermont advisory for children under 15 years of age and women of childbearing age. As a result, 9% of New York anglers exceeded the New York advisories, while only 1% of anglers exceeded the Vermont advisories.

Anglers' responses to toxic chemical contamination of rivers and sport fish were tested on three rivers in Michigan having three different levels of consumption warnings: the Saginaw (no consumption), Kalamazoo (lesser warning) and Grand (no warning) (Udd and Fridgen 1985). Across three levels of contamination, there was no difference among anglers in their awareness of, responses to or avoidance of contaminants, even among the river with high levels of toxics. Most (57%) respondents catching fish in the Saginaw River indicated they planned to eat the fish. The authors suggest that rather than following the maximization of expected utility model, anglers more closely follow a model of bounded rationality which in essence states that people make less than rational decisions based on less than perfect knowledge.

Risk perception studies show people may underestimate significant risks while overestimating others. Government agencies may assume the public is aware of risks once the agency has issued warnings, but this is often not the case (Burger and Gochfeld 1993). Of 154 groups interviewed as they fished on the catchment basins of Jamaica Bay Wildlife Refuge in New York City, only 19% believed the waters or fish were contaminated or unsafe, despite state warnings to the contrary. The authors believe that anglers ignore the health warnings because the fishing setting is pleasurable, familiar, voluntary, and because they have not become ill from eating the fish.

Gold, M. S. and E. O. van Ravenswaay (1984) are among the few to have examined the quantification of benefits (or costs avoided) from reduced consumption of fish containing contaminants. For example, the value of preventing one cancer ranged from \$514,928 to \$3,125,516. Estimates of total benefits (costs saved) if all PCBs could be eliminated (i.e., if all cancers under a no tolerance situation could be prevented) ranged from \$3.19 million to \$158.15 million. The best "point" estimates of the benefits of such "100% effective" PCB regulation ranged from \$12.56 million under low risk assumptions to \$102.49 million under high risk assumptions. These are expressed in 1982 dollars. The data incorporate estimates of new cancers per year for the 15.2% of Americans who ate fish then. At a PCB standard of 2 ppm, these total numbers are 3.8 (low risk), 10.0 (medium risk) and 34.3 (high risk).

While PCBs and mercury -- two of the toxics of concern in Lake Champlain -- are shown to cause cancer and other health disorders in laboratory experiments, directly linking them to specific illnesses in individuals is a lengthy, difficult research effort. Researchers at the Center for Neurobehavioral Effects of Environmental Toxins have been undertaking that type of research, and recently released their findings from hundreds of newborns studied from 1991 to 1994. Their evidence indicates that the combination of toxins found in Great Lakes fish affects the "habituation" response in babies, indicating that human behavior may be affected by the relatively small amount of toxins like PCBs, dioxin, and other pollutants throughout the Great Lakes. An earlier study found that physical changes caused by toxins increased as years went by (Plattsburgh Press-Republican 1995). The economic impacts of behavioral changes could manifest themselves in lowered learning ability affecting education costs, job training costs, and lowered earnings.

In the US as a whole, at least 60,000 deaths occur annually because of toxic agents (Vermont Department of Health 1995), and a large proportion of those deaths likely involve cancer. Vermont cancer death rates in general appear to be at or slightly above the national average. For example, in Vermont there were an average of 143.2 deaths annually per 100,000 females in the 1987-1991 period, while nationally there were 141.1 (Ries et al. 1994). Comparatively, for New York counties along Lake Champlain, the figures were 141.3 for Clinton County, 157.1 for Essex County, and 154.5 deaths annual per 100,000 females for Washington County (NYS Department of Health, Bureau of Cancer Epidemiology 1994).

In terms of breast cancer, there were 28.0 deaths per 100,000 Vermont women annually from breast cancer in the 1987-1991, while nationally there were 27.4 deaths, on average (Vermont Department of Health 1995; American Cancer Society 1995). Data from New York show that in Clinton County breast cancer deaths were 26.1 per 100,000 women, in Essex County were 31.2 per 100,000, and in Washington County were 23.1 (NYS Department of Health, Bureau of Cancer Epidemiology 1994). Colon cancers within the Lake Champlain basin were slightly above the national average. These higher than average cancer rates in the basin area -- especially reflected in the figures for Essex County, New York -- are not attributable to the consumption of Lake Champlain fish, or any other specific cause that the study team was aware of. This overview of the cancer statistics for the basin is presented in response to concerns raised at the Economic Focus Group sessions carried out for this project, and described elsewhere in this report.

Vermont estimates that the total annual hospital charges in Vermont associated with breast cancer are \$1.6 million, while colorectal cancers add another \$4.4 million in hospital bills (Vermont Department of Health 1995). The high costs for these types of illnesses are in fact considerably higher to society when earnings, family suffering during lengthy illnesses, and quality of life issues are factored into the equation. The average cost of a cancer illness was not forthcoming from the literature reviewed for this section, primarily because of the large variety of cancers (as many as 24 listed in one study) and the various treatments available.

In summary, Reinert et al. (1991) point out that while disclosure to anglers and the public at large of the risks of consuming fish containing contaminants is important and essential, the public needs an improved framework for evaluating the information. Citing other studies, they place the lifetime risk of contracting an environmentally-related cancer in the 2% to 5% range. These authors cite studies that have estimated the lifetime cancer risk of drinking one pint of milk per day, eating 4 tablespoons of peanut butter per day, and drinking one diet soda per day containing saccharin. In addition to cancer-related risks, they point out the risk associated with driving to and from the fishing site, and the risk of boating while fishing. Thus, in addition to improving the visibility of health advisories related to fish consumption, it is important to provide the public com-



parative data on other risks and an improved framework for deciding which risks to accept or reject.

### **5.1.3 Economic Impacts of Beach Closings**

Both the monitoring of water quality near public swimming areas and the communication of results to the public is critical to minimizing water-borne illnesses (e.g., skin, ear, eye, respiratory, and gastrointestinal problems) contracted by swimmers. Cabelli (1989) emphasizes, and cites a number of other studies that show that the above illnesses can readily be contracted from waters that would be rated aesthetically acceptable. Moreover, in such waters, the public often does not suspect a problem unless they are warned. Cabelli goes on to state that in concentrated swimming areas the most likely source of staphylococcus aureus levels is from the bathers themselves. However, because of the small number of individuals who contribute to this problem, predictability is poor. This would also be true of fecal wastes from overflowing septic systems or from dumping of tanks on pleasure craft. Thus, monitoring fecal coliform counts in areas of concentrated swimming or in areas where high counts have been noted previously is very important.

In general, pathogens from animal waste (e.g., through storm runoff) are expected to carry a much lower rate of illness in waters used for swimming than human waste. Thus, Cabelli notes that the risk of illness when predicted from coliforms (direct coliform, thermotolerant coliforms, E coli) are likely to be overstated when those coliforms result from animal versus human waste.

The USEPA recently adopted the criterion of accepting a risk of the relatively benign illness, acute gastroenteritis, at the federal level of concern of about 19 cases per 1,000 swimmers, and recommended the corresponding guideline, a mean enterococcus level in the bathing water of 35 CFU/100 ml. It was assumed that except for very unusual circumstances, the risk of contracting more serious illnesses would be negligible.

Cabelli notes that the publication (or posting) of results of water quality analyses at public beaches, an action plan recommendation, is used in a number of places and is increasingly being used in combination with a minimum safe federal water quality standard that state and local units of government may choose to make more restrictive.

There are about 54 public and commercial beaches and 10 private beaches on the shore of Lake Champlain (Farnum 1995). In the draft Plan, the section on Human Health provides beach closing data for 11 municipal beaches for the period 1989-1993. Table 4-1 up-dates that information with data for 1994 and 1995. There does not appear to be an overall trend in beach closings, although in 1995 there were more closed days than average for 4 of the 11 beaches.

Beach closings in 1995 appear to be primarily related to coliform bacteria counts, and the problems appear to be very site specific, with the source of coliform being in the vicinity of the beach, or up-stream in the watershed area above the beach. While the source of the contaminants have been identified for some beaches, for others it is still unknown. In one case, Red Rocks Beach, the source appears to be a population of beaver inhabiting ponds in the watershed above the beach.

Since beach closings are site specific, and apparently not symptomatic of a lake-wide coliform bacteria problem, beach users have a number of options when arriving at a beach and seeing a "CLOSED" sign. They can look for another beach on Lake Champlain, travel to another lake entirely, or cancel their beach trip for the day. In terms of economic impacts, in the first case, the economic benefit of their beach trip-related expenditures is transferred to the other beach loca-

**Table 5-1: Up-Dated Beach Closing Data, 11 Municipal Beaches on Lake Champlain**

Beaches	Number of Days Closed by Year						
	1989	1990	1991	1992	1993	1994	1995
Burlington VT - North Beach	n/a	4 days	1 day	0	0	2 days	7 days
Burlington VT - Blanchard Beach	n/a	n/a	closed	closed	closed	closed	closed
Burlington VT - Cove Beach	n/a	2 days	1 day	0	0	0	0
Burlington VT - Leddy Beach	n/a	0	1 day	2 days	2 days	2 days	5 days
Colchester VT - Bayside Beach	2 days	0	0	3 days	0	0	0
Shelburne VT	n/a	n/a	n/a	n/a	0	14 days	most of summer
So. Burlington VT - Red Rocks Beach	12 days	5 days	2 days	1 day	2 days	1 day	8 days
Port Douglas NY	n/a	n/a	n/a	n/a	7 days	0	0
Essex Beach NY	n/a	1 day	closed	closed	closed	closed	closed
Cliff Haven Beach NY	n/a	n/a	n/a	0	0	0	0
Plattsburgh Beach NY	n/a	n/a	n/a	7 days	1 day	0	0

Sources: Lake Champlain draft Plan; data collected for this project from various Beach managers.

tion. In the other two scenarios, the economic impact is lost to Lake Champlain area businesses. What is lost is the estimated expenditures by the beach user. One estimate of beach related expenditures for Lake Champlain were provided by Tommy Brown (personal communication, Cornell Human Dimensions Research Unit, 9/19/95). In his 1984 research involving Cumberland Bay Park, NY on Lake Champlain, Brown found that most users were primarily interested in swimming. They spent on average \$12.18 per person. By subtracting out the entrance fee, and converting the expenditure to 1995 dollars, the average Lake Champlain beach user expenditure is approximately \$16.60 per person per day.

Another estimate can be derived from Dziekan (1995), who surveyed park users on Lake Champlain. She found that park users' main interest was swimming, and that average expenditures were \$30.90 per day. By subtracting out site and parking fees (\$5.82) and lodging fees (\$10.30), the average beach-related expenditure in her study would be approximately \$14.87 per day, similar to the amount found by Brown.

Without a detailed analysis of beach attendance and beach closings by date, it is difficult to estimate the economic impact of beach closings. Just by example, if a beach with an average use of 500 people on a weekend day were closed on a Saturday, using the \$16.60 figure, the direct economic value foregone would be \$8,300 per closed day, not including the entrance fee.

The economic impact of beach closings would appear to go far beyond the one day impact in the example given above. For some, when a beach is closed once, they chose not to return to that beach for the rest of the year. Similarly, when a "Beach Closed" sign appears repeatedly, another percentage of the user group will chose to travel to a beach that is open more consistently. On a broader, public perception level, beach closing notices give the impression that the lake is somehow polluted, regardless of the localized nature of the problem. For that segment of the population, use of any beach on the lake, and lake use in general, may be curtailed.

According to recent surveys of users on Lake Champlain, beaches and swimming areas were among the top priority areas for needing improved facilities (Dzeikan 1995). Public beaches often lack user fees, so are provided as a community amenity that enhances quality of life in the area. For some small communities, the difficulty and cost of solving the water quality problem at the local beach has been determined as not cost effective, and the beach has been closed. In the community of Westport, New York, the traditional public beach was permanently closed because of reoccurring coliform bacteria problems, and a new, safer beach developed in 1995 by a partnership of private and public interests.

## **5.2 Implications for Individual Action Items**

### **5.2.1 Opportunity A. Reduced Risks from Human Contact with Pathogens**

The actions within this opportunity are aimed partially at information gathering and public education, and partially at investigating faulty septic systems. The public education costs total \$24,000 in one time costs and would involve a coordinated effort to study beach problems as a whole on the lake. With the researchers just having going through the process of trying to compile beach information, and finding it very difficult due to the number of beaches and lack of coordination, this would appear to be money very well spent. Our conclusion from the beach section above is that the problems seem to be localized. However, that does not deny the need for coordination and a lake wide over-view. With the goal of avoiding those "Beach Closed" signs that lead to uncertainty about water quality in general, and a reluctance to re-visit those particular beaches, this public education effort appears cost effective.

The investigation of faulty septic systems (A.3), would seem to follow from the information gathering effort in A1, and would be most cost effective if the targeting of coliform bacteria problem areas is incorporated into the action. As discussed above in the beach section of this chapter, not all beach closings are due to human septic systems. Beavers may play a role. In addition, swimmers itch, caused by an organism that apparently moves between birds and snails, is also a known cause of beach closings on Lake Champlain.

### **5.2.2 Opportunity B. Protecting Drinking Water Systems**

The two Actions pertain to obtaining funding from the State and Federal governments to implement the requirements of the Safe Drinking Water Act (SDWA) and to assist operators of small systems. There are no costs associated with these actions, other than current state agency staff involvement, so they appear to be very cost effective.

### **5.2.3 Opportunity C. Protecting Unregulated Drinking Water Systems**

The one Action involves gathering information from, and presenting educational materials to, small unregulated water users of Lake Champlain. This type of activity would be useful due to the widespread occurrence of these systems in the lakeshore area, the wide variety of possible contaminants, and recent establishment of zebra mussels which dictates a unique set of water system maintenance measures. Given the lack of available mailing lists, etc. to facilitate reaching many of these households, this project would seem to be more appropriately undertaken by a consortium of watershed and lake associations. They would have easier access to the users and would perhaps be a more effective source of contact, than would state agency personnel. The \$15,000 estimated cost for this action would likely be best spent as a grant to the consortium, for

their collecting the information and developing the informational materials, with the assistance of agency personnel.

## **5.2.4 Opportunity D. Identifying and Explaining Risks from Fish Consumption**

D.1 in the draft Plan, the first of four actions, recommends a coordinated fish sampling program among VT, NY, and Quebec. As noted in the Plan, this recommendation is almost identical to Fish & Wildlife Action D.1, with the same cost estimate of \$100,000 annually. A similar recommendation also appears in the Toxics Chapter Action D.3, as part of a \$400,000 to \$500,000 Biological Monitoring Network. The recommendation appears to be most cost effective and less controversial in the context here of the Human Health Chapter. It is the risk to human health that is most adversely impacting tourism economies, charter boat fishing, etc. around the lake. The coordination aspect is also key, because it demonstrates to the public a concerted effort to address the problem. The cost of this recommendation would appear to be offset by the value of information gained on risks from fish consumption,.

The cost effectiveness of D.1, would be almost assured if D.2 included three related information distribution activities with the action: 1.) providing information on specific activities to control current toxic contamination in the lake; 2.) information on specific efforts to control new toxins entering the lake; 3.) a publication and marketing effort that includes distribution of the "good" news along with the bad.

As stated by one charter boat captain, "the state only puts out the bad news, they are doing nothing to help us get the word out on what is good about the lake". Before releasing contamination press releases, the state agencies responsible should coordinate with the LCBP or a similar organization to develop positive information to relay to the public as well. For example, descriptions of safe species, and safe locations in the lake, would be useful and informative, as well as techniques for cleaning fishing to make them safer for eating, in addition to providing up-dates on current research. A strong public education and outreach effort such as this is a necessary extension of D.1.

D.3 and D.4 are research activities that further clarify the findings of the fish consumption study, with an estimated cost of \$75,000 and \$50,000 respectively. If the assumptions are true, and specific groups of basin residents are at greater risk due to higher than average fish consumption, then these actions may result in less people consuming Lake Champlain fish. However, the economic impacts would be minimal since these are local residents who would be making limited fishing-related expenditures.

In summary, many of the recommended actions pertaining to human health revolve around improved education. In the nonformal setting in which most adult education takes place, this translates to improved communications. In a similar analysis to the Reinert et al. (1991) evaluation of fish consumption advisories, Wardlaw and Bruvold (1989) evaluated consumer notification under the Safe Drinking Water Act (SDWA) of 1974 and the Amendments of 1986. They point out that it is easy to endorse in principle the right of the public to know about environmental risks, but it is exceptionally difficult to assure that the information receives more than symbolic attention. They emphasize the importance of all aspects of the communications message, including its clarity, visibility, packaging, and distribution. Limited follow-up studies of SDWA-related communications showed that roughly half of the intended audience did not remember receiving the message; most indicated they were sure they did not receive the message. Other studies indicated that while the

vast majority of people indicated that they received and read the message, very few demonstrated upon further questioning a good understanding of the message.

Thus, in the case of both drinking water and fish consumption advisory messages, further education and communication efforts appear to be justified. The cost associated with these efforts will be closely related to the number of messages and how they are delivered. As discussed above, including positive aspects of Lake Champlain water quality and fisheries might be appropriate in some cases to help to re-direct use, rather than simply discourage it. In addition, risk should be put in some type of context, such as in relation to risk related to other common activities.

## **6. Action Plan for Protecting Wetlands**

### **6.1 Introduction**

There are over 300,000 acres of wetlands in the Lake Champlain basin. These wetlands provide a wide variety of ecological functions that include improving water quality by filtering sediments, pollutants, and nutrients; protecting groundwater and drinking water; contributing to overall biological diversity; providing habitat for fish and wildlife; and, providing habitat for some rare and endangered species and natural communities. Wetlands also help stabilize shorelines and prevent erosion, provide recreational and educational opportunities, and contribute to the aesthetics of the region. While the wetlands resource in the basin is substantial, it is important to realize that (1) this resource has gradually declined over time in both quantity and quality, (2) wetlands provide societal benefits not only to people who live within the basin, but to others who live outside it, and (3) many of the total benefits provided by privately owned wetlands do not accrue to their owners (Bardecki 1984).

Many of the benefits of wetlands are not reflected in market transactions. Nevertheless, it is well understood among economists, and there is a growing understanding across wider segments of the public, that wetlands are valuable economic resources when maintained in their natural or semi-natural state. Components of wetland systems -- water, some plants, and fish and wildlife -- are of direct benefit to humans. In some cases wetland aesthetics make a region more attractive to tourists and thus contribute to local economies. Undeveloped wetlands have a variety of possible future option values, some of which we may have little awareness of today; those options become lost for wetlands that are developed. Wetlands also have nonuse values or existence values in that people are willing to pay something to keep them in their natural state even when they have no intention of using these areas.

Complex policy issues surrounding wetlands often arise not only because many wetland values are not readily captured by markets, but also because those who own wetlands often receive few of the total benefits that wetlands supply. While the total economic benefits provided by wetlands in the Lake Champlain basin are undoubtedly quite high, the important question from a management perspective is whether conversion or degradation of a specific wetland or portion thereof would result in net costs to society. Unfortunately, the current state of knowledge of wetland processes and functions, together with a lack of markets for most wetland functions, makes it prohibitively expensive to definitively quantify the benefits and costs of protecting particular wetlands.

### **6.2 Estimating Wetland Values**

While many wetlands economic values cannot be derived with great precision, our ability to estimate ranges of economic values for wetlands functions has increased substantially in the past two decades. The following studies illustrate this work as well as highlight additional research needs. It is important to realize that some studies focus on use values, such as accrue to an-

glers, hunters, and bird watchers; while others attempt to illuminate nonuse values, defined as the value derived from preservation independent of on-site or off-site use. The two are separate valuations and together would comprise the total value of a wetland.

Given the very different ecological characteristics of wetlands in various parts of the country and the complex interaction between these ecological characteristics and human factors in determining wetland values, it is not possible to use the results of the studies cited below to develop a complete estimate of the economic value of wetlands in the Lake Champlain basin. However, it is instructive to examine research findings from other areas to learn what type of wetland values are being considered, and how benefits and costs of wetland preservation have been allocated.

Wetlands provide habitat and spawning grounds for many species of fish. While we were unable to locate any studies that relate fishery productivity and associated economic values with wetland area in a freshwater ecosystem, several studies of this relationship have been conducted for saltwater marshes. Lynne et al. (1981) used a bioeconomic model of the Florida blue crab fishery to identify a statistically significant relationship between marsh acreage and crab harvest, while holding fishing effort and other human factors constant. Bell (1989) used a similar analytical approach to estimate the marginal value of an acre of wetland for commercial and recreational fishing on the east and west coasts of Florida. Bell also found a statistically significant relationship between salt marsh acreage and fishery production.

Wetlands also provide critical temporary habitat for many migratory bird species and migratory bird hunting generates significant levels of expenditures that benefit local economies. These hunting expenditures are not known for the Champlain basin, but in Vermont, about half of which lies within the basin, approximately 7,300 migratory bird hunters spent \$383 each in 1991, for a total of \$2.8 million (US Fish and Wildlife Service 1993). Better data are needed to determine expenditures made within the basin, what portion of those expenditures represent new dollars coming into the basin, and the secondary economic impacts of that spending. In addition it is important to determine how migratory bird species are affected by incremental changes in the quantity and quality of wetlands.

The value of recreational opportunities offered by wetlands generally exceed the actual expenditures and travel costs people incur for the experience. Bergstrom et al. (1990) found that in addition to \$118 million in expenditures made by 76,000 recreationists in coastal Southeastern Louisiana, these recreationists received an aggregate consumer surplus of \$27.4 million, or \$8.42 per acre. A separate study by Stoll, Bergstrom and Titre (1989) used a mail survey to inform anglers and hunters in Louisiana that wetlands loss could reduce bag and catch rates and asked the respondents to indicate what they would be willing to pay for wetlands preservation. Over 2,000 anglers and hunters responded to the mail survey indicating an average willingness to pay of \$330 per person to prevent further wetlands loss. In a California study, Cooper and Loomis (1993) found that increasing water deliveries to national wildlife refuges for optimal refuge management increased the consumer surplus of waterfowl hunters. The authors found that the marginal value for an additional acre-foot of water ranged from \$1.00 at a refuge where the water flow was already at near-optimal levels, to a \$14.05 to \$20.00 range (depending on the model used to derive the estimate) for a refuge where the water level was considerably below optimal management levels.

Studies have also shown a willingness to pay on the part of the general public to protect wetlands. Loomis et al. (1991) found that Californians would be willing to pay an additional \$154 per year in higher taxes for the purchase of water to prevent a substantial reduction in wetlands in the San Joaquin Valley. Surveys of Alberta anglers, hunters, and households generally found that they valued wildlife habitat with significant wetland components at \$110 to \$767 per acre, based on their willingness to pay for additional acreage (Phillips et al. 1993). The authors conclude that these rates are comparable to the economic value of lower quality agricultural lands.

Economists estimated that the marginal value of an acre of wetlands in the Galveston Bay, Texas area for recreational fishing was about \$320 per year in 1989. Using a discount rate of 4 percent, the net present value was estimated at \$8,500 per acre. The estimate of the economic value of an acre of wetlands is much higher than the existing market price (i.e., about \$500 per acre) because it takes into account the loss to recreational fishing activities that occurs when an acre of wetlands is lost (Whittington et al. 1994).

The most recent study available on wetland valuation in New England and the Northeast was conducted in 1993 and involved a contingent valuation survey of 2,510 randomly selected New England residents. Respondents were willing to pay an average of between \$74 and \$80 per year (over a five-year period) for wetlands providing flood protection, water supply, and water pollution control. They were willing to pay between \$81 and \$96 per year for wetlands containing rare species of plants. The authors concluded that the survey results suggest that most of this value is nonuse value, and that failure to consider nonuse values in decision making can understate the value of wetland preservation by a substantial margin (Stevens et al. 1995).

As noted prior to this brief review of literature, it is not possible at this time to use the results of wetland valuation studies from other areas to develop a complete estimate of wetland values in the Lake Champlain basin. In addition, willingness to pay research on wetlands is continually being improved and refined. The Stevens et al. (1995) research is very recent and likely reflects the latest refinements in willingness to pay survey techniques. However, earlier research on wetlands has been criticized for both over-estimating and under-estimating the value of wetlands (Dennis et al. 1995). For example, wetland values might be over-estimated because of a widely held conservation ethic, with the economic findings reflecting more on the respondents' general beliefs about nature and conservation, than on the value of the wetlands being evaluated. On the other hand, the migratory bird habitat provided by wetlands have national and international significance, possibly resulting in an under-estimation of wetland values because of unaccounted for benefits to individuals outside the area of study (Dennis et al. 1995).

Recommendations for further research that would yield improved estimates of the value of wetlands in the Lake Champlain basin are outlined below.

