

OPPORTUNITIES FOR ACTION

An Evolving Plan for the Future of the Lake Champlain Basin

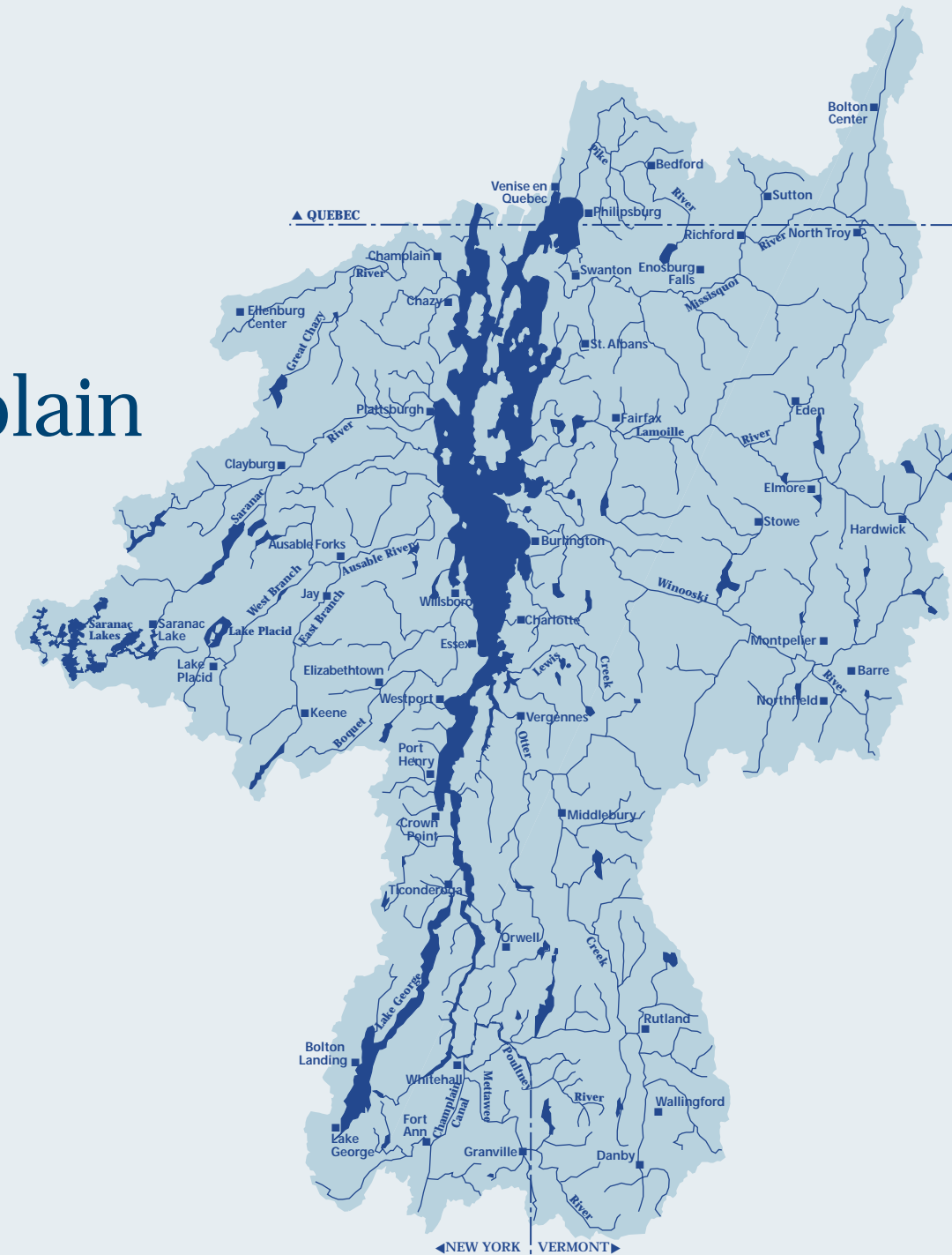


Prepared by the Lake Champlain Steering Committee
April 2003



Figure 1.

Lake Champlain Basin



TO THE CITIZENS OF THE LAKE CHAMPLAIN BASIN:



On behalf of the States of New York and Vermont and the US Environmental Protection Agency, we are pleased to approve the revised *Opportunities for Action: An Evolving Plan for the Future of the Lake Champlain Basin*.

Opportunities for Action is comprehensive in its scope and focused in its mission. This revision of the 1996 plan builds on the successes of the past six years of plan implementation and responds to changing environmental conditions to better protect the future of Lake Champlain. The successes achieved to date are the result of tremendous dedication and