- Determine the relationship between wetlands acreage and recreationally valuable wildlife and fish populations and use this information, together with surveys of hunters, anglers and bird watchers in the Lake Champlain basin, to estimate the recreational costs of continued wetlands loss.
- Estimate the stormwater and snow melt storage capacity of wetlands in the Lake Champlain basin and determine the cost of flood control measures that would be necessary for different degrees of wetland conversion.
- Conduct statistical analyses of differences in property values attributable to their location adjacent to wetlands of various sizes and quality.
- Evaluate the role of wetlands as sinks for phosphorus, and quantify the avoided costs of phosphorus control measures that would otherwise have to be implemented.



## **6.2.1 Who Benefits from and Who Pays for Wetlands Protection**

It is important to distinguish between the distributional and aggregate economic effects of regulations limiting development of wetlands. From the perspective of the basin as a whole there is no shortage of undeveloped land and limiting development in wetland areas is unlikely to restrain growth in the near future. To some degree, developers and others seeking to purchase or lease land could experience an increase in costs if wetlands regulations significantly reduce the supply of developable land. Conversely, owners of land that are not defined as wetlands will realize some benefit in the form of higher land values. This general increase in the price of land will be related to the percentage of land in the affected region for which wetlands regulation limit development options. If only a fraction of the developable land is defined as wetlands the effect on general land prices will be quite small.

Given reasonable estimates of the numerous benefits that wetlands provide, this aggregate, regional perspective would argue for strong wetlands protection. However, for some landowners and communities, the costs of wetlands regulation may be quite high. This raises a second policy issue which is whether the benefits that wetlands provide are public property which private landowners have no right to impair, or whether the costs of wetlands protection should be shared between private landowners and the public. This issue has implications for the appropriate mix of acquisition programs, financial incentives, and market mechanisms to use in wetlands protection programs. For further discussion of individual versus societal property rights questions, and efficiency and equity concerns in wetlands protection, see the Council for Agricultural Science and Technology (CAST) (1994).

## **6.2.2 The Role of Economic Incentives and Market Mechanisms in Wetlands Protection**

Past agricultural and flood control policies have sometimes had the unintended impact of causing the drainage of wetlands for agriculture. Stavins and Jaffe (1990) used dynamic optimization models in their study of agricultural and forestry land use decisions over a 50-year period in a 36-county area of Arkansas, Louisiana, and Mississippi. They found that landowners generally responded to economic incentives in their land use decisions, although at times a lag period existed. Federal flood control and drainage projects caused an additional 1.15 million acres of forested wetlands to be converted to agriculture. Conversion of these lands would not have been profitable in the absence of these federal programs.

Recent agricultural policy reforms have eliminated some of the incentives for farmers to clear wetlands. The Swampbuster provision of the Food Security Act of 1985 prohibits farmers that drain and clear wetlands from obtaining farm program benefits. In addition, the 1986 Tax Reform Act eliminated income tax deductions for drainage expenses. Randall and Kramer (1993) developed a farm income model to examine how these changes in financial incentives would affect land use decisions in three bottomland agricultural counties in Louisiana, Arkansas, and Mississippi. The results of their study indicate that the policy changes were sufficient to eliminate the economic incentives for converting bottomland wetlands to agricultural land in most parts of the Mississippi Delta region.

These studies highlight the importance of tax policies and financial incentives in wetlands protection efforts. Tax policies should at the very least be designed to avoid providing incentives for wetlands conversion. If development or agricultural uses are restricted in wetlands, property taxes for land defined as wetlands should be based on lower market values. In light of the many external benefits provided by wetlands, it may also be appropriate to provide landowners that protect or restore wetlands with tax credits. Indeed, the purchase of conservation easements and even the outright acquisition of wetlands are simply financial incentives that are provided in one lump sum instead of repeatedly over time.

One of the most promising market mechanisms for minimizing wetlands loss is mitigation banking. Mitigation banking refers to a wide range of public programs and private business ventures that involve the creation, restoration or enhancement of wetlands as an advance offset for degradation or conversion of wetlands elsewhere (Silverstein 1994). For example, a developer might receive mitigation credits for restoring a previously drained agricultural wetland. The developer could bank these credits and exchange them at some future time for the right to convert a similar or smaller area of wetlands as part of a separate development. Depending on the policies of the mitigation banking program, the original creator of the wetlands credits might also be permitted to sell them to a different developer. Making the mitigation credits transferable can provide a profit motive for creating, restoring or enhancing wetlands.

Reppert (1992) indicated that at least 37 mitigation banks are operating in the U.S. and at least 64 others are in the planning stage. Compensation for highway impacts has been the greatest motivation for mitigation banking, but the practice is applicable to many other proposed developments, and can be geared toward a variety of purposes such as enhancing wildlife corridors or providing habitat for inland species in need of large acreages (White et al. 1992).

One of the principal benefits of mitigation banking are that it can reduce the cost of adhering to a no net loss policy. Mitigation banks can also ease the burden of wetlands regulation on individual landowners and communities by providing them with additional opportunities for development. In addition, mitigation banking permits regulators and conservation organizations to take a landscape approach and focus on a larger wetland system for creation, restoration, or enhancement. Ecologists and resource managers now realize that the cumulative effects of habitat loss at a landscape level may prove significantly more harmful to biodiversity than the sum of the individual habitat losses. Mitigation banking can help ensure a coordinated approach that avoids "postage stamp" wetlands in which each one or two acre development is replaced in kind with small individual wetlands of comparable size but which often maintain minimal system contributions to ecological or hydrological functions (Silverstein 1994). The advantages of mitigation banking also include the fact that the "banking" is done in advance of the taking or development (Weems and Canter 1995). In addition to difficulties that may be encountered in putting a system in place, a possible disadvantage of mitigation banking is that having a bank in place may make development easier. That is, officials may choose not to apply as rigidly the required tests of showing no other feasible alternative, or of a necessary taking, when mitigation banking is in effect.

## **6.3 Implications for Individual Action Items**

Wetlands are an excellent example of a situation where failing to take action can cause irreversible damage or at least substantially increase costs. If a wetland is developed for commercial or residential use, the costs of returning it to its natural state at some later time will have increased substantially. It is therefore essential to identify highly valuable wetlands that are potentially threatened and focus protection and acquisition efforts on these sites. While this targeting process is underway, research should continue on innovative regulatory approaches, financing

mechanisms, and incentive programs that minimize costs to affected landowners and communities. Flexibility should be maintained to permit tailoring of protection programs that achieve a balance between public sector costs and local impacts.

As increasing amounts of wetland are permanently protected through acquisition or other means, the marginal benefits of protecting or acquiring additional wetlands would be expected to decline and the economic costs of doing so would be expected to increase. Consequently, as protection and acquisition programs proceed, it is important to periodically reevaluate the costs and benefits of additional acquisition as well as the costs and benefits of changes in regulatory programs.

The draft wetlands action plan generally adheres to these economic considerations regarding prioritization and implementation. The states of New York and Vermont have classification systems indicating the relative importance of wetlands. In addition, the Lake Champlain Wetlands Acquisition Study Committee, a public-private partnership, is working to identify and obtain funding for acquisition of the highest quality wetland sites in the basin. The Vermont Agency of Natural Resources also received an EPA grant to identify and develop appropriate protection programs for wetlands in Chittendon County that support rare species or have high ecological value. These prioritization and targeting efforts should be supported and applied in a comprehensive manner.

**A. Updating Wetland Inventories** - This is an essential first step for a targeted, prioritized approach to wetlands management. Clearly defined wetlands boundaries will also help to reduce uncertainty on the part of landowners and developers.

**B.1 Establish a Consistent Approach to Wetlands Regulation in the Basin** - Basin wide consistency in the definition, categorization, and regulation of wetlands is an important goal. However, intra-state and state-federal coordination of wetland management and regulatory efforts are vital to wetlands protection, and perhaps more easily achieved. Uncertainty over the definition of wetlands, the land uses permitted on or adjacent to different classes of wetlands, and the future direction of wetlands regulation create added costs for landowners and developers. Even if there are differences between New York, Vermont, and Quebec on these issues, creating clearer and more streamlined regulations within each state and the province of Quebec would have substantial benefits.

**B.2 Explore the Feasibility of a Mitigation Banking Program** - Evaluation of a wide range of market based approaches to wetlands protection should be given high priority. These programs can help to reduce the overall cost of wetlands protection and avoid placing a disproportionate share of these costs on a few landowners or communities. The potential benefits of mitigation banking programs are outlined above (see Section 6.2.2). In addition to mitigation banking, transferable development rights, conservation easements, and tax incentives should be thoroughly evaluated for potential use in the Lake Champlain basin.

**C.1 Secure Funding for and Implement the Lake Champlain Wetlands Acquisition Strategy** - The Acquisition Strategy is an excellent example of the targeted, prioritized approach outlined above. The merits of this public-private partnership are evidenced by the receipt of \$630,000 in first year funding from a nationally competitive federal grant program. While the program involves purchase of land from willing sellers, it is still important to examine and respond to the economic effects on particular communities of removing land from the tax rolls. In addition, there should be a periodic reassessment of the acquisition strategy that incorporates new information on the costs and benefits of additional wetlands acquisition with new ecological information about the relative value of particular wetlands.

**C.2 Expand Wetland Restoration Efforts in the Basin** - The critical economic issue that must be addressed in regard to this action item is whether limited public resources should be devoted to wetlands restoration or concentrated on acquiring and protecting functioning wetlands. Funds should be expended on wetlands restoration only if the benefits of these restored wetlands per dollar of expenditure are expected to exceed the benefits from wetland acquisition per dollar of expenditure. A targeted and prioritized approach is essential. Restoration funding should be directed to former wetlands that would provide the greatest benefit. In addition, restoration, acquisition and protection efforts must be combined into an integrated wetlands management strategy at both a basin-wide and river watershed scale.

**C.3 Develop Incentives to Protect, Restore and Enhance Wetlands** - See discussion of incentives and market mechanisms and comments on action item B.2 above.

**D.1 Promote Local Watershed Planning Efforts** - State and federal planning, acquisition and regulatory programs will not be effective without local cooperation and support. The advance planning and management project in the Chittendon County area should be evaluated as a pilot program for a watershed planning approach that integrates and streamlines federal, state, and local policies and programs.

**E.1 to E.3 - Demonstrate the Proper Size of Wetland Buffer Zones, Assess Impacts of Upland Land Use, Demonstrate Use of Constructed Wetlands for Treating Wastewater** - The results of these action items could provide valuable information with which to refine wetlands management programs. It is not clear, however, if one or two demonstration projects will provide the necessary information. It may be more appropriate to begin with a comprehensive literature review, since many studies on these topics have been conducted around the country, and the world. If this preliminary research indicates the need for and value of field studies in the Lake Champlain basin, demonstration projects could then be implemented.

**F.1 Implement a Wetland Education Strategy** - Given its relatively low cost and potential benefits this action item should be given high priority. Degradation and destruction of wetlands are incremental processes caused by numerous individual land use decisions. Many landowners will voluntarily take steps to restore and protect wetlands if they are provided with appropriate information on how to do so.

There is currently significant debate about wetlands policy, at least at the federal level. The debate includes how to define wetlands for regulatory purposes, and which regulatory policies and protection programs are appropriate given this definition. More fundamentally, the debate is about property values. Are wetlands and the ecosystem services they provide a public resource which private landowners should be obligated to protect, or are they private property for which the public should compensate the landowner if development options are limited through regulation? In the midst of this controversy there are at least two points of general agreement. First, all parties to the debate seem to agree that the confusing and duplicative mix of current wetlands regulatory programs and responsibilities unnecessarily increases costs and creates uncertainty for landowners and developers. Second, there is broad agreement that certain types of wetlands provide very substantial public benefits and should be protected. Building upon these areas of agreement and the impressive degree of public/private and intergovernmental cooperation already underway within the basin, the Lake Champlain Basin Program has an opportunity to fashion an integrated set of regulation, acquisition programs, and economic incentives that strike an appropriate balance between public benefits and private costs.



## **7. Action Plan for Managing Non-Native Nuisance Aquatic Plants and Animals**

### **7.1 Introduction**

Nuisance aquatics cause recreational use problems that can be clearly linked to economic impacts. As pointed out in the draft Plan, "attacks by adult sea lamprey on salmon, lake trout, and other fish species have limited full development of a Lake Champlain fishery, and restricted recreational and associated economic opportunities" (Lake Champlain Basin Program 1994: Nuisance Aquatics p.3). The successful, cooperative program to combat sea lamprey on Lake Champlain, including joint efforts by federal agencies, New York State, and Vermont, is illustrative of the type of cooperative remediation efforts among Vermont, New York, and Quebec recommended in many other sections of the draft Plan.

In addition to the past and on-going economic and environmental problems resulting from sea lamprey and non-native aquatic plants, the zebra mussel is now inhabiting Lake Champlain waters and its economic impacts are already being felt by drinking water suppliers, lakeshore homeowners, and boaters. Recent findings and estimates of the potential economic impacts of the zebra mussel on Lake Champlain businesses and communities are outlined in the following section.

### **7.2 The Economic Impacts of Zebra Mussels**

When the Lake Champlain Management Conference began its work in 1990, zebra mussels were just becoming a problem in the Great Lakes, and had not yet made their way into Lake Champlain. By the time the draft Plan went to press in 1994, zebra mussels were spreading out from the south end of the lake, and were found as far north as Crown Point. Now, only a year later in the fall of 1995, zebra mussels or their microscopic immature form (i.e., veligers) have been found in virtually every part of the lake.

Since zebra mussels have been in the Great Lakes for almost eight years, it is instructive to study the impacts on communities in that region. The following brief description of the economic impacts of zebra mussels was recently posted on the Great Lakes Consortium's (GLC) World Wide Web (WWW) site:

Zebra mussels clog water-intake systems of power plants and water treatment facilities, and the cooling systems of boat engines. The financial costs of this invasion are high, with municipal and industrial water facilities and Great Lakes recreation suffering millions of dollars in damage. The cost of the zebra mussel invasion for Great Lakes water users could go as high as \$5 billion over the next decade, according to scientists (Great Lakes Consortium, World Wide Web site text, October 1995).

The Great Lakes Consortium also provides the following summary of diversity of environmental impacts attributable to zebra mussels:

Environmental effects of the zebra mussel are significant. The mollusk is a filter feeder, removing tiny organisms from the water column at a rate of about a liter per day. Since the invasion, water clarity in Lake Erie has increased almost sixfold, allowing rooted aquatic plants to flourish and clog harbors. Certain microscopic plants and animals at the base of the aquatic food chain have been reduced by up to 80 percent in some areas.

Data also suggest that the zebra mussels' fatty tissues allow them to accumulate toxic chemicals at levels 10 times higher than native mussels. When eaten, the mussel passes on the contaminants to fish and other organisms. In addition, they have severely reduced, and may eliminate native mussel species.

Female zebra mussels can produce as many as 1 million eggs per year. These develop into microscopic, free-swimming larvae (called veligers) that quickly begin to form shells. At about three weeks, the sand grain-sized larvae start to settle and attach to any firm surface using byssal thread. They will cover rock, gravel, metal, rubber, wood, crayfish, native mussels and each other.

Zebra mussels filter plankton from the surrounding water. Each mussel can filter about one quart of lake water per day. However, not all of what they remove is eaten. What they do not eat is combined with mucus as pseudofeces and discharged onto the lake bottom where it accumulates. This material may benefit bottom feeders while reducing the plankton food chain for upper water species (Great Lakes Consortium, World Wide Web site text, October 1995).

Since that original 10 year, \$5 billion dollar price tag was first estimated, the cost estimates have been revised downward as more information becomes available. One researcher who has been studying the economic impacts estimates that the 10 year cost will be in the range of \$2 to \$3 billion. A significant portion of the original estimate -- \$2 billion -- was the estimated impact on fisheries, however, none have been documented (personal communication: Chuck O'Neil, NY Sea Grant Zebra Mussel Clearing House at SUNY Brockport, November 1995).

According to a group of leading researchers on the socio-economic impacts of zebra mussels, the costs imposed by the zebra mussel were greatly reduced because a variety of research organizations (e.g., Sea Grant, Fish and Wildlife Service, Great Lakes Environmental Research Laboratory, the Great Lakes Commission) collaborated in a research and outreach effort around core issues. The Ohio State researchers go on to state that:

One particular focus is on the costs of reducing or eliminating chlorine as a control agent, especially to power plants. Chlorine is the least-cost control strategy for most facilities and its use has increased substantially in the Great Lakes because of the zebra mussel. Chlorine, however, is being considered for phase-out because of the negative impacts it has to the environment. If chlorine is eliminated as a control option for power plants, then the next least-cost alternative could double or triple control costs... With or without a chlorine use restriction, the development of more environmentally friendly control strategies that are cost competitive with chlorine will generate benefits through a higher quality environment (Hushak et al. 1995:4).

This concern over the use of chlorine and the economic implications may or may not be an issue on Lake Champlain in terms of water supply systems.

A survey of water users in 18 states is now in progress concerning their experience with the zebra mussel. Preliminary findings are that there have been \$68 million worth of impacts to date, including impacts to water treatment plants, nuclear power plants, and locks and dams. That is with about 50% of the water users responding, and only about 50% of those having had zebra mussel impacts at this time. About 82 drinking water facilities have responded so far, and they have spent about \$20.3 million since 1989. Of those who have experienced impacts, some have spent as little as \$1,000 on monitoring zebra mussels, while others have spent \$1 million or more (e.g., New York City, Rochester, New York) (personal communication: Chuck O'Neil).

It is difficult, if not meaningless at this point to estimate an average cost per water treatment plant. The survey data includes treatment plants as varied in size as New York City, Chicago, and North Hero, Vermont. Cost depends greatly on the capacity of the pipes, but also relates to the capacity of the plant, and the average amount of water treated per day. The physical structure of the plant and pipes are also major factors, with distance to the water source and the amount of bends in the pipe affecting the cost of zebra mussel control. One plant that serves about 30,000 people spent approximately \$25,000 for a retro-fit, but that was using in-house labor, and does not include annual maintenance costs (personal communication: Chuck O'Neil).

By comparison, the Town of Willsboro NY has been studying the possible impacts of zebra mussels on their community water system for two years. They serve about 1,600 people and have an intake pipe that extends 2,500 feet into the lake. They recently budgeted \$60,000 to address the problem using a chlorine infuser. The necessary work has an estimated cost of \$120,000, however they anticipate cost savings by doing some of work themselves (personal communication, Teresa Sayward, Town of Willsboro, October 1995).

Meanwhile, a Lake Champlain, Vermont Coalition of Water Suppliers has been intently studying the economic impacts of zebra mussels on their eleven water suppliers. Presently, they are estimating a total of \$1.6 million dollars in capital costs for those eleven facilities. Cost estimates per facility range from \$60,000 to \$334,000. At least three systems now have chlorination control in operation (personal communication: John Coate, Champlain Water District, October 1995).

Water users other than the water treatment plants will be affected around Lake Champlain. For example, private homeowners who draw water from the lake will also have to address the possibility of zebra mussels in their pipes. As shown in Table 7-1, Lake Champlain is the source of drinking water for approximately 60,000 households (156,426 people), with 55,015 households receiving their water through community drinking water systems, and an estimated 5,149 households drawing drinking water directly from the lake. Zebra mussels will affect each of these households directly or indirectly. For those households on community systems, they will likely see an increase in their bill reflecting the costs of deterring or removing zebra mussels from in-take pipes. Households that draw drinking water from the lake through personal systems will have direct costs related to keeping their water pipe clear of zebra mussels, with an estimated initial cost of \$300 to \$1,500 (John Choate, Champlain Water District, personal communication October 1995).

In addition to drinking water users, other users who withdraw Lake Champlain water will incur costs. For example, there are marinas, beaches, campgrounds and other commercial establishments on the Lake that may draw Lake Champlain water for washing, toilets, etc., and they will incur costs to keep those pipes clear of zebra mussels. Other water users impacted by zebra mussels will include fire departments that either draw water directly from the lake in the case of an emergency, or who rely at times on "dry" fire hydrants that are essentially a conduit for drawing water from an adjacent surface water source. There is at least one report of a building being lost to fire because zebra mussels clogged the dry hydrant pipe (personal communication: Chuck O'Neil). Lower costs are associated with zebra mussel control for all those types of small diameter water withdrawal pipes.



One of the larger, industrial-type users of Lake Champlain water is the Vermont fish hatchery on Grand Isle. Costs to prevent zebra mussels from affecting that operation could reportedly reach \$2 million or more. Information on the reliance of other large industrial users of Lake Champlain water was not compiled for this report.

Another major impact category related to zebra mussels is the area of recreational impacts. Results from initial studies on the recreational impacts of zebra mussels became available in 1994, and additional study is underway. A 1991 survey of individuals living in the vicinity of Lake Erie concluded:

**Table 7-1: Revised Estimate of the Number of the People Relying on Lake Champlain for Drinking Water**

Community (Public & Private) Drinking Water Systems Drawing Lake Champlain Water				Total Population Drawing Lake Champlain Drinking Water
	<u>Vermont</u>	<u>New York</u>	<u>Total</u>	
Number of Private Systems	6	2	8	
Number of Municipal Systems	25	3	28	
Number of People Served	137,803	5,236	143,039	143,039
Number of Households Served (@ 2.6 persons)	53,001	2,014	55,015	

Source: Personal communications: Bill Amberman, NY Health Department, Saranac Lake District Office, August 1992; Rita Mitchell, Clinton County Health Dept, September 1992; Susan Mitchell, Vermont Water Supply Division, August 1992; John Choate, Champlain Water District, October 1995. Holmes & Associates, 1995.

**Private Housing Units Individually Drawing Drinking Water from Lake Champlain**

	<u>Vermont</u>	<u>New York</u>	<u>Total</u>	
Housing Units in Shoreland Towns	53,238	37,035	90,273	
Percent Possibly Relying on Surface Water*	7.4%	7.9%		
House Units Possibly Drawing Surface Water	3,940	2,926	6,865	
Estimate of % drawing Lake Champlain Water	75%	75%		
Housing Units Drawing Lake Champlain Water	2,955	2,194	5,149	
Number of People in the Housing Units (@2.6)	7,682	5,705	13,387	13,387

\* Those households not on a public or private company system, and not using a well (1990 Census).

Not all housing units are occupied, so the number of housing units exceeds # of households.

In 1990, there were 77,665 households in shoreland towns.

Note that Quebec data was unavailable and would add additional households to the total.

Source: 1990 Census; Holmes & Associates estimates.

Holmes & Associates, 1995.

**156,426**

Despite its beneficial impact as a water filter, the zebra mussel is negatively perceived by a large number of respondents who had knowledge about the mussel's impact on water-based activities. However, it appears that few visitors have changed their visits to the lake in response to perceived lower quality of activities or have incurred increased recreational costs (Vilaplana and Hushak 1994:9).

In terms of recreational related expenditures related to zebra mussels, the Lake Erie research found that 13% of 109 responding boat owners reported expenditures for protective paints, with

an average cost of \$94. Four percent reported additional boat maintenance at an average cost of \$171, 3% reported increased insurance costs averaging \$207, and one respondent reported \$50 in boat motor damages directly attributable to the zebra mussel (Vilaplana and Hushak 1994:8).

A similar survey of Lake Erie region residents was carried out in 1992 and 1993. The general findings were similar to that in the 1991 study. According to the authors, the impact of the zebra mussel "on water related activities is less than expected and probably is not affecting the number of trips taken to the lake..." (Vilaplana and Hushak 1995:14). The authors do add a cautionary note on these fairly optimistic findings. "It is possible to argue that all those visitors who were negatively affected by the mussel have already stopped visiting Lake Erie, suggesting a dynamic process that weeds out unhappy visitors that was not captured by our data" (Vilaplana and Hushak 1995:14). Beach pollution seems to be one of the factors related to zebra mussels' influence on peoples' enjoyment of the lake.

In addition to some increased costs related to boating, the impacts of zebra mussels on recreational boaters require behavioral changes, such as storing their boat out of the water, painting or aggressively cleaning the bottom, and flushing the motor. Other costs of zebra mussels relate to beach clean-up when large quantities of zebra mussels wash up on shore. The mussels have to be dumped in a land fill, so tipping fees and hauling costs, as well as labor, are all economic concerns.

There are mixed blessings related to zebra mussels and underwater historic resources. On one hand, the zebra mussel has contributed to a significant increase in water clarity in some lakes. Parts of Lake Erie went from four foot visibility to 40 feet. This can be a boon to the dive industry in terms of increased visibility and enjoyment of ship wrecks on the bottom of the lake. Unfortunately, zebra mussels are attracted to any hard surface, and will readily attach themselves to the wrecks. Some of the historic resources at the bottom of Lake Champlain are already being covered by zebra mussels. In addition, there is a danger that the weight of accumulating mussels will collapse the wooden vessels on the bottom of the lake. Art Cohn, of Champlain Maritime Museum, predicts that shipwrecks in 80 ft of water or less will be covered by zebra mussels. A detailed report on the overall impacts on underwater historic resources in Lake Champlain is in currently in progress (personal communication: Art Cohn, November 1995).

In summary, individuals who are researching the economic impacts of zebra mussels report a variety of impact categories, as listed in Table 7-2. Impacts range from quantifiable economic impacts on water suppliers and other businesses and individuals drawing Lake Champlain water, to uncertain, potentially ruinous impacts to underwater historic resources. Ecological impacts will also occur in Lake Champlain, with primary impacts on the native freshwater mussel species present in the lake. The zebra mussel could result in at least one positive impact, that of increase water clarity in some sections of the lake.

## **7.3 A. Implementing a Comprehensive Management Program**

These five actions in the draft Plan recommend a comprehensive management program for nuisance aquatics in the basin, and associated control programs targeted on specific species. The Comprehensive Management Program (A.1) has unknown costs, while the specific program costs are estimated as follows:

- A.2. Sea Lamprey Control - \$355,000 per year
- A.3. Zebra Mussel Monitoring - \$50,000.

**Table 7-2: Preliminary Cost Estimate of Zebra Mussels on Lake Champlain**

Category	Type of Impact	Number Affected	Average Capital Cost, Each	Total Cost (Range)
<b>Lake Champlain Drinking Water Systems</b>				
Community Drinking Water Systems	Clogged pipes	36	\$39,000 - \$272,170	\$1,404,000 to \$9,798,120
Household Drinking Water Systems	Clogged pipes	5149	\$300 - \$3,000	\$1,544,700 to \$15,447,000
<b>Other Lake Water Users</b>				
Fish Hatcheries	Clogged pipes; transfer of contaminated water to other lakes	1		
Lakeshore Businesses (marinas, campgrounds, etc.) drawing water for cleaning, washing, etc. (est. 50% affected)	Clogged pipes	214	\$300 - \$1,500	\$64,200 to \$321,000
Fire Departments	Clogged pipes			
<b>Recreational Impacts</b>				
Boats or motors	Need for cleaning and/or storage out of water; fouled engines	12,000+		
Beaches	Need for cleaning; disposal of mussels	64		
Fishing	Uncertain			
<b>Cultural Impacts</b>				
Underwater shipwrecks	Covered w/mussels; possibly destroyed			
<b>Ecological</b>				
Fresh water mussels	High mortality in some areas			
<b>Preliminary Cost Estimate of Zebra Mussels</b>				<b>\$3,012,900 to \$25,566,120</b>

Source: Holmes & Associates, 1995.

A.4. Include Nuisance Species in other Monitoring Programs - \$25,000.

A.5. Enforce Laws on Transporting Nuisance Species - in-kind.

One way to examine the cost effectiveness of the various recommendations is to look at past program costs and evaluate their effectiveness. For example, the sea lamprey control program

has cost approximately \$500,000 per year for the past five years, and appears to be effective in addressing the problem. The final economic impact analysis for the program, expected in 1996, will evaluate the program's overall cost effectiveness.

Although not directly recommended in this action, the monitoring and possible control of water chestnut is implied in A.1 and A.4. Between 1982 and 1990, a total of \$1.7 million has been spent by Vermont, the State of New York, and the Army Corps of Engineers on water chestnut control. The average annual expenditure during that period was approximately \$177,000. However, since 1991, the average annual expenditure has dropped to \$74,000 (Bove 1995). It appears that federal funds are not being fully utilized because the necessary state matching funds have not been allocated.

According to a recent report on the water chestnut control program, a mid-season survey in 1994 by VTDEC biologists revealed that "the water chestnut infestation has grown considerably since the last Vermont harvest year of 1991." (Bove 1995:2). In addition, three new infestation sites were discovered during the survey, including one large site north of Ticonderoga NY. The documented increase in water chestnut was collaborated by the observations of a marina owner participating in first economic focus group session.

In summary, it appears that the water chestnut program is possibly underfunded, and under-represented in the this section of the draft Plan. Similarly, as pointed out in the prior section, the zebra mussel monitoring effort and budget should be increased and modified to included an education and outreach effort.

## **7.4 B. Improving the Information Base**

These five actions involve approximately \$200,000 of annual, long-term expenditures on monitoring, surveying, cataloging, and otherwise understanding the biology, introduction, and spread of nuisance aquatics in Lake Champlain. These activities appear to be important and cost effective given the actual and apparent adverse economic impacts related to sea lamprey, zebra mussels, and water chestnut, to name only three of the nuisance aquatics.

This type of activity is especially important in terms of cooperation and coordination among NY, VT, and Quebec, and therein lies its primary value. As pointed out in the economic considerations in the Plan, the value of information is quite high for nuisance aquatics, and it is important to have the flexibility to generate and incorporate new information as it become available. This remains true at this stage of the planning effort, with flexibility becoming a key consideration in the Lake Champlain planning process.

While the value of information is considered high, the cost effectiveness of the proposed actions will need to be evaluated in terms of who is going to benefit from this information and how. Nuisance aquatics have a number of potential impacts, including biological, recreational, water use, etc., and the appropriate action should vary accordingly, from eradication in the case of sea lamprey, to control as is often the case for water chestnut, to tolerance and adaptation on the part of lake users as in the case for zebra mussels.

There needs to be a vehicle set in place to link the information compiled in this action, and the decision on when, where, what type, and how much effort is going to be devoted to a particular nuisance problem. All of these actions are difficult to assess economically without illuminating the links between a defined problem and the resulting information gathering, monitoring, and action. The sea lamprey eradication program provides an example of an aggressive and expensive effort to address one nuisance problem. Efforts seem to be most cost effective when the program is directed for a specific purpose, as in this case, to control the sea lamprey in order to improve sport fishing, among other benefits.

Item B.4, Continuing Volunteer Monitoring, is especially cost effective as it relies on volunteers. These types of programs serve a dual purpose of getting the work done, while educating the public in the process.

## **7.5 C. Evaluating and Demonstrating New and Existing Control Technologies**

The types of programs described in the five individual actions are of interest to both Vermont and New York, and are already underway to some degree around the lake. A key economic aspect

contributing to their cost effectiveness is that they continue to expand their cooperative programs with a great deal of exchange of information and findings.

The cost effectiveness of these actions could also be enhanced by increased use of private and public partnerships, in two ways. First, it would seem that a majority of the new control strategies, devices, barriers, and control techniques are being developed and produced in the private sector. The manufacturers should be included as potential funding sources, in terms of discounts or in-kind contributions of goods and services. Second, these control strategies are being proposed in most cases because they have an actual or perceived economic impact on businesses or recreationists who rely on the lake. Developing, installing, and evaluating control strategies which are cost effective, thus successful, can only be so if they answer the concerns and needs of businesses, communities, sportsmen groups, and lake and watershed associations.

## **7.6 D. Expanding Public Education Efforts**

The one action item addresses a number of aspects of a public education effort, including coordinated responses to inquiries, continuing to develop and distribute information, conducting public workshops, and building educational partnerships. At a proposed annual cost of \$50,000, the benefits of this action appears to exceed costs. This is especially true since in many cases the management goal will be to control the nuisance, rather than eradicate it, therefore the public has key role in preventing the spread of the nuisance. Since the program includes a number of the main nuisances, this will be a cost effective way to get the information out to a broad cross-section of lake users, including those that fish, boat, swim, and draw water from the lake.

## 8. Action Plan for Protecting Cultural Heritage Resources

### 8.1 Introduction

The draft Plan contains a description of the economic benefit of historic sites in the Lake Champlain basin, summarized as follows:

- **The major historic sites in the basin generate millions of dollars annually in the basin economy.** Those sites are listed among the major employers in the areas where they are located. In addition, numerous small homesteads and museums scattered throughout the basin help stimulate small, local economies by providing an enjoyable activity to both visitors and residents. Additional evidence of the economic value of cultural heritage sites is the significant effort being invested in developing new museums and interpretive efforts around the basin. Community leaders are recognizing that historic districts, interpretive walking tours, museums, and many other approaches for displaying an area's history and culture have a direct economic impact on their communities.
- **The protection of cultural heritage resources is economically linked directly and indirectly to the pollution prevention and restoration efforts proposed in the Plan.** As specific areas are targeted for clean-up, and as others benefit indirectly from a cleaner Lake, lakeshore communities will begin to see economic opportunities in capitalizing on what the Lake and shoreline have to offer, both as recreation and transportation resources, and as cultural and historic resources.
- **As discussed throughout this section of the Plan, cultural heritage resources have non-monetary benefits to a community and a region.** These resources serve to link people to their community by providing the recognition of continuity to human activities in the area. This sense of place is a main ingredient for community spirit and the development of communities where people lead satisfying lives working together. The educational value of these resources is also difficult to quantify monetarily, even though the enjoyment and learning offered by the cultural and historic sites to thousands of school children is obvious and significant.
- **The costs associated with protecting, maintaining, and operating cultural heritage sites seldom fall entirely within the public sector.** Many of the efforts are partnerships between the public and private sectors, where foundation grants and private donations traditionally provide a significant portion of the necessary funding. Significantly, user fees (i.e., cost of admission) are more common and accepted with visits to cultural heritage sites, than perhaps with any other type of recreational activity. In that sense, cultural heritage sites tend to "pay their own way" to a greater extent than other recreation areas, and will undoubtedly continue to do so.
- **The costs associated with not protecting and maintaining cultural heritage resources should be factored in to the economic considerations.** Ships from the Revolutionary War period will never again sail -- or sink -- in Lake Champlain; we will not see a 200 year-old homestead of a writer or statesman for at least another 200 years; nor will traditional logging

or mining equipment -- both closely linked to the history of the lake -- again be manufactured. These are only a few of the valuable, some would say priceless, economic resources embodied by the phrase "cultural heritage resources."

A recent report on the economics of historic preservation defines historic preservation as:

*The careful management of a community's historic resources; avoidance of wasted resources by careful planning and use; the thrifty use of those resources. To use or manage those historic resources with thrift or prudence; to avoid their waste or needless expenditure; to reduce expenses through the use of those historic resources (Rypkema 1994).*

As defined, the essence of historic preservation is economizing and avoiding waste. In addition to being fiscally responsible, the benefits of historic preservation and protecting cultural heritage include improved quality of life, increased sense of community, and improved economies due to tourism expenditures.

With all these positive economic impacts, and the relatively low cost of the proposed actions, the majority of recommendations in this section of the Plan would appear to be cost effective. There are obvious links between the lake and the cultural history of the region, the most significant being the lake's strategic importance as military and commercial waterway. Similarly, there is a genuine relationship between the lake's water quality and the cultural resources of the area.

The most direct relationship in that regard is that between submerged cultural heritage resources and water quality. In the case of Lake Champlain, there are numerous shipwrecks on the bottom of the lake. The study, enjoyment, and economic potential of those sites is undermined by water quality and lake management problems, including water clarity, siltation, vandalism, and now zebra mussels. The tourism potential of submerged cultural heritage resources is discussed in the next section.

The relationship between water quality and cultural resources is also evident in the current historic waterfront enhancements and historic district development in the basin. Burlington's waterfront development is an obvious success, and now both Clinton and Essex counties in New York are continuing waterfront development projects that would not be possible had the lake quality not improved over the last half-century. All of those waterfront activities feature historic sites as important components. Fort Ticonderoga, Crown Point, the historic military buildings at Plattsburgh, and historic buildings at Burlington, Vergennes, and White Hall, to name only a few locations, were built because of the strategic location of the lake. Now with the Lake Champlain planning effort, and the potential implementation of activities to improve the lake's water quality, it is likely that those locations will begin to see increased interest and use.

For example, the Plattsburgh and Clinton County Chamber of Commerce is developing a new promotional campaign focused on the Lake Champlain area of Clinton County, and is prominently featuring historic sites on a map of the area. Meanwhile, as evidence of the steady interest in historic sites in Vermont, a recent summary of the 1994 visitation levels found that while all eight travel activities measured experienced a decline as compared to the previous year, visits to historic sites remained relatively stable. Annual attendance at historic sites declined by less than 1% between 1993 and 1994, while attendance at state parks declined by 9% (Vermont Department of Employment and Training 1995:24).

Cultural resources in the basin, especially those on the lakeshore, remain closely linked to Lake Champlain. By recommending actions related to these locally valuable resources, the Plan helps to clarify the government's role as a catalyst in protecting and promoting cultural resources. The

relatively low cost of many of the recommendations in this chapter, as compared to other chapters in the draft Plan, provides some indication of their cost effectiveness. In addition, the low cost reflects the fact that cultural resources by and large pay their own way, traditionally relying on user fees and private sector grants to cover the expense of facility development, operation, and maintenance.

## **8.2 Economic Benefit of Submerged Cultural Heritage Resources**

In 1977, a Michigan State University professor began studying and promoting the concept of an underwater preserve for shipwrecks in the Michigan waters of the Great Lakes. In 1981, the first underwater preserve was established -- the Alger Bottomland Preserve in the Munising area -- containing ten known wrecks. By 1984 an estimated 6,000 divers were visiting the Alger Preserve, up from 1,600 in 1980. SCUBA divers and associated tourists spent approximately \$3.5 million in the community during the 1984 season (Kinnunen et al. 1985:80). Since 1981, a total of ten preserves have been created on Lake Michigan, and other underwater shipwreck preserves have been created on Lake Huron and Lake Superior. Because the number and variety of preserves has increased so dramatically, and with many of them located nearer to large urban areas, the fairly remote Alger site has experienced a leveling of visitation at about 2,000 divers a year (personal communication: Peter Lindquist, Grand Island Charters MI, October 1995).

Throughout the Great Lakes region diving and underwater tourism activities continue to grow. According to a Michigan State University Sea Grant agent, diving to shipwrecks in the Great Lakes continues to experience increased participation each year (personal communication: Ronald Kinnunen, Michigan State University Extension, October 1995). Even the remote sites on Lake Superior that were explored by only a few divers a year prior to receiving underwater preserve status, now are visited by 1,000 or more divers annually. Diversity in underwater tourism also is occurring. For example, a charter service on a remote section of Lake Michigan recently added a glass-bottom boat service, serving 3,500 customers the first year while operating only on weekdays (personal communication: Peter Lindquist, October 1995).

A 1986 survey of Great Lakes divers found a number of interesting characteristics, providing strong indication of the economic opportunity for diving to submerged cultural heritage resources in Lake Champlain. For example, the average diver took 6 trips in 1986, while participating in 31 individual dives. Each diver had an average investment of \$2,500 in their diving gear, and spent an average of \$141 per person, per trip while in the vicinity of the underwater preserve. Total trip expenditures were \$245. Of their local expenditures, 12% were for dive shop services, 12% were charter fees, 8% were boat related expenditures, and 3% were in marina fees and boat rentals. So at least 35% of the \$141, or \$49, was in direct lake-related expenditures. The remaining \$92 was spent in the vicinity of the lake area (Peterson et al. 1987b).

Among the more crucial attributes influencing the selection of a diving location by divers in the Great Lakes were: dive shop services, information about diving sites, availability of diving charters, quality of shipwrecks, and well marked diving sites (Peterson et al. 1987b). Close to 60% of first time divers and 46% of seasoned divers prefer to use charter diving services. About two-thirds of Great Lakes divers participate in the activity in July or August (Peterson et al. 1987a). These findings seem to indicate that there is significant economic opportunity in an expanded underwater preserve system on Lake Champlain, especially if promotion and services are expanded concurrently.



A recent study of divers who visited Lake Champlain found that their average trip expenditures while at Lake Champlain were \$209, with divers having average daily expenditures of \$110 per person. An additional \$100 was spent in preparation for the trip and while in transit. Of the \$209 spent in the vicinity of Lake Champlain, 43%, or \$90, was in direct lake-related expenditures for diving rentals, boat supplies, launching fees, etc. The most popular diving areas appear to be in the vicinity of Plattsburgh and Willsboro, NY and Burlington, VT. Three quarters of respondents indicated that they dive at designated Vermont underwater historic preserve sites on Lake Champlain, and that the average diver visited those sites about 5 times per year. A majority of divers indicated the need for more diving sites, and indicated a willingness to pay an average of \$5 per dive for the development and maintenance of underwater sites (Dziekan 1994). With diving trips already generating over \$200 per trip in local expenditures on Lake Champlain, and given the success of diving tourism in the Great Lakes, there appears to be economic opportunity related to diving to cultural resources in Lake Champlain. Establishment and promotion of additional dive sites will lead to related business growth in charters, dive shops, and other services that will further enhance the economic return in local communities around the lake.

As discussed in Nuisance Aquatics chapter in this report (Section 7.2), zebra mussels may contribute to water clarity and thereby enhance the diving industry on Lake Champlain. However, zebra mussels are already attaching themselves to the shipwrecks, and will continue to do so. Since many of the Lake Champlain dive sites are wooden boats, it is possible that the massing of zebra mussels on shipwrecks could collapse and destroy many of the cultural resources that divers want to see. That is a problem that has not been researched extensively on the Great Lakes because many of the popular dive sites there are metal shipwrecks. A research report on the impacts of zebra mussels on submerged cultural resources in Lake Champlain was in progress at the time of this reporting (personal communication, Art Cohn, November 1995).

## **8.3 Implications for Individual Action Items**

### **8.3.1 A. Raising Recognition and Appreciation of Cultural Resources**

- A.1 Develop and Promote a Network of Heritage Trails and Programs** - The \$25,000 annual expenditure appears to be cost effective for the potential return in tourist expenditures. Vacations are shorter, and interest in historic sites is high, so efforts to package and promote sites regionally should pay high dividends. One immediate benefit would be increased opportunity in expanding use of historic sites beyond the short summer season.
- A.2 Develop Public Education Materials** - The educational value of this \$50,000 annual expenditure would be enhanced with considerable local participation by historic societies, museums, etc. The smaller, local historic sites especially are in need of expertise and financial assistance to protect and display their historic materials. In addition, networking, cooperative promotion, and linked displays will enhance economic opportunities for all. This action might be better directed as a competitive grant program to local institutions, with in-kind assistance by state agencies and larger museums. As recommended, local schools could be integrated into the process.
- A.3 Develop an Integrated Visitor Information Distribution System** - This item links closely to A1, enhancing the promotion of historic sites and activities. A promotional effort focused on historic sites and activities would seem especially appropriate as a demonstration project for a year or two. At that time, if the effort is worthy, the private sector would pick up the project, funding the promotional materials through advertising and donations.

### **8.3.2 B. Strengthening Current Management and Protection Programs**

- B.1 Develop a Stewardship Program** - The focus on voluntary historic resource protection through education and technical assistance should enhance considerably the cost effectiveness of this program. The \$100,000 and staff time will be devoted to assisting land owners, rather than enforcing regulations.
- B.2 Develop and Implement Cultural Heritage Resource Management Plans** - It is difficult to assess the value of management plans, without knowing the problems at particular sites of concern. This item appears to overlap with B3 in terms of underwater sites, and as pointed out in the Plan, would link to activities in C1 and C2. A more cost effective use of the \$100,000 would be to carry out C1, then apply the guidelines in a basin wide management plan for all sites of concern, outlining B2 a.-f. (see draft Plan) for each site of concern. Following from that basin wide assessment of historic sites, could be more in-depth plans of the type envisioned in B2 for the sites with major problems. Underwater sites should be addressed separately, under B3.
- B.3 Develop and Implement a Management Strategy for Lake Champlain's Underwater Historic Resources** - This appears to be an especially pressing item, with high cost attached to a "no action" option. Not only are the underwater sites not understood enough to promote them to the public and thereby enhance local economies, the lack of knowledge and monitoring is contributing to their deterioration through vandalism, zebra mussels, and water quality problems. The information learned from this \$150,000 year-long effort will permit better protection of the sites, while contributing directly to promotional activities to enhance their tourism potential. With diving trips already generating over \$200 per trip in local expenditures on Lake Champlain, it is feasible to expect the 750 additional annual diving trips necessary to justify this activity. With an increase in use, the related business growth in charters, dive shops, and other services will further enhance the economic return in local communities around the lake.
- B.4 Protect Lake Champlain's Historic Shipwrecks from Zebra Mussels** - As a \$10,000 pilot project, this is undoubtedly a good investment. Given the uncertainty surrounding the spread and impacts of zebra mussels in Lake Champlain, it is a wise investment to monitor the impacts closely and to stay abreast of recent findings from other areas.
- B.5 Review and Revise Protective Legislation for Cultural Heritage Resources** - This in-kind activity is worthy of support because of its focus on improving the regulatory process. It will likely be carried out in conjunction with many of the actions in this chapter, including B1, B2, B3, C1, and C2.

### **8.3.3 C. Improving Cultural Resource Planning**

- C.1 Develop and Apply Uniform Guidelines** - This in-kind activity will help to ensure that subsequent planning and protection activities are efficient and cost effective.
- C.2 Involve the Public and Constituent Groups** - Public involvement is key to the success of most of the other actions in this chapter, and has been found to be of keen interest among citizens in the basin. As discussed in the Economic Focus Group (session 2), many of the individuals and groups most affected are least able to attend public meetings. Therefore adequate funding is necessary to do the public outreach that will help to involve those peo-

ple. The estimated \$5,000 may be insufficient to the task unless staff are available to assist in public outreach and public participation.

### **8.3.4 D. Expanding Economic Opportunities of Cultural Resources**

- D1. Demonstrate Links between Cultural Resources and Economic Development** - Research on Lake Champlain users, especially historic site users, does seem to be limited or out of date. This is an ideal partnership activity. Most of the larger historic sites in the basin do some type of periodic on-site visitor survey. Funding from government and other sources could be used in combination with assistance from university researchers and students, who would standardize survey instruments and ensure that the research methods meet scientific standards. Once developed, the survey work could be applied at the smaller sites.
- D2. Link Cultural Heritage into Existing Recreation/Tourism Marketing Programs** - This is an excellent demonstration of a partnership effort between business and government. Visits to cultural heritage sites is one of the fastest growing forms of tourism. As a result, there is greater urgency in the need to stay abreast of current tourism research in order to promote the area effectively to the growing and changing clientele. There is significant expertise in historic preservation in both VT and NY state departments. Linking that contemporary expertise to the diverse, although connected, historic sites throughout the basin creates a win / win situation for local economies and historic preservation.
- D3. Encourage Local Efforts to Coordinate Heritage and Economic Development Projects** - As in D1 and D2, this effort focuses on applying historic preservation and promotion expertise to planning and development issues at local historic sites. The beneficiaries of this action are local communities.

### **8.3.5 E. Improving Cultural Resource Data, Regional Data Management and Information Access**

- E1. Create a Basin-wide Cultural Heritage Resource Data Base** - The data collection and database development activities under this item would occur in part within each of the other items in this chapter. Developing networks, educational materials, management plans, stewardship programs, guidelines, etc. all involve collecting and analyzing data. Therefore it is appropriate that this is an in-kind type of activity, however, it is important that a framework for the database and standardized methods of data collection be established before any of the other activities are undertaken. Some staff time and database expertise will be required to establish, maintain, and up-date the database. The importance of this database effort should not be underestimated because once in place, it is the vehicle for creating links between the objectives of this Action Plan and the many local historical and cultural initiatives taking place around the basin.

## **9. Economic Focus Group and Technical Advisory Committee Economic Discussion Sessions**

### **9.1 Introduction**

This second phase of the preliminary economic analysis required the study team to explore and document the economic arguments about the Plan being put forth by individuals and institutions around the basin. Specifically, the scope of work requires the study team to do the following two tasks:

(The study team) will conduct two meetings with an economic focus group, to include individuals or institutions advancing economic arguments in the public discourse process. ... (The study team) will summarize the economic argument, identify data needs to resolve questions which are raised, and refine or provide objective comment...

(The study team) will conduct two one day meetings including representatives of all Technical Advisory Committee (TAC) subcommittees...to review and revise cost estimates provided for the Plan. Revisions to the preliminary reports will include a discussion of this critique and any further information on the limitations of the cost estimates that result,...a spread sheet summarizing those areas that are in agreement across state lines and which compare and contrast economic impacts in each state,...(and) summarize relevant economic arguments and identify data needs to resolve questions that are raised.

It should be noted that the study team is focusing primarily on economic issues. While there are necessarily overlaps and considerations related to technical issues on how an action can be implemented, and political issues on who will implement an action and when, the study team is not attempting to address those important issues in as much detail as the economic issues.

The following section summarizes the main findings and economic arguments gathered from the economic focus group and the TAC meetings.

### **9.2 Economic Focus Group Sessions, Summary of Findings**

As requested, the study team organized and facilitated two economic focus group sessions, the first on July 17, 1995 at Clinton County College south of Plattsburgh, NY, and the other on September 8, at Champlain College in Burlington, VT. The sessions were designed as 3.5 hour morning sessions, to facilitate participation among the private sector. Twenty individuals attended the first session, and nine participated in the second. Six individuals attended both sessions, so a total of 23 individuals representing economic interests around the basin became involved in these formal discussions on the economic issues involved in the Lake Champlain planning effort. While

somewhat limited in the numbers, those in attendance represented a very wide cross-section of economic interests around the lake, including: marinas, the paper industry, City of Burlington, Plattsburgh Chamber of Commerce, local government, agriculture, forestry, recreation, banking, and watershed associations. Both meetings were attended by six staff, consultants, and resource persons, who answered questions and took notes.

The original list of invitees to the focus group session totaled 156 people residing and working around the basin. The individuals were recommended by a number of key contacts, including LCBP staff, TAC members, PFT members, economics sub-committee members, and the study team members themselves. Most of the individuals on the original list had either expressed economic concerns at previous basin Program meetings and public hearings, or were known to have a direct economic interest in the Plan recommendations. The emphasis in selecting individuals was on contacting people who were in the private and local government sectors of the economy, and who had not had much involvement with the Lake Champlain planning process up to this point. Of those 156 individuals originally contacted, 45 expressed interest in attending one or both of the economic discussion sessions. This group, listed in Table 9-1, became the core mailing list for the economic focus group sessions. They were each invited to both meetings, and all were sent typed summaries of both sessions.

Following are a brief synopsis from the two sessions. The complete session summaries are presented as Appendix A. and B.

### **9.2.1 Session 1**

The first session involved a certain degree of disagreement, and there was lively discussion on a number of basic economic issues, including the following:

1. **Disagreement on the use and interpretation of economic benefits of Plan items.** Some felt that the benefits have to be area specific and should not reflect the value of the lake to greater basin population, many of whom may not receive any direct economic benefit from the lake; while other felt that since this is a Plan for the future, a wide variety of possible present and future benefits should be considered. One aspect of the basin-wide benefits of a clean lake was expressed in terms of the lake as asset to local industry in attracting higher caliber employees.
2. **Disagreement on the allocation of costs.** Some felt that primary, secondary, and tertiary costs should be quantified for specific areas around the lake and that the estimated benefits should only be accounted for in relation to those specific areas. Others pointed out that recreational benefits of cleaner water could occur throughout the lake, so it will difficult to reconcile costs and benefits for a particular bay or other location on the lake.
3. **Concern expressed over the timing, budget, and time-frame for the economic analysis.** Can an accurate economic analysis be completed in the time allotted, can it be integrated into the planning process, and if it has errors, will there be time to correct them and to incorporate the corrections into the final plan? Concern expressed that the economic analysis to date is primarily a fiscal analysis. Some expressed the notion that many times decisions are made with little or no economic analysis, and that the economic analysis should focus on recommendations with obvious economic impact, making the timeframe and budget more realistic.

A related concern centered on the methodologies being used by the economics consultants, and what role cost-benefit analysis, risk assessment, discounting, and other research techniques should play in the analysis of each action item.

**Table 9-1: Economic Focus Group Mailing List**

First Name	Last	Company	Area	Phone	Position	Address	City	State	Zip
John	Andrus	Clinton Co. Health Dept	518	565-4840		133 Margaret	Plattsburgh	NY	12901
Mark	Barie	Cross Border Development	518	297-7741	President	1 Lincoln Blvd	Rouses Pt	NY	12979
Claire	Barnett	Lake Champlain Committee	518	962-4708	BA, MBA, NY Chair	South Main St	Westport	NY	12993
Randy	Beach	Adk Bank, Adk Builders Assoc	518	561-1816		PO Box 2632	Plattsburgh	NY	12901
Pennie	Beach	Basin Harbor Club	802	475-2545	President	Basin Harbor Rd	Verigennes	VT	05491
Phil	Benedict	VT Dept of Agriculture	802	828-2500	Director	120 State St	Montpelier	VT	05602
Dwight	Brown	New York Farm Bureau	518	436-8495		Rt 9 W, PO Box 992	Glenmont	NY	12077
Rod	Brown	Clinton City Planning Office	518	565-4709		137 Margaret St	Plattsburgh	NY	12901
Brude	Burgess	Bicycle Federation of America	802	388-2453	Assistant Director	Route 3, Box 2394	Middlebury	VT	05753
Greg	Campbell	Adirondack Park Agency	518	562-8496	Chairman	RR 1, Box 411	Keeseville	NY	12944
Jane	Campbell	VT Bus. for Social Resp	802	665-4300	Exec Director	PO Box 462	Burlington	VT	05402
William Boyd	Davies	Water Resources Bd	802	828-2871		58 E State St, Drawer 20	Montpelier	VT	05602
Robert	DiPalma	Lake Champlain Regional Cham of C	802	658-2311	Regional Affairs Comm Chair	1 Church St	Burlington	VT	05402
Bob	Dicky	Georgia Pacific	518	561-3500	Operations Manager	327 Margaret St	Plattsburgh	NY	12901
Garry	Douglas	Plattsburgh & Clinton City Cham of C	518	563-1000		PO Box 310	Plattsburgh	NY	12901
Herb	Durfee	Chittendon Regional Planning	802	658-3004		PO Box 108	Essex Junction	VT	05453
Steve	Dworsky	Village of Rouses Point	518	297-5502		139 Lake St	Rouses Pt	NY	12979
Frenta	Frenta	Georgia Pacific	518	561-3500	Environmental Specialist	327 Margaret St	Plattsburgh	NY	12901
Mo	Germain	The Moorings Marina	802	862-1407		PO Box 241	Colchester	VT	05446
Penrose	Jackson	Intervale Fnd, Lake Champlain CoFC	802	660-3501	w/Lake Cham Reg C of C	128 Intervale Rd	Burlington	VT	05401
Gary	Kjelleren	Lockhead Armament Systems	802	657-6876	Manager Env Health & Safety	Lakeside Ave	Burlington	VT	05401
Peter	Kreisel	Kreisel Segear & Co.	802	863-1641	CPA, VT Citizens Adv Comm	550 Hinesburg Rd, Suite 101	S. Burlington	VT	05403
Sandra	LaBarron	NYS DEC	518	623-3671	Adirondack Affairs	Hudson St Ext	Warrensburg	NY	12885
Greg	Lord	Central VT Chamber of Commerce	802	479-1013		PO Box 336	Barre	VT	05641
Melissa	McManus	Village of Champlain	518	298-4152		PO Box 1158	Champlain	VT	12919
Marcy	Neville	Essex Cty Econ Dev Zone	518	546-3606	Zone Coordinator	14 Park Place	Port Henry	NY	12974
Ron	Other	Lake Placid, Essex Cty Visitors Bur	518	597-4646	Director of Tourism	RR1, Box 220	Crown Pt	NY	12928
Bill	Paine	Green Mtn Dairy Farmers Coop	802	453-2691		330 East St	New Haven	VT	05472
Ron	Pote	International Paper Co.	518	585-5313	Env Health & Safety Manager	Shore Airport Rd	Ticonderoga	NY	12883
Harris	Quesnel	Lake Champlain Charter Boat Ass	802	878-2365	Secretary	13 Colvert St	Essex Junction	VT	05452
Doug	Robertson	VT Boat & Marina Assoc	802	864-0405	VT Marina Owners Assoc	336 Mallets Bay Ave	Colchester	VT	05446
Patrick	Robins	McAuliffe, Inc	802	658-9700	President	208 Flynn Ave, Box 848	Burlington	VT	05402-0848
John	Ruff	City of Plattsburgh	518	563-7730	Environmental Manager	City Hall	Plattsburgh	NY	12901
Patrick	Russel	Abbott, Frenyea, Russell & Coffey	518	561-7030		134 Boylton Ave	Plattsburgh	NY	12901
Anne	Ruzow-Holland	Friends of the North Country	518	834-9606	Exec Director	PO Box 446	Keeseville	NY	12944
William	Sayre	The A. Johnson Company	802	453-4884		Rt 116, Box 9000	Bristol	VT	05443
Teresa	Sayward	Town of Willsboro	518	963-8668	Supervisor		Willsboro	NY	12996
Bruce	Seifer	Community & Econ Dev Office	802	865-7179		City Hall	Burlington	VT	05401
Harvey	Smith	Addison Cty Farm Bureau	802	877-2712	President	Box 82A	New Haven	VT	05472
Linda	Sterns	Addison Chamber of Comm	802	388-7951		2 Court St	Middlebury	VT	05753
Barbara	Sweet	Essex Co. Ind Dev Corp	518	582-4835		Church St	Elizabethtown	NY	12932
Dick	Ullom	Chipman Point Marina	802	948-2288	Owner	RD 1, Box 109 B	Orwell	VT	05760
Robin	Umer	Boquet River Assc.	518	873-3688	Director	Essex Cty Gov Center	Elizabethtown	NY	12932
Jerry	Williams	Lake Champlain Transportation	802	864-9804	Pres	King St. Dock	Burlington	VT	05401

A portion of the session was devoted to **identifying those plan items that appear to have adverse economic impact in the basin.** The following were identified, among others:

1. Mandating the retro-fitting of stormwater treatment systems (C4 and C5): separating and treating stormwater would be economically devastating.
2. Concern about the whole lake approach to phosphorus control, while only three areas of the lake have been identified with serious problems. Similarly, concerned about which phosphorus control strategy, as presented in the preliminary economic analysis, will be selected and how
3. Nonpoint source (C8): septic tank inspection lacks clear benefits.
4. Managing Fish & Wildlife Action Plan (B1, B2): the use of indicator species appears to extend the endangered species act to this area, where there are no endangered species other than 5 that pass through the area.
5. Nuisance Aquatics (Chapter G): Not enough attention to zebra mussel threat, more attention needed on the economic impacts of zebra mussels.
6. Public Access (Chapter H, Section B): Seems exclusively targeted at tax payer funded improvements and expansion. Should be more attention to private launch facilities (e.g., marinas) as public access points, and the economics involved.
7. Non-Native plants in the south Lake: The 10 year program to control water chestnuts is losing ground and is seriously under-funded. The plants are a serious threat to tourism and the marina industry in the south Lake.
8. Concerned about ability to plan for the future and maintaining flexibility in the Plan. A few years ago we were not even thinking about zebra mussels, and now they are becoming a major problem. Need to have flexibility in the Plan and not be locked into a rigid action and spending plan.
9. There are at least 6 or 7 tax breaks among the 167 plan items. No where are they quantified to gauge the over-all economic impact. Someone pays the price of these tax breaks.
10. Some things were not given enough economic attention, such as:
  - a) Linking the marinas in the south lake to the canal system and the economic benefits of that type of cooperative activity;
  - b) A community loan fund that would help individuals and business to mitigate lake impacts, for example, improved sewer systems;
  - c) Lack of thinking about land swaps: if a farmer can't fence because he is in a flood area, or does not have enough pasture to do rotational grazing, is there not other land he could swap for.
  - d) Have not looked enough at the economic impacts of urbanization.
11. Competitiveness is the key economic cost from my perspective in local government. Increase costs for pollution control and sewage treatment may mean lowered ability to attract new industries. So when you look at the benefits of recreation, you need to also factor in the costs in other components of the economy.

12. Competitive implications for paper making in Plattsburgh is also an economic concern. As they are trying to determine in the Great Lakes, what is the economic benefit of shutting mills down, if that is the end result.

Another part of the session focused on **identifying those plan items that are beneficial to the short and long term interests of the basin economy**. The following were identified, among others:

1. Education needs more emphasis, that is where much of the benefit will be. As people become more educated, we will better able to discuss the issues, and understand why they are issues.
2. The Plan stakes out a moderately aggressive program for control of the lamprey eel. This is appropriate given the economic impact of the eel on the Lake's sport fishery.
3. Plattsburgh Chamber supports the Plan items supporting fisheries, with the exception of the endangered species items.
4. The tourism promotion aspects, such as the Bikeways, are very positive, economic benefits of the Plan.
5. Economic linkage between cultural and heritage resources and the lake should help local economies. Educate local residents on what we have.
6. The Plan starts to look at a sub-basin approach, and that is good and should be expanded. It results in a more ecologically sensitive approach, is more efficient, and is more cost effective. The Basin Program people deserve a great deal of credit for introducing the sub-basin concept, but do not take it nearly far enough.
7. It is difficult to put an economic value on improving and protecting habitat and biota, that is addressed in parts of the Plan.
8. I worked in recruiting for IBM for a number of years, and quality of life is very important in attracting good employees; quality of life also is a factor in selecting a new site for a business.

Third area of discussion was on remaining **information gaps**, in terms of economics, that included the following points:

1. Toxics - C2 - new reduction rules for new generators. Who are these generators? What are the impacts of these increased standards? Does every business in the basin need to get new light fixtures? We do not know.
2. What impact will zebra mussels have on the reduction of phosphorus? Not addressed in the Plan.
3. How does reduced phosphorus affect sludge and sludge disposal and what are the economic implications to wastewater treatment plants? In addition there are odor implications.
4. Virtually everything in the nonpoint source chapter is weak on science and cause & effect. The science just isn't there. Applies to urban controls, private septic, agriculture, etc., the impacts and benefits of control just are not there.
5. No figures on rotational grazing and the impacts on phosphorus.



6. No comparison between pucker brush and active crops in terms of phosphorus run-off on the same land. If you give up the farm do you worsen the phosphorus situation, maybe you do.
7. Will the reduction of phosphorus actually give us the improvement we think; will we see the results? If we spend millions of dollars, and then see no improvement, then obviously we have wasted our financial resources.
8. Up-dated debt service and O & M figures are needed for wastewater treatment plants.
9. Consistency between NY and VT, and how the new regulations are going to be implemented. Everyone is pushing for this .08 mg discharge, but looks like it will be applied differently. 100% funding in VT, but we in NY will have to do it whether the funding is there or not. Concern is both with consistency of the standard and consistency of its application.
10. Do treatment plants have the capacity to take more sewage if private households are encouraged to pump more frequently? Hard to find a plant to take sewage in Essex County NY, especially in winter.
11. There is a gap in terms of outcomes. What is the downside of success? If we are successful in cleaning up the lake, and there is more economic activity, what are the costs in terms of roads, infrastructure, etc.?

## 9.2.2 Session 2

During the second session, the main discussion centered on specific measures to boost economy and business while protecting Lake Champlain, and at least 11 distinct proposals were offered and discussed. Most seemed to be heartily supported by the group present, although there was no attempt at a group consensus. Some of the main themes running through the ideas include the following:

1. **Innovation, ideas, creativity -- all need to be encouraged in the private sector and supported by government.** This is how economically efficient and equitable environmental change comes about. There are already numerous examples at the state and national levels. The EPA's "Golden Carrot Award" and the NYSDEC Governor's Award are two examples, whereby government recognizes and rewards innovation in business in terms of protecting the environment. One problem is that while government sponsors these awards, they do not seem to participate themselves. Would like to see an award program for innovation and efficiency for government employees and departments.
2. **Pollution prevention is key to cleaning up the lake, and prevention is tied to the encouragement of innovation, as noted in 1 above.** Prevention is good for business, and industry continues to develop new ideas for pollution prevention. Industry knows that it is cheaper to prevent pollution at the source, than it is to remove it after it leaves the end of the pipe. The organization of retired engineers (REAP) and other organizations are already working in the basin to facilitate the move towards pollution prevention. In addition, solving pollution problems can directly help the local economy. One example is Living Technologies in VT, just awarded a \$1 million contract in the UK. Pollution prevention also involves revising our approach to regulation. There are pilot projects in Addison County, where performance based septic systems are being installed, rather than design based. Design based regulations can result in bigger lots, rather than addressing the real problem of controlling waste.

3. **There is a role for government in protecting local economies while preventing pollution of Lake Champlain.** Government has helped start loan programs, such as the Northern Community Investment Corporation, that has helped numerous businesses in northern VT and NH. The City of Burlington has been involved in developing the new wood-chip gasifier plant and the Lake Champlain Science Center on the waterfront. Marketing, tax issues, and identifying business opportunities are other areas where government can play a positive role. From an economic viewpoint, government can be more effective as a catalyst, than a regulator.
4. **On-going Lake Champlain planning efforts must facilitate and accommodate the participation of economic interests.** There does not seem to be that much disagreement between economic and environmental concerns, but problems inevitably arise when economic interests are not invited to the table. However, a number of barriers effectively prevent the business community from participating, including: too many meetings already; the business person cannot afford to be away from the business, with daytime and meetings running late into the night being most troublesome; small business people often do not have paid staff who attend meetings for them; and, there is an intimidation factor for the small business person. Implementation plans need to address how to facilitate the participation of economic interests, given these barriers to involvement.

In addition to this type of thoughtful, creative discussion on turning protection of the lake into a net positive for the local economy, the participants discussed concerns about the planning process itself. We received an up-date on the schedule of the plan and its current status. We also discussed some of the remaining economic analyses, including the Final Economic Analysis, scheduled to begin in October. Sustainability concepts, land use data, and the compatibility of agriculture and bicycle tourism were also major areas of discussion.

### 9.3 Technical Advisory Committee Meetings

As requested, the study team attempted to meet with each of the Technical Advisory Committee subcommittees to discuss economic issues. There were three main purposes of the TAC economic workshops, as follows:

- refine the costs listed in the draft Plan;
- clarification of costs expected for both states (% allocated to VT and NY); and,
- prioritization of the action items within each Action Plan.

The consultants also proposed criteria for a framework for economic prioritization of Plan elements, while recognizing that many of the categories may be empty, or only partially completed, during this phase of the analysis.

The study team was able to complete nine of the eleven subcommittee economics workshops, as follows:

Nutrient and Non-Point Source Action Plans, August 9, 1995, Westport, NY.

Toxics, August 10, 1995: 6:45 AM, Hampton Inn, Colchester VT.

Living Resources: Fish & Wildlife, Wetlands, and Nuisance Aquatics, August 10, 1995, 10:00 - noon, at the Fish Hatchery on Grand Isle VT.

Watershed Planning, August 29, 9:30 - 12:00, LCBP office, Grand Isle.

Cultural Resources, September 8, 3:30 - 5:00, Montpelier VT.

Recreation, Conference call, September 26, 1:00 - 2:30.

The subcommittees on Protecting Human Health and Educating and Involving the Public (E&O) did not formally meet with the consultants, however, we did discuss major issues with the chairs of those two committees. The Human Health chair, Lee Steppacher, provided contact names for up-dating the beach closure data in the draft Plan, while Liz Soper, E&O chair meet briefly with Holmes to look over the economic criteria.

The meetings proved very valuable to the study team for learning about the latest thinking on the Plan recommendations by those most involved in formulating those recommendations. Since there was concurrent efforts by the TACs, PFT, and LCMC in revising, prioritizing, and finalizing plan elements, the study team was able to stay somewhat abreast of the current status of the Plan. This helped the study team to focus their efforts most efficiently.

Economic issues had not been in the forefront of sub-committee discussions up to this point. Most committees were preoccupied with developing recommendations and research plans that most accurately addressed the problem of concern. For that reason, the economic discussions were especially interesting and the dialogue among the subcommittee members represented some of the first focused economic discussions they had had since first developing cost estimates for the draft Plan. Most subcommittees were hesitant to make any changes to the original cost estimates, with only one minor cost change coming to the attention of the study team. Although there was not a considerable amount of new economic data forthcoming from the sessions, each workshop resulted in the study team gaining new insights into the economic considerations within each chapter, and, we came away with additional references and contacts for further information. The analysis presented in this report reflects those insights.

## **10. A Prioritization and Implementation Framework for the Lake Champlain Basin Program**

Many important studies initiated by the Lake Champlain Management Conference are still underway; some are only in the planning stages. This leaves the Management Conference with substantial gaps in its knowledge of the costs and benefits of many action items included in the draft Plan. While those involved in developing the Plan have understood that it would be periodically updated in light of new information, the public may have the impression that approval of the Plan implies a commitment to begin implementation of all the Plan's action items. It would therefore be beneficial for the management Conference to emphasize that the Plan is part of an ongoing process of scientific research, policy development, implementation and adjustment. This chapter outlines a framework for policy development and implementation in situations where costs and benefits are uncertain and new information can be generated over time. The framework draws upon basic concepts of decision theory, an analytic technique that is widely used in economics, policy analysis and business planning.

### **10.1 Making Decisions with Imperfect Information**

Decision theory is an extension of benefit-cost analysis to situations where many possible alternatives are available to the decisionmaker and benefits and costs are not known with certainty. One aspect of decision theory that is particularly relevant for prioritization and implementation of the draft Plan is that it provides a basis for comparing the expected net benefits of taking immediate action, taking no action or gathering more information before reaching a decision.

The first issue to be considered in evaluating each action item is whether the expected benefits of implementing it are likely to exceed the costs. This benefit-cost evaluation requires an assessment of the direct costs and effectiveness of the pollution prevention, control or restoration measure(s) being considered, as well as the indirect ecological and socio-economic affects of implementing the proposed action(s).

Even if current data indicate that benefits of implementing a particular action item are likely to exceed costs, this does not necessarily mean the item should be implemented immediately and completely. If there is sufficient uncertainty in either benefit or cost estimates, or both, it is possible that costs could turn out to exceed benefits. For action items for which there is significant uncertainty about benefits and/or costs, two additional questions must be answered before reaching a decision on implementation. First, is there a relatively inexpensive way, such as further study or implementation of pilot projects, to refine benefit and cost estimates. Second, would delaying full implementation of the action item significantly increase costs or reduce benefits. If the answer to the first question is yes, and the answer to the second is no, then the option of gathering additional information through further research, demonstration projects, or a pilot program should be given serious consideration.

Conversely, even if current information indicates that the costs of implementing an action item will exceed the benefits, the item should not necessarily be dropped from further consideration. If there is a realistic possibility that costs might be overestimated and/or benefits (avoided costs)

underestimated and there are inexpensive ways of refining existing cost and benefit estimates, then providing funding for further study is likely to be appropriate.

The distribution of costs and benefits must also be taken into account. In theory, if benefits exceed costs, an acceptable distribution of costs could be achieved through appropriate financing mechanisms. However, due to political or institutional constraints, it is not always possible to implement equitable financing and compensation arrangements. Recommended action items in the final Plan may therefore need to be made contingent on the use of specified financing arrangements.

To take advantage of new information as it becomes available, the Lake Champlain Basin Program must incorporate periodic review procedures into the process established for implementation of the Plan. As new information becomes available, the benefits, costs and remaining uncertainties involved in taking action should be reevaluated. Similarly, for programs and other actions involving continued public expenditures or other costs over time, monitoring and evaluation efforts should be implemented to periodically determine whether these programs, regulations, etc. should continue unchanged, be revised, or eliminated altogether.

Although there is some danger of oversimplification, the framework outlined above can be summarized in the form of a checklist.

- Do expected benefits exceed expected costs?
- Can financing arrangements be implemented that will ensure an equitable distribution of costs and benefits?
- Is there a high level of uncertainty in benefit and/or cost estimates?
- Can this uncertainty be reduced at relatively low cost through further study or pilot projects?
- Could taking little or no action cause irreversible damage, greatly increase costs, or significantly reduce benefits?
- Have institutional arrangements been established to ensure periodic reevaluation of the benefits and costs of taking action or revising ongoing programs?

Each of the items in the checklist above can be developed in further detail to indicate the types of studies and information that are needed to reach a conclusion.

- Do expected benefits exceed expected costs?
  - \* Costs or lost benefits of no action.
  - \* Timing of costs and benefits.
  - \* Potential sources of funding.
- Can financing arrangements be used to ensure net benefits are equitably distributed?
  - \* Economic impacts of proposed financing arrangements on small businesses, farmers and communities.
  - \* Potential for user fee systems that obtain funding from groups who would benefit most.
  - \* Potential for market based solutions and economic incentives to achieve cost-effectiveness and equitable outcome.
  - \* Political feasibility of implementing preferred financing arrangements.
- Is there a high level of uncertainty in benefit and/or cost estimates?
  - \* Are the underlying physical, chemical and biological relationships well understood?

- \* Has the effectiveness of the proposed technologies or programmatic approaches been demonstrated?
  - \* Does the proposed action item require new institutional arrangements?
  - \* Is there uncertainty over the level of benefits from the intended environmental improvements?
  - \* Have secondary costs and benefits been evaluated?
- Can this uncertainty be reduced at relatively low cost through further study or pilot projects?
    - \* Expected costs of further studies
    - \* Degree of improvement in knowledge expected to result from these studies
  - Could taking little or no action cause irreversible damage or greatly increase costs?
    - \* Could wetlands or other valuable habitat be lost to development?
    - \* Does inaction or significant delay pose significant human health risks?
  - Can institutional arrangements be established to ensure periodic reevaluation of the benefits and costs of taking action or revising ongoing programs?
    - \* Requirements for monitoring and evaluation.
    - \* Incentives for innovation and flexibility in response to change.

To clarify how certain elements of the prioritization and implementation framework fit together it may be useful to present a few highly simplified examples complete with hypothetical numeric data. These examples should not be interpreted as indicating that the framework can only be applied when all elements in the analysis have been quantified. They are intended only to illustrate the types and sequence of evaluations that should be made in the context of the proposed decision framework.

### Example 1

Suppose currently available studies of a proposed pollution control program indicate that the most likely result of implementation would be net benefits of approximately \$1 million. However, there is a 30% probability that implementing the pollution control program would have net costs of \$0.5 million. For simplicity, assume that the pollution control program would require expenditure of all costs within a short period of time. It is also possible to delay implementation of the proposed program and develop highly accurate estimates of costs and benefits by spending \$100,000 on additional studies. Delaying implementation would not significantly increase costs or reduce benefits.

There are three possible courses of action in this example; immediate implementation, no action, and further study followed by a decision after study results are available. By definition, the no action alternative has no costs or benefits relative to the status quo. The expected net benefits of the other alternatives can be computed by multiplying the probability of each possible outcome by the estimated net benefits of that outcome and then adding the resulting probability weighted net benefit estimates.

Given the data for this example, the expected net benefits of the immediate implementation of the pollution control program can be computed by multiplying the 0.70 probability that there will be positive net benefits by the estimated \$1.0 million in positive net benefits and then adding the

product that results by multiplying the 0.30 probability that there will be negative net benefits with the potential net cost of \$0.5 million. This calculation is summarized as:

$$0.70 \times \$1.0 \text{ million} + 0.30 \times (-\$0.5 \text{ million}) = \$0.55 \text{ million expected net benefits}$$

The expected net benefits of further study are a bit more complicated to calculate. Based on current information there is a 70% chance that further study will indicate that implementation of the pollution control program will yield net benefits of \$1.0 million. Given these study results it is reasonable to assume that the program would in fact be implemented. But there is a 30% chance that further study will show that the pollution control program would have net costs to society of \$0.5 million. Given these study results it is reasonable to assume that the program would not be implemented. No matter what the results of further study turn out to be, the costs of the studies themselves must be subtracted from the resulting net benefits of the course of action that is ultimately chosen. Therefore the expected net benefits of engaging in further study can be computed as follows:

$$0.70 \times \$1.0 \text{ million} + 0.30 \times \$0 - \$0.1 \text{ million} = \$0.6 \text{ million}$$

In this example, the high degree of uncertainty over costs and benefits, the lack of significant consequences of delaying action and the relatively low cost of gathering useful new information creates a situation where initiating further study and delaying a decision on implementation until these studies have been completed is the best course of action. The superiority of further study over either no action or immediate implementation would be even greater in this example if the studies could be used to improve the design of the pollution control program thereby increasing net benefits. However, in this example, if additional studies were significantly more expensive and/or would not result either in significant improvement in costs and benefit estimate or program design, then immediate implementation would be the preferred option.

### Example 2

Now consider a slightly modified version of Example 1. In this example, the most likely result of implementing the pollution control program would be net costs to society of approximately \$0.5 million. However, there is a 30% probability that implementing the program would yield net benefits of \$1.0 million. Again, It is also possible to delay implementation and develop highly accurate estimates of costs and benefits by spending \$100,000 on additional studies. Delaying implementation would not significantly increase costs or decrease benefits. As before, taking no further action at all would have no costs or benefits relative to the status quo. The expected net benefits of immediate implementation of the pollution control program are:

$$0.70 \times \$-0.5 \text{ million} + 0.30 \times \$1.0 \text{ million} = \$-0.05 \text{ million}$$

The terms of that equation are:

$$(\text{probability of net cost}) \times (\text{net cost to society}) + (\text{probability of benefits from implementation}) \times (\text{net benefits to society}) = \text{net benefit (- cost) of implementation}$$

The expected net benefits of further study are:

$$0.70 \times \$0 + .30 \times \$1.0 \text{ million} - \$0.1 \text{ million} = \$0.2 \text{ million}$$

The terms of that equation are:

$$(\text{zero cost of delayed implementation}) + (\text{benefits of further study}) - (\text{cost of further study}) = \text{net benefit of further study or partial implementation}$$

This example illustrates that even if the expected net benefits of pollution control or environmental protection efforts are believed to be negative it may still be in the public interest to continue with further study if there is a significant possibility that new information might indicate that the proposed environmental protection efforts would yield net benefits.

It is important to recognize that new information can often be obtained without paying for expensive new studies. In some cases simply delaying action and continuing ongoing monitoring efforts can yield important information on the potential benefits of environmental programs. In other situations, a demonstration project may be the best means of refining cost and benefit estimates. For some action items new information can only be gained through implementation. However, if a proposed action item can be modified or terminated at relatively low cost, then provisional implementation combined with monitoring and evaluation may be the most appropriate course of action. In general, when there is high uncertainty about costs and benefits, and relatively inexpensive additional studies, demonstration projects or pilot programs could reduce this uncertainty or improve program design. It is then appropriate to pursue these activities prior to reaching a final decision on the proposed action item. These conditions exist for many of the action items in the draft Plan particularly the nonpoint source and toxics action plans.

### Example 3

As a final example again consider the situation where there is significant uncertainty over costs and benefits of acquiring a wetland. Assume that potential costs, benefits and their probability of occurrence given immediate acquisition are the same as in Example 1 above. The costs of further studies are also the same. However, in this case there is a 50% chance that by the time further studies of costs and benefits are completed the wetland will have been degraded such that the net benefits of acquisition would be reduced by 50%.

In this example, the expected benefits of immediate acquisition are the same as in Example 1, \$0.55 million. But now the expected net benefits of postponing a decision until further studies are completed is computed as follows.

$$0.5 \times 0.7 \times \$1.0 \text{ million} + 0.5 \times 0.7 \times \$0.5 - \$0.1 \text{ million} = \$0.515 \text{ million}$$

Given the combination of an expectation that benefits exceed costs and a substantial probability that benefits will decline (or costs will increase) if immediate action is not taken to protect the wetland, makes immediate acquisition the appropriate choice even though there is still significant uncertainty about costs and benefits. This example has particular relevance not only for efforts to protect priority wetlands, but also for action items to protect rare or endangered species, control non-native nuisance species, or limit phosphorus loads from new development.



## **10.2 Spreadsheet Compilation and Analysis of Economic Comments and Issues: Examples for Two Action Plans**

In order to enhance our ability to compare and contrast various characteristics of each recommendation, a systematic outline possible costs and benefits could be useful. The study team developed an economic issues outline presentation for two chapters of the draft Plan, Toxics and Recreation, displayed as Table 10-2 beginning on page 85.

The first sheet of the three-part spreadsheet information summarizes the economic and related information gleaned from the technical advisory committee meetings, summarized above, and federal and state agency comments on the plan submitted to the LCBP. The second spreadsheet summarizes comments compiled during the two economic focus group sessions carried out for this project, as well as public comments received by the LCBP. The third spreadsheet outlines the characteristics of the prioritization and implementation framework, discussed above.

The first column in each spread sheet provides the draft Plan chapter name, and lists each of the action items and elements. The remain columns out to the right represent major issue categories that evolved out of this research. Within a particular cell is the categorization or data item for that plan element in terms of the issue listed at the top of the column. The study team did not attempt to fill every cell in each table. Cells are filled only where some type of information on the item was forthcoming from agency comments or the focus group sessions.

The issue categories are listed in Table 10-1 on page 84, along with a brief description of how the issue is categorized or measured for each item.

The reader should keep in mind two additional caveats on the information contained in the spreadsheets:

First, by necessity the spreadsheet summarizes and simplifies the information deemed necessary to making informed judgments on Lake Champlain planning issues. The five year Lake Champlain Planning effort has generated a considerable knowledge base about the lake and basin environment. To a lesser degree, we have expanded our knowledge about the communities and economies around the lake. The information available through the LCBP office is a necessary supplement to the spreadsheet examples presented below.

Second, the spreadsheets are by necessity incomplete because some studies are on-going, some are planned, and many others are on the drawing board. This framework is intended as a starting point, a working model, for organizing and prioritizing research activities and planning issues around Lake Champlain.

A key issue raised in the focus group sessions and amplified here by the study team is that a planning effort of this scope, especially one that is a bi-state effort, needs to maintain a high degree of flexibility. Implicit in that suggestion is that the planning effort would be revisited on a regular basis to up-date the knowledge base for Lake Champlain and re-focus limited research and planning funds. Using some type of common denominator as the basis of that analysis, as represented by the spreadsheet categories, would aid in those periodic reassessments. Not all categories would be relevant to the reassessment process.

An economist with the NYS Department of Parks Recreation and Historic Preservation reviewed the spreadsheet outlines and provided a suggestion for further clarifying the costs and benefits of

each action item (personal communication: Wesley Bartlett, NYSPR&HP, September 1995). Mr. Bartlett suggested adding a fourth spreadsheet that summarizes the information crucial to a benefit cost analysis. The suggested spreadsheet categories are as follows:

1. Primary and secondary costs.
2. Indirect costs.
3. Total costs.
4. Direct benefits.
5. Secondary benefits (including multiplier effects, if any).
6. Cost / Benefit ratio.
7. Level of confidence in estimates.
8. Geographic Location of Benefits.
9. Cost of No Action alternative.

The nine categories provide a solid basis for organizing the economic analysis of the final Lake Champlain Pollution Prevention, Control, and Restoration Plan.

## 10.3 Summary

The numeric examples presented above are intended only to illustrate the types of judgments that can and should be made in considering the priority and timing of various action items. Costs and benefits should be understood in the broadest sense. Included should be direct public expenditures, administrative costs, and additional private sector costs as well as direct public health, recreational, and aesthetic benefits. Also important are indirect benefits in the form of increased business profits and employment, and maintenance of ecological health.

For many of the environmental protection and restoration efforts outlined in the draft Plan, costs and benefits cannot be completely quantified. Qualitative judgments must be made about net benefits of each action item to society. This does not affect the basic conclusions outlined above or reduce the importance of the proposed decision framework. On the contrary, the framework and accompanying outline of benefit cost analysis categories are useful because they are effective tools for identifying and re-evaluating what is known and unknown.

If there is little confidence in cost or benefit estimates but a significant probability that benefits or avoided costs could be substantial, then gathering further information and establishing a formal process of review and reevaluation in light of this new information probably makes sense. If pilot or provisional programs can be implemented at relatively low cost, they may be the most effective means of gathering additional information, given clear guidelines for program review and reevaluation. In situations where the most likely estimate of benefits exceed anticipated costs and delay in taking action would cause irreversible damage or significantly increase costs, then immediate action is likely to be the best choice.

### Table 10-1: Benefit Cost Issue Categories

#### Issue Categories - 1st Spreadsheet: Federal and State Agency, and Technical Comments, as Interpreted by the Preliminary Economic Analysis Consultants

<u>Issues (column headings)</u>	<u>Categories (cell contents)</u>
1. Over-Lap w/ other Item(s)	list Action Plan and Items
2. Annual Cost Estimate	draft Plan amount, up-dated if available
3. Perceived Accuracy of Estimate	agency comments: too high, too low; or, project already done, or in progress
4. Duration: Short- or Long-Term	short (1 or 2 years), or long term
5. Staff Increase per State (FTE)	number of new staff persons needed
6. Level Geographic Targeting	low (basin-wide), medium, high (very specific)
7. Perceived Financial Need	low (being addressed), medium, high (no funds avail)
8. Coordination Possible in Short Term	low (state by state), med (cooperation possible) high (basin level coordination)
9. Perceived Agency Priority	low, med, high (strong support), by state

#### Issue Categories - 2nd Spreadsheet: Summary of Public Comment and Economic Focus Group Discussions, as Interpreted by the Preliminary Economic Analysis Consultants

<u>Issues (column headings)</u>	<u>Categories (cell contents)</u>
1. Potential Secondary Costs	type of cost identified, and who impacted
2. Other Indirect Costs	other cost identified
3. Opportunity for Short-Term Benefits	high only identified, type of benefit
4. Opportunity for Long-Term Benefits	high only identified, type of benefit
5. Need for Private Economic Incentives	high: need for cooperative programs w/business
6. Indicates Need for New Rules or Laws	none, or description of law or mandate, and source: federal or state
7. Socio- Economic Information Needs	ID information gaps
8. Perceived Public Support	consultants perception: low, med, high
9. Perceived Level of Controversy	consultants perception: low, med, high

#### Issue Categories - 3rd Spreadsheet: Prioritization and Implementation Framework Criteria

<u>Issues (column headings)</u>	<u>Categories (cell contents)</u>
1. Do Benefits Exceed Costs	yes, no, unknown
2. Level of Confidence in Benefit Estimate	low, med, high
3. Approaches to Remove Uncertainty	suggested research topics
4. Type of Benefit	tourism, quality of life, environmental quality
5. Location of Benefits	basin wide, NY, VT, specific location
6. Significant Cost of No Action	type of cost identified, or none
7. Reversibility of Action	high (easily reversed) low (irreversible)
8. Pilot Projects Possible	type of pilot project

**Table 10-2a: Lake Champlain Opportunities for Action: Summary of Federal & State Agency, and Technical Comments as Interpreted by the Economic Analysis Consultants**

Plan Actions Items Specific Elements	Over-Lap w/ other Item(s)	Annual Cost Estimate	Perceived Accuracy of Estimate	Duration: Short- or Long-Term	Staff Increase per State (FTE)	Level of Geographic Targeting	Perceived Financial Need	Coordination Possible in Short Term (NY/VT)	Perceived Agency Priority
<b>C. Preventing Pollution from Toxic Substances</b>									
A. Adopt Risk-based Strategy for Managing Toxic Subs.									
1. Focus on toxics of concern and others	B1, C1	50,000	too high <sup>2</sup>	Long	1	High Basin	Low <sup>1</sup>	Low	
B. Reducing Toxics of Concern & Manage Sites									
1. Dev. & implement pollution strat. for PCBs & Mercury		500,000	too high <sup>2</sup>	Long	1	High: Cumberland Bay NY is top priority, + 2 sites in VT.	High <sup>1,2</sup>	Low	High <sup>1</sup> Low <sup>2</sup>
2. Evaluate management alternatives for sites of concern			too high per site, but more sites <sup>2</sup>	Long			High <sup>2</sup> Low <sup>1</sup>		
a, b. ID sites & characterize extent & severity		1,050,000							
c, d. Consider alternatives, recom		?							
3. Implement low-tech pollution prevention and recyclin	C1-C5	75,000 (NY)		Long		Medium: Likely a larger # of sources in VT.			Low <sup>2</sup>
C. Pollution Prevention									
1. Target Sub-basins for accelerated Reductions		50,000		Short	0.5	Larger # of sources in VT.	High <sup>1</sup> High <sup>1,2</sup>	High	High <sup>1,2</sup>
2. Accelerate implementation of pollution prevent prog.		250,000		Long	1		High <sup>1</sup>		High <sup>1</sup>
3. Est. or improve household haz. waste collect. programs		150,000		Long	0.5				High <sup>1</sup>
4. Educate on alternatives, use, & disposal of toxics		75,000	too high <sup>1</sup>	Long	0.25				High <sup>1</sup>
5. Promote alternatives to pesticide-intensive practices	C3, C4	25,000		Long					High <sup>1</sup>
D. Improving Ambient Monitoring and Ass of Toxics									
1. Continue research on fate and effects of toxics		250,000	accurate <sup>1</sup>	Long		Low. Basin	High <sup>1</sup>		
2. Evaluate, revise and coord. Chemical Monitoring Net		200,000		Long					
3. Evaluate, revise and coord. Biological Monitoring Net		450,000		Long					
4. Integrate & review all monitoring programs		150,000	too low <sup>2</sup>	Long					Start w/ Pilot Project <sup>2</sup>
E. ID Sources and Quantifying Loads of Toxic Substances									
1. Dev. & implement target watersheds for ID & Reduction		150,000		Long		High: targeting			
2. Adopt a mass balance approach for toxics		500,000		Long					
3. Continue to review discharge data for sources		250,000	NY cost estimate	Long			Medium <sup>1</sup>		
4. Assess importance of sites of concern as toxic sources		600,000		Long					
F. Evaluating and Improving Goals and Standards									
1. Est consist. standards: water quality, ecosystem indicators		0		Long	1	Low. Basin	High <sup>1</sup>		
2. Evaluate existing regulatory framework on toxics reduction		?		Long					
G. Enhancing educational efforts	Other E & O efforts								
1. Assist. to citizen-based monitoring & watershed Assoc		75,000	too high <sup>1</sup>	Long		Low. Basin			
2. Hold public workshops on toxics research		25,000		Long					

1. New York State agency comments on the draft Plan, 2. Vermont State agency comments on the draft Plan.

**Table 10-2b: Lake Champlain Opportunities for Action: Summary of Public and Economic Focus Group Comments as Interpreted by the Economic Analysis Consultants**

Plan Actions Items	Specific Elements		Potential Secondary Costs	Other Indirect Costs	Opportunity for Lake Related Short-Term Benefits	Opportunity for Lake Related Long-Term Benefits	Need for Private Economic Incentives	Indicates Need for New Rules or Laws	Socio- Economic Information Needs	Perceived Public Support	Perceived Level of Controversy
C. Preventing Pollution from Toxic Substances											
A. Adopt Risk-based Strategy for Managing Toxic Subs.								None indicated	High	High	
1. Focus on toxics of concern and others									Additional research on fish consumption by species and location		
B. Reducing Toxics of Concern & Manage Sites				Publicity over clean-up impacting fishing, tourism	Low	High: Improved fishing, tourism, quality of life					
1. Dev. & implement pollution strat. for PCBs & Mercury		Staff Time, Publicity could cause alarm									
2. Evaluate management alternatives for sites of concern											
a.b. ID sites & characterize extent & severity											
c.d. Consider alternatives, recom											
3. Implement low-tech pollution prevention and recycling							High				
C. Pollution Prevention					Demonstrating action on reducing fish contamination	High: Improved fishing, tourism, quality of life			Medium: EH review and analysis of household use and disposal of haz. waste		
1. Target Sub-basins for accelerated Reductions		Publicity could cause alarm			Prevention is less costly than clean up			None indicated		High	Low
2. Accelerate implementation of pollution prevent prog						Medium: HH not a major source of toxics	High				Medium
3. Est. or improve household haz. waste collect. progra		Disposal costs			education education education						
4. Educate on alternatives, use, & disposal of toxics											
5. Promote alternatives to pesticide-intensive practices											
D. Improving Ambient Monitoring and Ass of Toxics					Monitoring does not reduce contamination (EPA)						
1. Continue research on fate and effects of toxics		Diverging funds from clean-up & control									
2. Evaluate, revise and coord. Chemical Monitoring Network						High		None indicated	Low	Med	Low
3. Evaluate, revise and coord Biological Monitoring Network											
4. Integrate & review all monitoring programs											
E. ID Sources and Quantifying Loads of Toxic Substances											
1. Dev. & implement target watersheds for ID & Reduction		Implementation Costs		Medium		High		None indicated	business & ind.	High	Low
2. Adopt a mass balance approach for toxics											
3. Continue to review discharge data for sources											
4. Assess importance of sites of concern as toxic sources											
F. Evaluating and Improving Goals and Standards					Low	Medium		None indicated	Low	Med	Low
1. Est consist. standards: water quality, ecosystem indicators											
2. Evaluate existing regulatory framework on toxics reduction											
G. Enhancing educational efforts											
1. Assist. to citizen-based monitoring & watershed Assocs						Medium	Possibly as demo projects	None indicated	Assess program effectiveness	High	Low
2. Hold public workshops on toxics research											

**Table 10-2c: Lake Champlain Opportunities for Action:  
Prioritization and Implementation Framework Criteria**

Plan Actions Items	Do Benefits Exceed Costs	Level of Confidence in Benefit Estimate	Approaches to Removing Uncertainty	Type of Benefit	Location of Benefit	Significant Cost of No Action	Reversibility of Action	Pilot Projects Possible
Specific Elements								
<b>C. Preventing Pollution from Toxic Substances</b>								
A. Adopt Risk-based Strategy for Managing Toxic Subs.	Possibly, depending on toxic	Medium	Pilot project on priority contaminants	Reduced fish contamination, swimming hazards	Basin wide, cost effective	Medium	High Varies by recomm., low for dredging	
1. Focus on toxics of concern and others								
B. Reducing Toxics of Concern & Manage Sites	Possibly for Group 1	Medium	Pilot project on priority contaminants	Reduced fish contamination, swimming hazards	Lake wide; Potential for reduced fish contamination	High problem remains, fish contamination continues	High	target key sites
1. Dev. & implement pollution strat. for PCBs & Mercury								
2. Evaluate management alternatives for sites of concern								
a. b. ID sites & characterize extent & severity								
c. d. Consider alternatives, recom								
3. Implement low-tech pollution prevention and recycling								
C. Pollution Prevention	Possibly in some cases, not in others	low	Pilot project on priority contaminants	Reduced fish contamination, swimming hazards	Basin wide and Lake wide	Publicity on toxics = adverse impact on tourism	High	target key sites
1. Target Sub-basins for accelerated Reductions								
2. Accelerate implementation of pollution prevent prog	HH not a major source of toxics			Prevention is less costly than clean up				demonstration project
3. Est. or improve household haz. waste collect. progra								demonstration project
4. Educate on alternatives, use, & disposal of toxics								
5. Promote alternatives to pesticide-intensive practices								
D. Improving Ambient Monitoring and Ass of Toxics	Monitoring does not reduce contamination (EPA) low		Smaller, pilot projects, regular review of findings.	Early warning	Basin	Low	High	target key sites demonstration project
1. Continue research on fate and effects of toxics								demonstration project
2. Evaluate, revise and coord. Chemical Monitoring Network								demonstration project
3. Evaluate, revise and coord Biological Monitoring Network								demonstration project
4. Integrate & review all monitoring programs								demonstration project
E. ID Sources and Quantifying Loads of Toxic Substanc	Not with overlap w/other actions	med	regular review of progress	Stopping contamination at the source	Basin	Medium: Current sources continue as is	High	demonstration project
1. Dev. & implement target watersheds for ID & Reduction								demonstration project
2. Adopt a mass balance approach for toxics								
3. Continue to review discharge data for sources								demonstration project
4. Assess importance of sites of concern as toxic sources								
F. Evaluating and Improving Goals and Standards	Costs are unknown		Set cost efficient interim goals			Low	High	
1. Est consist. standards, water quality, ecosystem indicators								
2. Evaluate existing regulatory framework on toxics reduction								
G. Enhancing educational efforts	Yes, though some overlap w/other actions	med	Pilot projects w/local watershed assoc.	Education, prevention	Basin	Low	High	
1. Assist. to citizen-based monitoring & watershed Assocs								
2. Hold public workshops on toxics research								

**Table 10-2d: Lake Champlain Opportunities for Action: Summary of Federal & State Agency, and Technical Comments as Interpreted by the Economic Analysis Consultants**

Plan Actions Items	Over-Lap w/ other Item(s)	Annual Cost Estimate	Perceived Accuracy of Estimate	Duration: Short-Term Long-Term	Staff Increase per State (FTE)	Level of Geographic Targeting	Perceived Financial Need	Coordination Possible in Short Term (NY / VT)	Perceived Agency Priority
<b>H. Managing Recreation</b>									
<b>A. Improve and Enhance Existing Public Access Sites</b>									
1. Use regional partnerships		\$0		long		Basin-wide			high <sup>1</sup>
2. Establish a dedicated trust fund		\$20,000		long		Basin-wide			low <sup>1</sup>
3. Encourage adopt-an-access programs		\$20,000	O&M needs to be addressed	long		Basin-wide			high <sup>1</sup>
			In-kind costs are significant, take away from other duties?						
<b>B. Develop Additional Public Access Opportunities</b>									
1. Dev & implement strategy to provide new public access				long		Lake-shore			high
a. complete the public access strategy.		\$0				Lake-shore		high	
b. secure new access at prioritized sites.		?				Lake-shore			
2. Funding to local govts and non-profits for public access		?		long		Lake-shore			medium <sup>1</sup>
<b>C. Encouraging Tourism</b>									
1. Encourage new opportunities for recreation in Basin		?		long		Basin-wide		high	high
2. Explore tourism promotion		?		long		Basin-wide			high
3. Determine impacts of increased recreation		?		long		Basin-wide			
4. Open up econ dev funds for recreation/tourism		?		short		Basin-wide			
<b>D. Reducing Congestion and Conflicting Uses</b>									
1. Evaluate need for local recreation manage. plans		\$0		short		Basin-wide			medium <sup>1</sup>
2. Assist in developing local recreation manage. plans		\$50,000		long		Basin-wide			medium <sup>1</sup>
3. Enhance user education programs		?		long		Basin-wide			medium <sup>1</sup>
<b>E. Improving Safety and Enforcement</b>									
1. Evaluate & improve regulations and enforcement		\$0		short		Basin-wide			medium <sup>1</sup>
2. Evaluate navigational charts		\$0		short		Basin-wide			low <sup>1</sup>

1. New York State agency comments on the draft Plan; 2. Vermont State agency comments on the draft Plan.

**Table 10-2e: Lake Champlain Opportunities for Action: Summary of Public and Economic Focus Group Comments as Interpreted by the Economic Analysis Consultants**

Plan Actions Items	Specific Elements				Opportunity for Lake Related Short-Term Benefits	Opportunity for Lake Related Long-Term Benefits	Need for Private Economic Incentives	Indicates New Rules or Laws	Socio- Economic Information Needs	Perceived Public Support	Perceived Level of Controversy
	Potential Secondary Costs	Other Indirect Costs									
H. Managing Recreation											
A. Improve and Enhance Existing Public Access Sites											
1. Use regional partnerships								none identified			
2. Establish a dedicated trust fund								none identified			
	O & M could be significant at some accesses				Improved access = increased tourism, at low cost to gov			none identified			
3. Encourage adopt-an-access programs											
B. Develop Additional Public Access Opportunities											
									Examine relationship between public and private access.		medium (compete w/private providers)
1. Dev & implement strategy to provide new public acces w/marinas possible	Competition							none identified			
a. complete the public access strategy.								none identified			
b. secure new access at prioritized sites.								none identified	Research on cost & benefit of access sites in local communities		
2. Funding to local govts and non-profits for public acces	O & M could be significant at some accesses							none identified			
									Research on maximizing economic impact on local communities		
C. Encouraging Tourism											
1. Encourage new opportunities for recreation in Basin								none identified			medium (overlap w/local efforts)
2. Explore tourism promotion								none identified		high	
3. Determine impacts of increased recreation								none identified		high	
4. Open up econ dev funds for recreation/tourism								none identified			
									Evaluate utility & success of Malletts Bay plan		
D. Reducing Congestion and Conflicting Uses											
1. Evaluate need for local recreation management plans								none identified			
2. Assist in developing local recreation manage. plans								none identified			
3. Enhance user education programs								none identified			
E. Improving Safety and Enforcement											
1. Evaluate & improve regulations and enforcement								none identified		high	
2. Evaluate navigational charts								none identified			



**Table 10-2f: Lake Champlain Opportunities for Action:  
Prioritization and Implementation Framework Criteria**

Plan Actions Items Specific Elements	Do Benefits Exceed Costs	Level of Confidence in Benefit Estimate	Approaches to Removing Uncertainty	Type of Benefit	Location of Benefit	Significant Cost of No Action	Reversibility of Action	Pilot Projects Possible
H. Managing Recreation								
A. Improve and Enhance Existing Public Access Sites	Yes (low cost, minimal gov funds)	high		tourism & recreation; quality of life	Lake wide			
1. Use regional partnerships						none	high	
2. Establish a dedicated trust fund						none	high	
3. Encourage adopt-an-access programs						none	high	
B. Develop Additional Public Access Opportunities			Demonstration analysis : public & private access	tourism & recreation; quality of life	Lake wide			
1. Dev & implement strategy to provide new public acces	unknown almost completed	low				none	high	
a. complete the public access strategy.		low				none	high	
b. secure new access at prioritized sites.	unknown	low			targeted sites	none	low, once new site established	
2. Funding to local govts and non-profits for public acces	unknown	low				none	high	
C. Encouraging Tourism			Focused research on specific sites	tourism	Basin wide			
1. Encourage new opportunities for recreation in Basin	unknown	low				none	high	
2. Explore tourism promotion	unknown	low				none	high	
3. Determine impacts of increased recreation	unknown	low		water quality, environmental quality		localized impacts continue	high	target sites limited test program
4. Open up econ dev funds for recreation/tourism	yes (low cost)	high				none	high	
D. Reducing Congestion and Conflicting Uses			Evaluate Malletts Bay plan	recreational enjoyment; safety	Lake wide			
1. Evaluate need for local recreation management plans	unknown	low				none	high	continue Malletts Bay process
2. Assist in developing local recreation manage. plans	unknown	low				none	high	
3. Enhance user education programs	yes (low cost)	high				none	high	
E. Improving Safety and Enforcement					Lake wide			
1. Evaluate & improve regulations and enforcement	yes (current duplication of effort)	high				none	high	
2. Evaluate navigational charts	yes (low cost)	high				none	high	

# 11. Conclusions and Recommendations

## 11.1 Implications of Economic Findings for a Plan Implementation Strategy

Priority action items should continue to be examined and revised to generate improved estimates of costs, benefits, and remaining levels of uncertainty. As this new information becomes available, the net benefit of taking further action needs to be reevaluated. Similarly, for actions items involving continued public expenditures or other costs over time, monitoring and evaluation efforts should be implemented to periodically determine whether these programs, regulations, etc. should continue unchanged, be revised, or eliminated altogether. In situations where delay or inaction could significantly increase costs, reduce benefits, or result in irreversible changes, immediate implementation of targeted actions is likely justified.

From a local economic perspective, as gleaned from the two Lake Champlain Economic Focus Group sessions, the following four points seem necessary to a successful Lake Champlain protection and restoration program:

1. **The LCBP must encourage strong support from local communities.** Representation on a basin-level committee alone is insufficient to ensure that all the various interests are included in the process. Many communities are already involved in lake protection activities, such as up-grades to waste water treatment plants, and others would like to do more. Local communities should be allowed to adapt proposed land use and lake use recommendations to their own circumstances, and to have expertise available to assist them in their efforts.
2. **Local communities, economic interests, and residents need to be active participants in the LCBP projects and programs.** The priority issues and programs need to be generated at the grass-roots, from the bottom up, as well as at the state and federal agency level. People recognize the benefits of a clean lake more clearly if they see it having an effect in their own communities. Similarly, they respond more positively to information and education programs, than to regulation and enforcement. The Lake Champlain Community Partnership program is an excellent example of this approach, and appears to be a very successful aspect of the Lake Champlain Basin Program.
3. **Existing local watershed organizations need to be supported and new ones need to be encouraged.** While a lake wide LCBP is necessary to communicate and coordinate activities between Vermont, New York, and Quebec, the real change in peoples attitudes and activities related to water is occurring at the local level. The Boquet River Association in New York, Friends of the Mad River in Vermont, and others have a successful track record that should be built upon. Attempts should be made to avoid competition for funding, and some procedure should be developed whereby a certain percentage of LCBP funding is distributed to citizen-based river and lake associations within the basin.
4. **The state governments in Vermont and New York must provide adequate operating funds for the LCBP.** Vermont state legislators recognize more readily the importance of

Lake Champlain to their state's economy, while the New York North Country delegation could be more effective than they have in the past in encouraging legislative approval of Lake Champlain related funding. By any measure, the New York counties along Lake Champlain are among the most economically troubled in the state; concurrently, Lake Champlain is shown to be an important component of local economies. The counties are unable to support the LCBP on their own. With adequate operating funds provided by New York and Vermont, the LCBP should be able to leverage additional project funds from donations, grants, and other fund raising efforts.

The Lake Champlain planning effort has involved a number of economic analysis studies and community case studies. An additional economic analysis of the final Plan will be undertaken before the planning process is complete. There are few simple answers in economic analysis, just as there are few easy solutions to the environmental issues of concern around Lake Champlain. A major goal of this preliminary economic analysis, including the previously published Part 1 analysis, has been to incorporate economic and socio-economic considerations into the Lake Champlain planning effort. The approach has included: presenting summaries of relevant scientific literature, creating models for cost optimization, establishing baseline data for future evaluation, and developing economic decision-making frameworks that are all understandable and useable by anyone involved in Lake Champlain study and planning. At the same time, most of these Lake Champlain-specific economic tools and datasets can be easily up-dated and modified as necessary to account for changing characteristics and issues within the basin. As was repeatedly expressed in the economic forums organized for this study, flexibility is key to addressing environmental problems and developing effective, equitable solutions.

**Appendix A**

**Economic Focus Group Session, #1**

# HOLMES & ASSOCIATES

PO Box 295  
Saranac Lake, New York 12983  
(518) 891-6525 (phone or fax)  
E-mail: tph1@aol.com

2 August, 1995

Dear Lake Champlain Economics Focus Group Participant:

Attached is a summary of the first economics focus group session, held July 17 at Clinton Community College. There were 20 individuals participating (13 from NY, 7 from VT), representing a wide range of industry, small business, and local government interests. Six Basin Program staff, consultants, and resource persons also were present.

During the 3.5 hour session the discussion ranged from concerns over the timing of the economic analysis in relation to the planning process, to very specific questions on the accuracy and source of particular economic data. Answers to some of the questions were provided by Basin Program staff at the session -- and are included in the summary paper -- others are being investigated by the consultants in the interim between focus group sessions.

A major concern centered on the methodologies being used by the economics consultants, and what role cost-benefit analysis, risk assessment, discounting, and other research techniques should play in the analysis of each action item. Since we were unable to address the topic adequately in the first session, this will be an agenda item for the second session. The consultants will be discussing these issues and others in economic workshop sessions with some of the members of the various Technical Advisory Committees. You are welcome to participate in these sessions, tentatively scheduled as follows:

## Nutrient and Non-Point Source Action Plans:

Wednesday, August 9, 1995, 11:30 - 12:45, in Westport NY at the Cornell Extension Office  
(a continuation of the already scheduled meeting)

Toxics: possibly afternoon of 8/9 or morning of 8/10 on the University of VT campus in Burlington  
Living Resources: Fish & Wildlife, Wetlands, and Nuisance Aquatics

Thursday, August 10, 1995, 10:00 - noon, at the Fish Hatchery on Grand Isle VT  
Human Health: TBA

Recreation & Cultural Resources: September 8, 1:00 - 2:30, Champlain College, Burlington  
Watershed Planning, Educating and Involving the Public: TBA

If you plan to attend any of these workshops, please call me ahead of time to confirm time and location.

The second economics focus group session is scheduled for September 8, 1995 at Champlain College in Burlington VT, from 8:30 to 12:30. Please confirm your availability to participate if you have not already, or if you were uncertain at the time of our first communication.

Thanks again for your interest in Lake Champlain economic issues.

Sincerely,

Timothy P. Holmes

# HOLMES & ASSOCIATES

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## **Lake Champlain Draft Opportunities for Action Economic Focus Group Session #1**

held at Clinton Community College, July 17, 1995

### **Summary Paper (8/2/95)**

**prepared for the Lake Champlain Management Conference**

#### Agenda

- 8:30 Arrive, Coffee.
- 8:45 Welcome, Purpose of forum, Discuss agenda.
- 9:00 Current status of the Lake Champlain planning effort, Brief description of the on-going economic analysis of the Plan.
- 9:15 Identification of specific items in the Plan perceived to work counter to the economic interests of the Basin.
- 10:30 Identification of specific items in the Plan perceived to benefit the long term economic interests of the Basin.
- 11:00 Break.
- 11:15 Identification of specific items in the Plan perceived to benefit short term economic interests of the Basin.
- 11:45 Information gaps: Listing areas where more information is needed in order to determine the economic effects on the Basin or specific sectors of the economy.
- 12:15 Final comments: Final comments of participants, Brief evaluation of the session, Preview of the September forum, and adjournment.

# **Lake Champlain Draft Opportunities for Action Economic Focus Group Session #1: List of Participants**

Clinton Community College, July 17, 1995

First Name	Last	Alternate	Company	Area	Fax Number	Phone	Address	City	State	Zip
John	Andrus	Ed Snizek (1st)	Clinton Co. Health Dept	518	565-4717	565-4840	133 Margaret	Plattsburgh	NY	12901
John	Banta		Adirondack Park Agency	518		891-4050	PO Box 99	Ray Brook	NY	12977
Mark	Barie		Cross Border Development	518	297-3264	297-7741	1 Lincoln Blvd	Rouses Pt	NY	12979
Randy	Beach		Adirondack Bank	518	561-0672	561-1816	PO Box 2632	Plattsburgh	NY	12901
Rod	Brown	Glen Cutler (1st)	Clinton City Planning Office	518	565-4885	565-4709	137 Margaret St	Plattsburgh	NY	12901
Jim	Connolly		NYS DEC	518	897-1394	897-1222	Route 86	Ray Brook	NY	12977
Robert	DePaulina		Lake Champlain Chamber of Comm	802	658-0042		1 Church St	Burlington	VT	05402
Bob	Dicky		Georgia Pacific	518	561-8339	561-3500	327 Margaret St	Plattsburgh	NY	12901
Garry	Douglas		Plattsburgh & Clinton City Chamber	518	563-1028	563-1000	PO Box 310	Plattsburgh	NY	12901
Gary	Frenia	Tom Nix	Georgia Pacific	518	561-8339	561-3500	327 Margaret St	Plattsburgh	NY	12901
Mo	Germain		The Moorings Marina	802		862-1407	PO Box 241	Colchester	VT	05446
Timothy	Holmes		Holmes & Associates	518	891-6525	891-6525	PO Box 295	Saranac Lake	NY	12983
Penrose	Jackson		Intervale Foundation	802	660-3501	660-3501	128 Intervale Rd	Burlington	VT	05401
Peter	Kreisel		VT Citizens Advisory Comm.	802	863-1232	863-1641	550 Hinesburg Rd, Suite 101	S. Burlington	VT	05403
Sandra	LaBarron		NYS DEC	518		623-3671	Hudson St Ext	Warrensburg	NY	12885
Barry	Lawson		Barry Lawson Associates	802	592-3950	592-3950	PO Box 26	Peacham	VT	05862
Melissa	McManus	Douglas Agor	Village of Champlain	518	298-2075		PO Box 1158	Champlain	VT	12919
Marcy	Neville	Thomas Scozzafava	Essex Cty Econ Dev Zone	518	546-3606	546-3606	14 Park Place	Port Henry	NY	12974
Bill	Paine		Green Mtn Dairy Farmers Coop	802		453-2691	330 East St	New Haven	VT	05472
Eric	Perkins		Lake Champlain Basin Program	802	372-6131	372-3213	54 West Shore Rd	Grand Isle	VT	05458
Doug	Robertson		VT Boat & Marina Assoc	802		864-0405	336 Mallets Bay Ave	Colchester	VT	05446
John	Ruff		City of Plattsburgh	518	563-3645	563-7730	City Hall	Plattsburgh	NY	12901
Patrick	Russel		Abbott, Frenyea, Russell & Coffey	518	561-7107	561-7030	134 Boynton Ave	Plattsburgh	NY	12901
Harvey	Smith		Addison Cty Farm Bureau	802	877-2712	877-2712	Box 82A	New Haven	VT	05472
Dick	Ullom		Chipman Point Marina	802		948-2288	RD 1, Box 109 B	Orwell	VT	05760
Robin	Ulmer		Boquet River Ass'c.	518	873-6550	873-3688	Essex Cty Gov Center	Elizabethtown	NY	12932

# **Lake Champlain Draft Opportunities for Action**

## **Economic Focus Group Session #1:**

### **Summary of Comments and Discussion**

[Note that the comments are by individuals; there was no organized attempt to reach consensus or to produce a group statement or position.]

#### **Discussion of Agenda**

Need a dialogue with the economics consultants on the process and methodologies being used.  
I agree, need to know where the dollar amounts came from and methods being used.  
The analysis should reflect economic reality. Need to know what is being assessed, and what are the secondary and tertiary impacts.  
Should have the dialogue up front.

#### **Dialogue on the Economic Analysis Completed to Date**

There are five key concerns we (Plattsburgh Chamber) have for an economic analysis of the Plan:

1. Do not want to see one big cost and one big benefit. Each action should remain discrete.
2. Economic is not just a cost estimate, there are primary, secondary, and tertiary economic impacts. It is cost assessment plus impacts related to taxes, cost of doing business, and viability of business (e.g., farming), for example:
  - Impacts on local gov budgets, taxes, and property taxes,
  - Impacts on the competitiveness on paper making in Plattsburgh,
  - Impacts on future re-use and development of the Plattsburgh Air Force Base.
3. Keep things real, identified benefits should be area-specific. Keep the costs connected to where the benefit occurs.
4. Relate where economic impacts cannot be determined, especially where there are no risk assessments available. Be willing to tell the LCMC that the science is not to the point where we can accurately determine the costs and benefits.
5. Show the relative impacts and benefits in terms of New York and Vermont. There are many differences (politically, socially, economically), so do not assume region-wide costs and benefits.

I would add to that, exactly identify exactly where the financial data is coming from.

Looking at the wastewater treatment costs, debt service, etc. (Tech Report 12B: p94, Table 5-11) the costs for the Village of Champlain and City of Plattsburgh are out of date.

Our debt service for Champlain is much higher than that presented, the numbers appear to be 5 years old. In 1993, our debt services was \$135,000, the next year it jumped up to \$147,000. Your figure of \$20,360 in Table 5-11 does not reflect our \$3 million up-grade, we have another coming up.

We also perceive secondary economic impacts in the form of sewer up-grades driving up taxes, which in turn drives up the costs for industries we are trying to attract to our town. They will look elsewhere if the costs are too high. Other communities would have much more marketable than ours.



At Georgia Pacific, our costs are tied to helping fund the Plattsburgh municipal facility, and we would like that reflected in the economic analysis as well.

For Plattsburgh, there are tertiary costs, such as the removal of sludge, that are not reflected in the economic analysis.

Overall, the preliminary economic analysis is primarily a fiscal analysis, rather than an economic analysis. An economic analysis would estimate how many farms might have to shut down because of phosphorus reduction requirements.

I would think that to get a complete economic analysis of the impacts on wastewater treatment plants, you would have to visit each plant and assess their operation individually.

My concern as a farmer is where the money is going to come from to make the necessary upgrades to farming operations. So far we are looking at 85% commitment or costs share in Vermont. That still leaves the farmer with 15% of the cost, not including the labor and equipment necessary to do some of the farm improvements. Are we going to put agriculture in the Basin at a competitive disadvantage? Farmers are willing to do what they can to improve water quality, but we need to know that what we do is going to have a measurable impact. I bring that up because the agriculture improvements made in the St. Albans Bay area (manure structures, BMPs) do not seem to be having an impact on water quality. The phosphorus levels do not seem to be declining there.

[LCMC staff noted that the Management Conference, not the economics consultant, will be looking at availability of funding.]

Concerned that if the economic data is flawed, we will have a flawed economic analysis.

[LCMC staff noted that other research on costs is going on in addition to the economic analysis, as part of on-going scientific study and analysis.]

The Galveston Bay Study does not appear relevant to Lake Champlain. How does the socio-economic conditions and pollution problems in Galveston Bay compare to Lake Champlain? Their problems were so extreme, with the water on fire, etc., that it draws into question the quality of your whole economic analysis.

[Economic consultant pointed out that it is one of over 20 water quality economic analysis reviewed in the report. The on-going research is expanding the analysis of the water quality benefit studies, and will report on these issues of applicability (e.g., type of problem, characteristics of the area, socio-economic attributes). If nothing else, the Galveston Bay research establishes the high end of what a household might be willing to pay for improved water quality, and in fact it was the highest value reported among the studies reviewed.]

Methodology - Keep the benefit real. Not warm and fuzzy... Do not use willingness to pay as a measure of benefits, how much people are willing to pay for a clean lake is meaningless to me.

I am worried that soft and fuzzy means that we ignore any benefits outside of those that are immediate and concrete. It appears that if we stick to the five points (above) we are limiting our discussion strictly to costs. This is supposed to be a Plan for the future, and if we consider the future then we have to consider a wide variety of benefits that could occur.

#### **Discussion of the Schedule of the Plan and Economic Analysis, and How they Relate.**

Where do we go next, what if the costs are grossly off, will there be time to correct the economic analysis in time to influence the final plan?

Will there be money for an economic analysis of the final plan.

[LCMC staff: The preliminary analysis is funded and there are funds (approx. \$75,000) for an analysis of the final plan. Some feel that is not enough money for the final economic analysis.]

The second phase of the preliminary analysis should be completed in September, and the economic analysis of the final plan should begin in September.

[The final draft plan should be completed by December, 1995, with public hearings in January or Feb, 1996. A similar problem we will have is that the economic analysis of the final draft will be published at about the same time as the public hearings.]

[Part of the second phase is to meet with the various sub-committees to confirm costs.]

It appears that the time frame and the amount of money is too limited for a detailed economic analysis of the final plan.

An analogy from the building trade would be that an architect spent most of the money for designing the building, and only left a small amount to build it, and he used most of the time allowed. Now we have a Plan but so little time and money to evaluate and implement it.

[LCMC staff note that we do not expect an engineering assessment of every wastewater treatment plant in the Basin. But we should be able to get much more geographically specific on the economic impacts.]

Why don't we change the approach. Let's try to do a complete economic analysis and take as much time as necessary to do it. If need be, let's pull in NYS DED, and Cornell, and the other universities in the region. Since there is not much money available, perhaps we can draw in some other resources. NYSDED has never been included in the process.

[LCMC staff: You are involved right now in changing the process. We are trying to level the playing field among the economic interests involved.]

Important to keep in mind that oftentimes decisions are made with little or no economic analysis. People choose, or choose not to do things, based on criteria other than economic. So a complete economic assessment of each Plan element may not be required or necessary. However, there may be some items that you feel very strongly will have economic impacts, and those are the ones we should focus on.

[LCMC staff: and many of the recommendations will change in some form or another during the priority setting sessions of the LCMC.]

Fear that we may end up with no Plan if the business community cannot support it. And no Plan would not be good either. But there does not seem to be enough time for carefully, economic evaluation by the business community.

I thought that is what this session is for, to get more input by the business community.

Do not see how the economic analysis will be completed in time to influence the plan.

Not sure that our comments today, and especially in the Sept session, can really make it into the Plan.

Economics needs more time.

Is there pressure coming down from above to hurry up this Plan? It is frustrating for me, because we still are dealing in generalities in many cases, and I would like to go through this in a lot more detail.

## Identifying Those Plan Items that Appear to Have Adverse Economic Impact in the Basin

There appear to be at least 39 legislative mandates in the Plan. One of the most economically devastating is the Nonpoint Source Item C.4, and others in that section of the Plan that mandate retro-fitting stormwater treatment systems.

C5. would also be extremely expensive. This has been talked about in DEC for years, and I think that if all stormwater is eventually mandated to be treated for pathogens and phosphorus, and separated, it would be a serious blow to our economy.

Concerned about forestry, because it is not mentioned much in the Plan and not addressed in the economic analysis. Concern is that will the forest industry be blindsided because there has not been much discussion.

Plattsburgh Chamber is evaluating the forestry section of the Plan.

Concerned about no mention of non-dairy farming. A lot of former dairy land has high phosphorus levels, so what are the economic implications to someone trying to farm that land.

The fish and wildlife section is focused on the lake, and feel that the value of the tributaries is neglected in terms of over-wintering areas and spawning habitat.

Have not looked seriously at the impact of increased tourism possibly influencing increasing urbanization, which could in turn lead to increased urban run-off problems. There is pre-planning that could be done to help mitigate impacts.

Have a problem with the whole lake approach in terms of phosphorus control, since there only 3 areas of the lake that have been identified with serious phosphorus problems. It appears that those areas are beyond hope, but we are still faced with a whole lake approach. Few are debating the value of future pollution prevention and control. It is the restoration aspect of the plan that is scary. Appears that the problem areas can not be fixed.

Seconding that, definite impact on business and industry to pay for reductions in Cumberland Bay, if phosphorus is not an issue there.

Setting up a septic tank inspection program (Nonpoint Source, Item C. 8) should not be in the Plan. No benefits are identified.

PCB's in Cumberland Bay: fear a predisposition to get into an expensive dredging or encapsulation project.

Managing Fish & Wildlife Action Plan - B1. and B2. the use of indicator species appears to extend the endangered species act to this area, where there are no endangered species other than 5 that pass through the area. Has economic implications.

Nuisance Aquatics (Chapter G)- Not enough attention to zebra mussel threat, more attention needed on the economic impacts of zebra mussels.

Public Access (Chapter H, Section B)- Seems exclusively targeted at tax payer funded improvements and expansion. Should be more attention to private launch facilities (e.g., marinas) as public access points, and the economics involved.

Note that the marina capacity data presented in the preliminary economic analysis is out of date, showing 100% occupancy in the mid-1980s, while at least in Clinton County the occupancy is much lower.

Non-Native plants in the south Lake: The 10 year program to control water chestnuts is losing ground and is seriously under-funded. The plants are a serious threat to tourism and the marina industry in the south Lake.

Concerned about ability to plan for the future and maintaining flexibility in the Plan. A few years ago we were not even thinking about zebra mussels, and now they are becoming a major problem. Need to have flexibility in the Plan and not be locked into a rigid action and spending plan.

Need to include some process to review the Plan in 5 years. Any type of Master Plan is not done forever, but is re-evaluated. This Plan appears to be trying to plan for the next 100 years, any by trying to doing that the impacts and benefits of the actions are vague (warm & fuzzy). Better to concentrate on the most serious problems we have now, then review in 5 years.

Agricultural improvements price tag - \$169,000, is likely too low. Need more economic analysis here, given the value of ag. to our region.

There are also secondary impacts here, if the ag industry is seriously hurt economically, you will see many other businesses and local governments (e.g., property tax, school tax) suffering economically as well.

A tertiary impact could be that as agriculture is negatively impacted, that agricultural land could move to some other developed use, resulting in more pollution.

There are at least 6 or 7 tax breaks among the 167 plan items. No where are they quantified to gauge the over-all economic impact. Someone pays the price of these tax breaks.

Some things were not given enough economic attention, such as:

Linking the marinas in the south lake to the canal system and the economic benefits of that type of cooperative activity;

A community loan fund that would help individuals and business to mitigate lake impacts, for example, improved sewer systems;

Lack of thinking about land swaps: if a farmer can't fence because he is in a flood area, or does not have enough pasture to do rotational grazing, is there not other land he could swap for.

One objection to that last point is that many of our most productive lands are in the riparian zones, so that would result in removing much of ag land (up to 1/3 in Addison Cty), so then you get into many other adverse economic impacts.

How this Plan is going to be implemented, and by who, should be one of the main concerns. While there are many good things in the Plan, there is not much attention paid to the implementation phase.

Concerned about which phosphorus control strategy, as presented in the preliminary economic analysis, will be selected and how.

[LCMC staff note that the LCMC will be deciding, but they may or may not select one of the scenarios presented in the economic analysis.]

Education needs more emphasis, that is where much of the benefit will be. As people become more educated, we will better able to discuss the issues, and understand why they are issues.

Competitiveness is the key economic cost from my perspective in local government. Increase costs for pollution control and sewage treatment may mean lowered ability to attract new industries. So when you look at the benefits of recreation, you need to also factor in the costs in other components of the economy.

[However, tax implications are a two-edge sword, with the possibility of increased taxes from other sectors, such as recreation businesses, etc.]

Competitive implications for paper making in Plattsburgh are also an economic concern.

As they are trying to determine in the Great Lakes, what is the economic benefit of shutting mills down, if that is the end result.

Should note that the Plattsburgh Chamber analysis of the Plan includes many other economic concerns and implications.

### **Identifying Those Plan Items that are Beneficial to the Short and Long Term Interests of the Basin Economy**

The Plan stakes out a moderately aggressive program for control of the lamprey eel. This is appropriate given the economic impact of the eel on the Lake's sport fishery.

Marinas are seeing some positive benefits from the lamprey eel program. See more fishing boats at our VT marina, and out of state people are beginning to leave their boats here. We could have a world class fishery here if things continue positively as they are.

Our marina capacity in VT is about 85% to 90%. We had about 10% Canadian, now only 1%. Impacts in NY related to Canadian declining use are more severe, since Canadians comprise as much as 90% of business. So decline in Canadian trade has differential impacts for NY & VT.

Plattsburgh Chamber supports the Plan items supporting fisheries, with the exception of the endangered species items.

The many Plan items on education and demonstration projects are positive, and especially supported by those of us who do not approve of government mandates and increased government intervention.

The agricultural interests support demonstration projects as well.

The education also helps to dispel the notion that Lake Champlain is dirty.

The Lake is as clean as its been in our lifetime.

The tourism promotion aspects, such as the Bikeways, are very positive, economic benefits.

The agriculture community is watching the Bikeways effort with some concern. Are the normal and usual practices we do going to be compatible with recreation, such as spreading manure, using fertilizers and pesticides, and farmers using the roads to get their equipment from field to field? Are there property rights implications?

Economic linkage between cultural and heritage resources and the lake should help local economies and encourage education of local residents on what we have.

The Plattsburgh Chamber agrees, as long as it is voluntary, and that there is no Interior Dept jurisdiction anywhere in the Basin.

This concerns me on where we are going with this. We should be concentrating on the water quality problems, and fish & wildlife. To what degree should we focus on these other issues. Seems like if we clean up the Lake, some of these other items (tourism) would be self generating. If we have a clean lake, the fisheries industry and the tourism industry will improve, but that is a second step. If we put our money there instead (tourism) they we might actually slow down the process, because we haven't done what needs to be done to attract people in the first place: clean up the lake. As we clean up the lake, these other things would just start to happen. If we focus on tourism, and we do not have the attributes they are looking for, they are not going to come back. How are we going to set priorities.

This relates to that we cannot do a cost benefit analysis on every item in the Plan. Need to focus.

The Plan starts to look at a sub-basin approach, and that is good and should be expanded. It results in a more ecologically sensitive approach, is more efficient, and is more cost effective. The Basin Program people deserve a great deal of credit for introducing the sub-basin concept, but do not take it nearly far enough. It is long over-due in dealing with this lake. There are many hot spots around the Lake, such as Wilcox Bay, Malletts Bay (traffic, recreation), but Malletts Bay is not Rouses Point. So you need to look at specific areas, not one size fits all. In many areas of the lake, state and federal involvement or funding is not necessary.

One caution or question is that if we go with priority watersheds, will the rules on agriculture get more strict, and get more into mandates and less on voluntary action. I am in a priority watershed, and I still have not seen much increase in funding for ag. programs. So I am concerned that funding is available if the rules get stricter.

Another example is archeological sensitive areas.

In traveling the country, I am impressed with the amount of private sector involvement in cultural and heritage sites and other amenities. For example, an IBM bicycle path would be great, because it does not come out of the taxpayers' pocket.

An example is the fort in Charlestown NH from the 1700s, and it has been operated solely on private funding to my knowledge. Ausable Chasm is another example, as is Fort Ticonderoga. Can't we pull in private funding in Plan to a greater extent than at present.

Private funding is included in the Plan in places, but mostly in terms of wetlands, streambank erosion.

My earlier comment on the lack of addressing the private marinas as providers of access relates to this point.

It is difficult to put an economic value on improving and protecting habitat and biota, that is addressed in parts of the Plan.

[How does the Lake and its amenities relate to attracting business to the area, or in attracting and retaining a higher caliber employee?]

There is an aspect where we can attract good employees who want to leave cities and live in this type of environment.

There are site selection decisions based on the bosses interest in sailing, but those are the exceptions. Most site selection is based on dollars and cents. Most of the new business in on this side of the Lake, in the north, are Canadian based, and the Lake seems to be an important factor is their deciding to locate here.

I worked in recruiting for IBM for a number of years, and quality of life is very important in attracting good employees. So it is a factor in selecting a new site for a business.

It is a large lake, so the water quality problems you see depend greatly on where you are. In VT, Lake Champlain is one of the few lakes with an health advisory.

## Information Gaps

Toxics - C2 - new reduction rules for new generators. Who are these generators? What are the impacts of these increased standards? Does every business in the Basin need to get new light fixtures? We do not know?

What impact will zebra mussels have on the reduction of phosphorus? Not addressed in the Plan.

[LCMC staff: we are pulling in information from the Great Lakes, NALMS, etc.]

How does reduced phosphorus affect sludge and sludge disposal and what are the economic implications to wastewater treatment plants?

Also brought up by the City of Plattsburgh. In addition there are odor implications.

Virtually everything in the nonpoint source chapter is weak on science and cause & effect. The science just isn't there. Applies to urban controls, private septic, agriculture, etc. the impacts and benefits of control just are not there.

No figures on rotational grazing and the impacts on phosphorus.

No comparison between pucker brush and active crops in terms of phosphorus run-off on the same land. If you give up the farm do you worsen the phosphorus situation, maybe you do.

Will the reduction of phosphorus actually give us the improvement we think, will we see the results. If we spend millions of dollars, and then see no improvement, then obviously we have wasted our financial resources.

Up-dated debt service and O & M figures are needed for wastewater treatment plants.

Consistency between NY and VT, and how the new regulations are going to be implemented. Everyone is pushing for this .8 mg discharge, but looks like it will be applied differently. 100% funding in VT, but we in NY will have to do it whether the funding is there or not. Concern is both with consistency of the standard and consistency of its application.

Do treatment plants have the capacity to take more sewage if private households are encouraged to pump more frequently. Hard to find a plant to take sewage in Essex Cty NY, especially in winter.

There is a gap in terms of outcomes. What is the downside of success. If we are successful in cleaning up the lake, and there is more economic activity, what are the costs in terms of roads, infrastructure, etc.

One of the major failures of the Plan is to prioritize in advance. Prioritization would have helped us to focus our discussions. It has created kind of a free for all, because no one knows how to spend useful time getting at the characteristics of the important issues.

Another way to look at it - does the Plan bite off more than anyone can chew. It really seems like a tremendously big agenda, too large to be managed. Put the brakes on, but the thing in neutral, and start prioritizing.

[Prioritization will take place at next LCMC meeting.]

But how can prioritization take place, without the economic analysis as a filter. Certainly economics should be a major filter in any prioritization process. I do not know how it can go on without some of the information brought up by people here today.

Prioritization will pertain directly to the efficient use of the \$75,000 available for economic analysis of the final plan.

*Following are specific questions submitted by John Ruff, environmental manager, City of Plattsburgh, by letter following the focus group session:*

On the preliminary economic analysis report (Technical Report 12B):

1. Table 5-11: From where did the personnel, contract, and debt service numbers come? On what were the capital outlay costs based? On what were the annualized upgrade costs based?

2. What is the difference between the Appendix A Tables on pages 1-6, 7-12, and 13-18?

3. Concerning Appendix A:

Page 13: What does the 1.74 next to Plattsburgh signify? The existing concentration since 1992 has averaged 0.88 mg/l. Page 14: What type of retrofits are assumed?

Page 15 & 16: What do the numbers in columns 2, 3, & 4 represent? What is type AS? Activated Sludge? What type of retrofits are assumed? What were the costs based on? Design flow should be 16 mgd. Total costs for Policy 2 do not appear to add up.

Page 17 & 18: How were these costs determined?

Once the above information is provided, further review can be provided to ensure data accuracy. Please contact me if you have any questions.

### **Final Comments and the Sept 8 Session**

Should we meet more often, before the Sept 8 meeting?

We did not get very specific today, we hit mainly on generalities. Finally we are getting to a discussion of economics after 5 years into this Plan, and will have difficulty covering the specifics with only one more meeting.

The economists' work will be almost done by Sept 8.

We should sit down with those involved in developing the costs.

[Artuso will be participating in Sept.]

[The consultant has limited time.]

[There are economic discussion meetings being scheduled when the economic consultants will sit down with technical advisory committee chairs and members to focus in on cost estimates. Those here who are interested could attend those meetings, a schedule will be distributed to all participants when it is finalized. These will be informal, with opportunity to participate.]

A delegation from this group might want to address the LCMC. However, we never intended to reach consensus or develop a group position.

Still difficult to tell if we are going to have an impact on the process, not sure if I wasted my time today.

The pieces of information are missing: the prioritization, independent of cost. Then once we have the priorities, we can look at cost and see where we can afford to take action.

So we will need the up-dated cost figures by then. If we see incorrect data, we can provide you with new data, it is as simple as that.

[LCMC staff: At the next meeting, Tim will be presenting the mechanism that he will give to the LCMC to do their economic analysis, how you make a judgment on which recommendations have greater benefits than costs. That will be very useful to get this groups input, and then to perhaps meet after the Sept meeting.]

The timeframe is so tight however, now is when the work needs to be done, the next 60 to 90 days.

At the next meeting, we will likely have a larger group, possibly 35 people compared to 25 today. So it may be more productive to break into smaller groups on specific issues.

Concerned that the whole group hears a summary though, because it has been very useful today to learn some of the problems for municipalities that relate to agriculture.



Who is going to get the answers to the questions and concerns that were brought up today?  
[Some will be provided in on-going research. Some of the specific economic questions related to incorrect data will be corrected by the economic consultant. Some of the big picture issues will have to be resolved in other technical committee work sessions.]

Will the notes from this session be distributed to the participants? [yes].

**Appendix B**

**Economic Focus Group Session, #2**

# HOLMES & ASSOCIATES

PO Box 295  
Saranac Lake, New York 12983  
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E-mail: tph1@aol.com

2 October, 1995

Dear Lake Champlain Economics Focus Group Participant:

Attached is a summary of the second economics focus group session, held September 8 at Champlain College. There were 9 individuals participating (7 from VT, 2 NY). While the numbers were smaller than in the first session, a wide range of interests were represented, including industry, agriculture, forestry, business, recreation, and the City of Burlington. Six Basin Program staff, consultants, and resource persons also were present, taking notes, answering questions, and asking for clarifications. One of the economic consultants, Anthony Artuso, joined the discussion from the University of Charleston through a teleconference connection.

The main discussion centered on specific measures to boost economy and business while protecting Lake Champlain, and at least 11 distinct proposals were offered and discussed. Most seemed to be heartily supported by the group present, although there was no attempt at a group consensus. Some of the main themes running through the ideas include the following:

1. **Innovation, ideas, creativity - all needs to be encouraged in the private sector and supported by government.** This is how economically efficient and equitable environmental change comes about. There are already numerous examples at the state and national levels. The EPA's "Golden Carrot Award" and the NYSDEC Governor's Award are two examples, whereby government recognizes and rewards innovation in business in terms of protecting the environment. One problem is that while government sponsors these awards, they do not seem to participate themselves. Would like to see an award program for innovation and efficiency for government employees and departments.
2. **Pollution prevention is key to cleaning up the lake, and prevention is tied to the encouragement of innovation, as noted in 1 above.** Prevention is good for business, and industry continues to develop new ideas for pollution prevention. Industry knows that it is cheaper to prevent pollution at the source, than it is to remove it after it leaves the end of the pipe. The organization of retired engineers (REAP) and other organizations are already working in the Basin to facilitate the move towards pollution prevention. In addition, solving pollution problems can directly help the local economy. One example is Living Technologies in VT, just awarded a \$1 million contract in the UK. Pollution prevention also involves revising our approach to regulation. There are pilot projects in Addison Cty, where performance based septic systems are being installed, rather than design based. Design based regulations can result in bigger lots, rather than addressing the real problem of controlling waste.

3. **There is a role for government in preventing pollution and protecting economies.** Government has helped start loan programs, such as the Northern Community Investment Corporation, that has helped numerous businesses in northern VT and NH. The City of Burlington has been involved in developing the new wood-chip gasifier plant and the Lake Champlain Science Center on the waterfront. Marketing, tax issues, and identifying business opportunities are other areas where government can play a positive role. From an economic viewpoint, government can be more effective as a catalyst, than a regulator.
4. **On-going Lake Champlain planning efforts must facilitate and accommodate the participation of economic interests.** There does not seem to be that much disconnect between economic and environmental concerns, but problems inevitably arise when economic interests are not invited to the table. However, there are a number of barriers to effectively including the business community, including: too many meetings already; the business person cannot afford to be away from the business very often, especially during the day and late at night; they often do not have staff paid to attend meetings; and, there is an intimidation factor for the small business person. Implementation plans need to address how to maintain the involvement of economic interests.

In addition to this type of thoughtful, creative discussion on turning protection of the lake into a net positive for the local economy, the participants discussed concerns about the planning process itself. We received an up-date on the schedule of the plan and its current status. We also discussed some of the remaining economic analyses, including the Final Economic Analysis, scheduled to begin in October. Sustainability concepts, land use data, and the compatibility of agriculture and bicycle tourism were also major areas of discussion.

This was the second of two economic focus group sessions formally requested for the Lake Champlain planning effort. The group present was very supportive of somehow continuing the involvement of economic interests in the planning and implementation. It was proposed that the economic focus group be kept informed of progress on the final economic analysis, and perhaps meet again to discuss that work.

Thanks again for your interest in Lake Champlain economic issues.

Sincerely,

Timothy P. Holmes

# HOLMES & ASSOCIATES

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## Preliminary Agenda

**Lake Champlain Draft Opportunities for Action: Economic Focus Group Session, #2**  
Champlain College, September 8, 1995

- 8:30 AM Welcome, introductions, schedule for the morning
- 8:45 Update on plan formulation process and revised schedule of LCBP
- 9:00 Report on high priority issues emanating from Management  
Conference deliberations
- 9:15 Response to questions and issues raised at July meeting
- 9:30 Specific measures to boost economy and business while protecting  
Lake Champlain; Creative approaches to Plan implementation.  
(See suggested topics, next page)
- 11:45 Summary of results/accomplishments and discussion.
- 12:25 PM Next Steps and Adjourn.

## **Main areas of concern expressed in the 1st Economics Focus Group Session:**

- Economic impact - define primary, secondary and tertiary impacts? Of what programs in particular do detailed analyses make sense? What to do when economic analysis is difficult or impossible? How should impact analyses be done, by whom?
- Priority setting - how to do it? Where and why is it necessary? What are the first, second, third fourth and fifth things to be done? (see preliminary decision making framework).
- Private sector involvement - demonstration projects? Specific areas for coordination? Matching public grants?
- Positive economic benefits - how to measure? How to tie to environmental improvements? Short or long term? Benefits for whom?

## **Other areas of concern:**

- Community loan program/trust funds - one program or one per community? Models to be used? Demonstration possibilities?
- Assist local/regional planning - money grants, seminars, cooperative publications?
- Roles of watershed groups - making more effective use of volunteers? Cooperatively produced publications? Focus activities on such-and-such priority concerns?
- Monitoring - who, when, how, and where?
- Incentives for wetland protection - monetary incentives? Regulatory relief? Compensatory measures?
- Coordination/integration of agencies and organizations - specific steps to be taken? Lead agency concept? How to avoid duplication? Consolidation of budgets?
- Strategy development - models for strategy development? Elements of a strategy? Measure/monitor success?
- Consistency - where critical? Where unimportant? What does consistency mean?
- Educational and demonstration projects - how to do? Standards to be met? How to transfer information? Types of projects where effective approach?
- Indicator species - best application and why? Specificity on applicable species and where?
- Risk assessments - where essential? How to conduct?

# **Lake Champlain Draft Opportunities for Action Economic Focus Group Session #2: List of Participants**

Champlain College, September 8, 1995

First Name	Last	Company	Area	Fax Number	Phone	Address	City	State	Zip
John	Barta	Adirondack Park Agency	518		891-4050	PO Box 99	Ray Brook	NY	12977
Lisa	Borre	Lake Champlain Basin Program	802	372-6131	372-3213	54 West Shore Rd	Grand Isle	VT	05458
Tommy	Brown	Cornell University, Fernow Hall	607	255-0349	255-7695	Depart of Natural Resources	Ithaca	NY	14853-3001
Bruce	Burgess	Bicycle Federation of America	802	388-3299	388-2453	Route 3, Box 2394	Middlebury	VT	05753
Robert	DePaulma	Lake Champlain Chamber of Comm	802	658-0042		1 Church St	Burlington	VT	05402
Garry	Douglas	Plattsburgh & Clinton Cty Chamber	518	563-1028	563-1000	PO Box 310	Plattsburgh	NY	12901
Gary	Frenia	Georgia Pacific	518	561-8339	561-3500	327 Margaret St	Plattsburgh	NY	12901
Timothy	Holmes	Holmes & Associates	518	891-6525	891-6525	PO Box 295	Saranac Lake	NY	12983
Peter	Kreisel	VT Citizens Advisory Comm.	802	863-1232	863-1641	550 Hinesburg Rd, Suite 101	S. Burlington	VT	05403
Barry	Lawson	Barry Lawson Associates	802	592-3950	592-3950	PO Box 26	Peacham	VT	05862
Bill	Paine	Green Mtn Dairy Farmers Coop	802	mail	453-2691	330 East St	New Haven	VT	05472
Eric	Perkins	Lake Champlain Basin Program	802	372-6131	372-3213	54 West Shore Rd	Grand Isle	VT	05458
William	Sayre	The A. Johnson Company	802		453-4884	Rt 116, Box 9000	Bristol	VT	05443
Bruce	Seifer	Community & Econ Dev Office	802	865-7024	865-7179	City Hall	Burlington	VT	05401
Harvey	Smith	Addison Cty Farm Bureau	802	877-2712	877-2712	Box 82A	New Haven	VT	05472

**Lake Champlain Draft Opportunities for Action  
Economic Focus Group Session #2:  
Summary of Comments and Discussion**

[Note that the comments are by individuals; there was no organized attempt to reach consensus or to produce a group statement or position.]

**Discussion of the Schedule of the Plan and Economic Analysis, and How they Relate.**

(question or issue is against margin, response from consultants or staff indented underneath).

The LCMC is currently involved in priority setting of Plan action items.

During their past two meetings, and at future meetings.

The trend so far is that about 1/3 of the actions are priority items.

Non-point source and nutrients will be discussed at the next LCMC meeting.

Within the priority list, will likely pick 1 or 2 from each chapter to highlight as the top priorities for the Plan.

The priority process is consensus based, disagreements are reconciled.

There are two more economic studies to be completed.

The second part of the economic analysis, currently in progress, of which this focus group session is one aspect.

The Part I & II Preliminary Economic analysis will contribute to an economics chapter in the final plan.

And an Economic Analysis of the Final Plan, which is going out for bid soon. The work will occur between October and February.

The Final analysis will focus on priority items, intended as a companion document to final plan.

Concern that the Plan Formulation Team (PFT) has the preliminary report by Sept 27 meeting.

They will have the report by that meeting.

The Final Plan will likely be a short document, bare bones, about 50 pages, highlighting priority actions.

The background material, presented in the draft Plan, will not be part of the formal plan, will be published separately.

**Dialogue on the Economic Analysis Completed to Date**

(question or issue is against margin, response from consultants or staff indented underneath).

Went over draft materials for the Part II Economic Analysis.

Questions from the 1st Focus Group Session:

We learned that fiscal data for the Town of Champlain, presented in the Part I report was a few years out of date. The Town provided up-dated information. Is a similar up-date going to be done on the other Towns?

Staff will start work on that, not the consultant at this point.

Will contact local gov'ts to update debt service, wastewater treatment costs, and loading data.



John Ruff, City of Plattsburgh Engineer submitted a list of questions on the phosphorus control model to the economics study team.

We have passed those on to Eric Smeltzer, Vermont Water Quality, since many of his questions related to the Diagnostic Feasibility Study. Plan to respond to him in writing by next week.

**New Issues:**

(question or issue is against margin, response from consultants or staff indented underneath).

What about the potential impact of zebra mussels on nutrients in the lake? How is that going to be addressed in the economics report?

Not enough information at this time to address it.

When will we see specific costs data on up-grading treatment plants?

Will be in the final economic assessment, only related to the priority recommendations.

The preliminary economic analysis of the nutrients chapter, section B. Point Source Reduction Alternatives, may need to be up-dated to reflect NY State's position on point source reductions.

The economic consultants will review that section in light of this comment.

Staff will review this as well.

What is the status of the current land use data? Concerned that agricultural recommendations are based on 1970s land use.

The new, revised land use up-date will not be available for 6 months or so.

The urban land use information has been corrected to some degree based on 1990 population data.

The agricultural land use information is actually very current, because it is based on contemporary animal units data.

The economic analysis does not address changing land use, urban development to any great degree.

Is that agricultural information really good enough, is the Plan based on accurate information? A correct representation of that balance between farm land and urban land is critical to this whole planning effort. Urbanization is increasing in rural areas, the ag community wants to be sure that the cost of lake water improvement is not falling unfairly on agriculture because of this undocumented rural urbanization.

The correlations of old land use data to new in-stream phosphorus levels seems to be accurate, but there are continually uncertainties.

This is why the economic consultants have noted the value of an incremental approach for some actions in the plan. To do what makes obvious sense first, then to annually review whether to extend the activity based on effectiveness, and in light of new information as it becomes available.

There are some areas where there is a good argument for immediate action. For example, some of the point sources, maybe 1/2 dozen treatment plants on each side of the lake.

And there are other examples, where the cost of no action rises substantially in the short term, or where there may be irreversible losses if no action is taken.

Examples might be BMP controls on new development, where it is vastly more expensive to control or remove phosphorus after the fact.

Wetlands is another example, where if valuable wetlands are not protected now, it is much more expensive to restore or replace after they are lost.

The agricultural community is committed to reducing in lake phosphorus, and is especially supportive of the demonstration project approach. Successful, cost effective activities would be picked up fast by other farmers.

The draft preliminary economic analysis on Toxics is interesting, though somewhat divisive in the PFT. Some members are concerned that the economic analysis is weighted too much on human health risks, and not enough on ecological factors. Others agree that is where the emphasis should lie.

The presentation as written may have given that impression, but the intent was to address comprehensive impacts and costs. Our approach to ecological issues does figure in related risks to human populations. There is more uncertainty surrounding costs and our obligation to ecosystems when there is no discernible impact on humans.

The economic consultants will be developing a clearer definition of costs and benefits. Our use of those terms is very broad, beyond just monetary costs. Includes aesthetic, recreational, and spiritual values of a clean environment. Similarly, risks include indirect risks, and risks to the ecosystem.

What about forestry? Still do not see much attention to it in the Plan. Does not seem to be a priority. Is that still true? Concerned because a lot of the concerns we have about agriculture, apply to forestry as well. Could also be expanded to gravel, granite, and other natural resources.

### **Discussion of Sustainability, How it is defined in the Plan.**

How is sustainability defined in the Plan? Agriculture has been sustainable for 1,000s of years now, same with forestry. So want to be clear on how sustainability is defined, and ensure that the key players in various industries are included in the discussion.

There is currently a demonstration project on sustainable forestry in Northern Vermont, funded through the Basin program.

Basin program recognizes the value of forest products in both NY and VT.

There are different attitudes toward sustainability. Some people think it is a total hands off approach. As a farmer, I think it means what we use what has been successful in the past along with new ideas and techniques as they become available, an evolving approach.

The glossary in the Plan, page 10, defines sustainable use. The ag community disagrees with the agricultural example, and recommend taking it out; mentions "avoid the use of pesticides and chemical fertilizers..." That is unacceptable. Defining sustainable agriculture needs input from real players. The goal should be strengthening industry (agriculture/forestry). Sustainability should include human management, and the flexibility to use new technology (e.g., chemical fertilizer use w/ discretion).

Will be revising that definition.

### **Discussion on Compatibility of Bicycling and Agriculture**

The indented statements are additional comments by participants.

In looking over the minutes from the first focus group session, there appears to be a misunderstanding related to promotion of bikeways in the Plan. The focus is on bicycle routes on public roads (Recreation p20, C1b). The mention of segments not on public roads may be an error, the bikeways program has no intention beyond public right of ways. According to conversations with the VT Farm Bureau, they have no concern or policy on bicycles use of roads.

The Farm Bureau has policies on recreational uses in agricultural areas, and concerns about compatibility of uses. For example, liquid manure, manure on roads, cattle crossings, dirt on roads, use of herbicides next to bikeways, etc. Are these compatible with recreational use? The farm community is not sure.

Some farmers also have a problem with some of the land use and respect for private property ethics of bicyclists. There have been bad experiences with bicyclists or others failing to close gates, picking fruits and vegetables out of road side fields.

These are the types of issues that may need to be addressed, but we are not standing in the way of use of public right of ways.

Sounds like the recreation community needs to sit down with the farm community. We need to answer some of these questions. It is my experience, from the bicycle community, that there is no conflict between agriculture and bicyclists. There seems to be a long history of harmonious relationships between the two, and both benefit the economy of our region.

Forest land owners have been working on many of these same issues and concerns for a number of years. Some forest land owners have found that giving permission for recreationists to use private roads and trails was a mistake. There seem to be some new conflicts emerging, with the recreation community now criticizing working landscapes as somehow infringing on their recreational use of what is really private, working forest.

Recreation community is attracted to those types of wild lands.

Yes, they are so attracted they do not want anything to change on those lands.

So it is not just the bicyclists, maybe not even just recreational users, but a whole compatibility issue of farming and timber harvesting with the image people have for a given landscape.

Sounds like there is a need for greater respect for the private, working landscape, as is more evident in Europe.

The VT Assoc of Snow Travelers (VAST) has a well defined approach to ethics of use.

Example of Snake Mtn, related to use of old road to hotel, indicates our failure to educate users.

### **Specific measures to boost economy and business while protecting Lake Champlain**

A number of specific, unique ideas were offered, numbered consecutively below.

1. Ideas are where success begins. We need to encourage competition on ideas, involve corporate sponsorship in developing ideas, gathering data.  
There are number of examples of competitions to find the best ideas to solve a particular problem. Why don't we develop interest in the private sector and government to sponsor a competition to find the best solutions for keeping phosphorus on the land for example.  
One example is the Golden Carrot Award, was a competition sponsored by the EPA to develop a low energy refrigerator.
2. We need to factor economic aspects into scientific analysis. Where is economy going? Finding economic opportunity is a shifting problem.  
We have the issue of the Barge Canal in Burlington, a \$50 million EPA proposal was rejected by the community.  
We have this large area of developable land. How do you factor in economic development issues?
3. Solving environmental problems could help the local economy.  
One example of an economic success of in terms of environment issues is the Bartlett Bay sewage treatment plant. New technology is being used in that plant, and the company developing it is based in Vermont, Living Technologies. They just recently won a \$1 million contract in the United Kingdom to bring their technology there.  
So we have the ability to sell our environmental solutions.
4. We need to connect to unique opportunities in the Lake Champlain Basin. There are "unique" characteristics of Basin region, mainly centered on small business and open agricultural areas. We need economic development that does not change the character of the area. And government should support these enterprises, not usurp them.

One example from the Basin program is how the government sponsored Lake Champlain Bikeways Committee has helped start the process of developing and promoting the region for bicycling, but is now stepping aside as private business, local Chambers, guide book publishers, etc. pick up on the activities.

Another example is the agricultural tourism that is starting to take off in the region, with some of the initial support coming from government initiative.

5. The agricultural and forest products businesses agree on the uniqueness of the area, and believe that agricultural and forestry are appropriate uses, especially in terms of water quality. So a major issue is, how do we maintain the economic vitality of these enterprises?

Even though agriculture is a large contributor of phosphorus, on a percentage basis in terms of P. per acre, it is lower than urban land. Economic analysis should look at least cost ways to protect agriculture and forestry.

Tax issue is the biggest problem, next are regulatory regimes.

There are direct costs associated with monitoring and compliance. If there are any more regulations, they will drive farmers out of business. So education is the way to go. Because more regulation will result in more abandonment of farms, leading to developed land and a more expensive and difficult process to reduce phosphorus loading off of those developed lands.

Marketing is a problem. NY does not assist agriculture in marketing an Adirondack North Country image. For example, North Country syrup producers sell most of their syrup in bulk in Boston and New York City. NY produces as much syrup as Vermont, but who wants "Adirondack" syrup? Need to build a "Champlain" and an "Adirondack" image in NY.

6. The ongoing governance process in Lake Champlain planning must include a specific effort to ensure adequate representation for economic interests around the Basin.

There is not that much disconnect between environmental and economic concerns. Main problem comes when economic concerns are not invited to the table. Economic, business considerations cannot be an afterthought.

7. A related concern to involving economic interests, is the need to facilitate and accommodate participation. We have trouble attending all the boards, committees, and groups that affect agriculture.

There are too many meetings now, and too many different organizations involved in land use issues (e.g., watershed groups, regional planning bds, town planning bds) for the farm community to adequately participate in them all. I am going to meetings all the time, and sometimes I am the only private business person (farmer) there.

This is a serious problem. Many organizations are represented by paid staff (e.g., environmental groups, state agencies), but we are not paid to attend meetings. Private business people cannot afford to attend many meetings. We are out there working, trying to make a living, contribute to the economy, etc.

A related problem is the timing of meetings. Meetings during the day are tough for us to attend, as are late night meetings. Need adequate lead time. There is also an intimidation factor involved, with the small business person not always accustomed to speaking up in a public forum.

As a result, recommendations tend to be biased towards the backgrounds of those who do have the time and ability to participate in those forums.

Chambers of Commerce could possibly act as the representation of some business interests, they are paid to represent their constituents at these types of meetings.

Some organizations might have to hire or contract out for people to attend meetings and represent their interests - but expensive and difficult to find the necessary expertise.

8. Economic concerns should focus on positive, results-oriented ideas; and, is there a role for government.

For example we have the Harbor Watch, with many business advertisements demonstrating that there is an active boating economy around the lake.

Burlington just broke ground on a new wood-chip gasifier power plant, a community effort, public owned.

The new lake study center being developed in Burlington, a joint effort of the city, colleges, and many organizations. Government is playing a role here.

As stated earlier, we should focus on our unique resources. The new work in the marble and calcium carbonate. The marble industry was suffering, now new uses for calcium carbonate is reviving the industry. Now there are plans for a granite museum in Barre.

There are likely research opportunities related to some of these unique resources in the basin. Similarly, new tourism opportunities, the "rock of ages" tour attracts 50,000 people per year, could be expanded to include other mineral resources.

There is a model to help new development happen. The Northern Community Investment Corporation operates in northern VT and New Hampshire and is government aided. They have an \$8,000,000 loan fund, make about 200 loans per year. This type of loan fund would be valuable in the Lake Champlain Basin.

One approach for identifying needed businesses is the location quotient analysis. We identified business opportunities in Burlington in 1984, and once we identified those niches, businesses quickly started moving in to fill them. Businesses are greatly in need of that type of information. So there is a role for government, if government takes an action oriented approach and helps to provide the vision, here is where we are going..., then business will begin to pick up on it.

9. Pollution prevention is really key to improving the lake, and private industry is an active participant in pollution prevention. We are developing BMPs on our own, to save money. It is cheaper to prevent pollution at the source, than it is to remove it after it comes out the end of the pipe.

But I am not sure that the Basin program is really aware of all the private pollution prevention initiatives that are going on in the Basin.

It would be useful for the Basin program to identify and list the private initiatives.

NYSDEC already has programs where they recognize companies for developing new, innovative, effective pollution control programs. The Governor's Award recognizes these businesses. VT must have a similar program. Must be a database of these innovative programs.

As one component in a large industry, we are always looking at other units in our organizations to see what new things they are doing in pollution prevention.

One example is tire fuel, chipping tires and using them for fuel.

Another related example is REAP, a program for retired engineers to help businesses.

Connie Leach Bisson 802-229-1930 is one contact.

I would like to see this type of award program for innovation and efficiency turned back on government itself. That is where we need this type of activity. We are starting to see more attention to this in the new NY state government administration.

10. We need to revise our approach to regulation. For example septic systems, we should be requiring systems that are performance based not just design based.

The design based septic regulations result in people trying to get around the rules by using bigger lots.

There is currently a demonstration project in Addison County to test new systems that are being tried in other parts of the country. Have 4 pilot projects going, demonstrating innovative change from standard design approach. They are better systems than what is required by the regulations, but as the regulations now stand, these new systems do not comply. One contact is in the VT Dept of Housing and Community Affairs (Peg Elmer). Judy Bond is project coordinator (802) 899-4347.

11. One issue not addressed in much detail in the plan is development, conversion of pasture land or wood land, to housing and other types of development.

(Some participants referred to this as sprawl, others as growth.)

One problem is that empty buildings are available for use in some of our communities, yet some companies come in and build a new building instead of using existing infrastructure.

Use of existing buildings would be better for our communities. One recent example is a federal office moving from downtown to a converted cow pasture. There are many costs to urban sprawl.

Tele-conference next week: President's Council on Sustainable Development: Costs of Sprawl.

Today's urban center was yesterdays "sprawl", so I prefer to call it development. I support well-planned growth, rather than opposing sprawl.

Traffic on VT roads is increasing at a greater rate than the population, we are losing our low volume roadways. Auto trips have doubled in the past 20 years. We need to think about deterring single occupancy vehicles.

## **Next Steps**

Let business forum people know how these ideas are or could be used.

Incorporate ideas into the economic analysis.

Provide notes to Basin Program staff for incorporation in reports

Report back to larger group, e.g. to Management Conference.

Try to maintain an ongoing conversation without need for meetings.

Perhaps a chance to review "minutes"

Economic focus group to review next economic report study.

Continuing representation of economic interests, perhaps reconvene every 2 to 3 months.

Next appropriate time for business reaction - late November maybe.

## **Descriptions of Relevant Projects Funded by the LCBP**

Several of the examples of innovative projects cited by focus group participants are being funded by the Basin Program. Participants asked that information on these projects be added to the meeting summary. Brief descriptions of three of these projects are included below, more information can be obtained from the project contact persons, or Eric Perkins at LCBP (800) 468-5227.

***Alternative Sewage Treatment Monitoring and Demonstration Project - Addison County Regional Planning Commission/Vermont On-site Sewage Committee/Vermont Agency of Natural Resources. Amount funded: \$73,863. Contact person: Judy Bond: (802) 899-4373.***

Three organizations have joined together to install and monitor four replacement on-site sewage treatment facilities in Addison County, VT. The facilities include a recirculating sand filter, an intermittent sand filter, a constructed wetland and a one-trench mound. Each site will be monitored for a period of one year and results will be used to educate homeowners, businesses, and policy makers on the availability and feasibility of alternative on-site technologies. Organized tours of all four facilities are scheduled for October (1995).

***Technical Assistance on Pollution Prevention for the Vehicle Service Industry - Retired Engineers and Professionals (REAP), Montpelier VT. Amount funded: \$17,722. Contact person: Connie Leach Bisson (802) 223-6840.***

Trained, retired engineers are providing on-site assistance to vehicle service employees interested in designing and implementing waste reduction and pollution prevention measures. The goal of the program is to reduce environmental impacts generated by the vehicle service industry in the Lake Champlain basin. This funding is enabling REAP to expand a 1994 pilot pollution prevention program for vehicle service facilities that was very well received by the industry. The REAP program in Vermont is now in its third year, and has provided on-site technical assistance to more than 50 industries in the State.

***A Sustainable Working Forest and Competitive Wood Products Industry - Economic Development Council of Northern Vermont. Amount funded: \$20,000. Contact person: Philippe Trotin (802) 524-4546.***

Based on the premise that forest land provides both environmental and economic benefits to the Basin, this project is establishing a flexible business network to help wood products manufacturers in the Basin (NY and VT) collaborate to meet common challenges, pursue new market opportunities, and compete more effectively with larger firms outside the Basin. The project is also providing education on the environmental and economic benefits of compliance with forest management practices designed to protect water quality.

## **Glossary of Economic Terms and Concepts**

**Benefit (Recreation)** - A proxy for the economic value of all the psychological satisfactions from outdoor recreation activities. This is identical to a widely accepted meaning of the economic term "utility" (Walsh 1986:44-45). Total benefit is the maximum amount of money consumers would be willing to pay rather than give up the recreation activity (Walsh 1986:130).

**Benefits Transfer** - The use of information from existing nonmarket valuation studies to develop value estimates for another valuation problem. It can reduce both the calendar time and resources needed to develop original estimates of values for environmental commodities (USEPA Policy, Planning, and Evaluation 1993:3).

**Benefit Valuation (Economic)** - Measuring in dollars how much the people affected by some policy will gain from it. They are not forecasts, and they usually do not attempt to predict other exogenous influences on people's behavior. Instead, a predefined set of conditions is assumed to characterize the nonpolicy variables. Then benefit estimates are derived by focusing on the effects of the conditions assumed to be changed by the policy (USEPA Policy, Planning, and Evaluation 1993:45).

**Bequest Values** - Bequest values are based on the satisfaction that individuals derive from knowing their children, or future generations in general, will be able to enjoy a clean(er) environment.

**Carrying Capacity** - The maximum population of a given species which a particular habitat can support indefinitely (under specified technology and organization, in the case of the human species).

**Cost/Benefit Analysis** - Ratio of dollar cost of project to dollar benefit it will produce, used to compare worthiness of various proposed projects.

**Comprehensive Income** - An economic measure of the total benefits from all life's activities, including recreation. It is the sum of how much consumers would be willing to pay for each of life's activities rather than forego them. There are four components of comprehensive income: (1) the market value of goods and services that consumers purchase with dollars from regular income or savings; (2) the willingness to pay for self-sufficiency goods and services that consumers produce for themselves; (3) the opportunity cost of leisure time that consumers commit to the activities; and (4) the consumer and producer surplus to individuals, representing the net benefits of all life's activities over and above consumer costs in dollars, effort, and time (Walsh 1986:57).

**Consumer Surplus** - The value to consumers of the opportunity to buy units of a good at a particular price. In terms of recreation, the value that participants derive from the recreation activity above and beyond what they actually spend on the activity. Asking people what they are willing to pay is a way of assigning dollar values to this consumer surplus and obtaining a more complete estimate of how much the recreation activity is worth to the participants (Vermont Department of Forests, Parks, and Recreation 1995). (see also: Recreation Benefit Valuation, Willingness to Pay).



**Contingent Valuation Approach** - As a method of providing acceptable economic measures of the benefits of recreation activities and resources, this approach relies on the stated intentions of a cross-section of the affected population to pay for recreation activities or resources contingent on hypothetical changes in their availability depicted in color photos or maps. The values reported represent the maximum willingness to pay rather than forego the recreation opportunity or resource (Walsh 1986:195).

**Culture** - A system of socially acquired and transmitted standards of judgment, belief, and conduct; the total set of beliefs, customs, or way of life of particular groups.

**Demand (marginal benefit)** - The quantity of any particular commodity that will be purchased on a market or groups of markets at a given price or series of prices.

**Diminishing Marginal Utility** - As the amount consumed of a good increases, the extra utility added by one extra last unit (or marginal utility) tends to decrease.

**Existence Values** - Existence value is any additional satisfaction, apart from direct use, option, or bequest values, that individuals receive simply from knowing that an important ecosystem has been protected. Also referred to as nonuse values.

**Externalities (External Costs)** - Costs of production that fall on others and for which the producer bears no financial responsibility; uncompensated adverse effects usually borne by others.

**Hedonic Pricing** - Hedonic price analysis utilizes a statistical technique known as multiple regression to estimate the property price effects attributable solely to variations in local environmental quality.

**Household Production** - Household production refers to the fact that consumers provide inputs of time and effort as well as dollars. Economists suggest that there is an implicit market within each household. Recreation activity is produced by households (i.e., consumers), with purchased goods and services, as well as their own self-sufficiency, leisure time, and other inputs that are publicly provided such as park facilities and a natural environment (Walsh 1986:57).

**Hypothetical Behavior Valuation Methods** - The contingent valuation approach is the primary "hypothetical" behavior method for assigning nonmarket values.

**Intergenerational (or Intertemporal) Transfer** - Economic decisions based on the perceived needs of future generations.

**Leisure Time** - Discretionary time to be used as one chooses.

**Margin** - The point at which the value of an added output equals the value of the unit of input that produced it; the point of maximum net return.

**Marginal Benefit** - The change in total benefit resulting from a change in the number of trips. It is the willingness to pay for an additional trip. The concept of diminishing marginal benefit states that as consumers take more and more trips, other things being equal, the benefit of each additional trip will decrease (Walsh 1986:130).

**Nonmarket Good Valuation** - Assessing the value of a good or service which is not traded in the market place and has no market value. Because it is not bought and sold some other measure than price must be used in establishing the value.

**Nonuse Values** - For wetlands, defined as the value derived from preservation independent of on-site or off-site use (Stevens et al. 1995). (also see existence value).

**Observed Behavior Valuation Methods** - Travel cost and hedonic pricing are examples of "observed" behavior methods for assigning nonmarket values.

**Opportunity Costs** - The return to the best alternative use by employing a unit of resource in a given manner.

**Option Value** - Option value is simply the value to the individual of preserving the opportunity to use a clean environment and is therefore closely related to -- but nevertheless conceptually distinct from -- direct use benefits. The annual payment of a kind of insurance premium to guarantee the possibility of future recreation use (in addition to the expected benefits of direct and indirect use)(Walsh 1986:85).

**Recreation** - Leisure time activity such as swimming, picnicking, boating, hunting, etc.; use of leisure time for personal satisfaction and enjoyment, a basic human need; an exceedingly variable term meaning almost anything people do with their leisure time.

A distinguishing characteristic of recreation is that individuals are producers as well as consumers of recreation activity. The individual consumer produces recreation days with a desired set of characteristics by combining: (1) his/her own inputs of knowledge, skill, and effort with nonmarket work time; (2) purchased goods and services produced by others; and (3) other inputs that are publicly provided such as a state park or reservoir (Walsh 1986:30).

**Recreation Benefit Valuation** - Total benefits are defined as the maximum amount that individuals would be willing to pay for a recreation activity -- a nonmarket good -- rather than forego it. Net benefits are total benefits less direct costs. As such, net benefits to consumers are analogous to net profits to business firms. In both cases, the value of the activity is determined by what is left over after all costs are met. Yet, some confusion results from the fact that the net benefits to consumers are not paid to anyone and thus do not appear in national accounts (Walsh 1986:59).

**Recreation Day** - A visit by one individual to a recreation area for recreation purposes during any reasonable portion or all of a 24-hour period of time. One person participating in an activity for any part of one calendar day (Walsh 1986:68).

**Recreation Visitor Day (or User Day)** - 12 person hours, which may be one person for 12 hours, 12 persons for one hour each, or any equivalent combination of individual or group use, either continuous or intermittently (Walsh 1986:68-69).

**Secondary Data Analysis** - Data collected and processed by one researcher are reanalyzed - Often for a different purpose - by another.

**TP** - Total phosphorus. In lake total phosphorus concentrations for Lake Champlain vary from 15 µg/l for the Main Lake, to 52 µg/l for the South Lake.

**Travel Cost Approach** - Used to estimate the value of recreation. Traditionally preferred by most economists because it is based on observed market behavior in a cross-section of users in response to direct out-of-pocket and time cost of travel. The basic premise of the approach is that the number of trips to a recreation site will decrease with increases in distance traveled, other things remaining equal. When determining the opportunity cost of work or leisure activities that are foregone for travel to and recreation at the site, this approach supports that both travel

and on-site time costs can be added to direct travel costs to determine the willingness to pay (Walsh 1986:94,195).

**Trophic State Index (TPI)** - Indicates a measure of the extent or condition of eutrophication in a body of water.

**Unit Day Value Approach** - Relies on expert judgement to develop an approximation of the average willingness to pay for recreation activities. An estimate is selected from a range of values approved by federal guidelines. Initially based on a survey of entrance fees at private recreation areas in 1962, the unit day values recommended by the guidelines have been adjusted for changes in the consumer price index since then (Walsh 1986:94,195).

**Use Value** - For wetlands, economic value related to recreation, flood control, ground-water recharge, and water quality (Stevens et al. 1995).

**Utility** - The ability of a good to satisfy human wants.

**Willingness to Pay** - A dollar measure of benefits, meaning how much individuals enjoy recreation activities. Usually valued over and above expenditures actually made while participating in the activity. The psychological content of benefits includes all of the feelings of pleasure which lead participants to exclaim "what a good time they had" or "what a good buy" or possibly "it wasn't worth it." The latter possibility reflects the fact that recreation economic decisions are made before the fact and that actual benefits may not come up to expectations. Federal guidelines recommend willingness to pay as the appropriate economic measure of the benefits of recreation (Walsh 1986:45). (see also: Comprehensive Income, Consumer Surplus, Household Production, Recreation Benefit Valuation)

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## Description of the Study Team

**Holmes & Associates** is a socio-economic research and consulting firm located in Saranac Lake, New York. Since 1989, Holmes & Associates has focused on illuminating the human dimensions of economic, social, and environmental policy issues in the Lake Champlain - St. Lawrence River region of New York, Vermont, Quebec, and Ontario.

**Timothy P. Holmes** holds an MA degree in sociology, with an emphasis in rural sociology. His background in lake-related research dates back to his thesis research in 1980, when he studied the relationship between human activities and the trophic status of 90 Idaho lakes. Holmes has developed a thorough knowledge of socio-economic conditions in the Lake Champlain Basin through development of the Lake Champlain Economic Database, as well as through his research for lake associations, local governments, and economic development organizations throughout the region.

**Anthony Artuso** holds a Ph.D. in natural resource policy and management, with a concentration in resource economics. He has over ten years of professional experience in economic analysis and public policy development with particular emphasis on water resources and protection of biodiversity. His previous work for the Lake Champlain Management Conference involved the analysis of potential applications of economic instruments for environmental protection in the Basin and the development of a comprehensive analytical framework for development of pollution control programs. He is currently a team leader in the newly created Public Policy Institute at the University of Charleston.

**Tommy L. Brown** holds an MS degree in forest recreation and has been a national leader in the human dimensions of fish and wildlife field. He has over 20 years of experience in conducting studies to determine how various stakeholder groups use fish and wildlife resources, how they want these resources managed, and how they are affected by various management alternatives. Brown heads the Human Dimensions Research Unit at Cornell University, which has a 20-year research partnership with New York's Department of Environmental Conservation - Division of Fish and Wildlife.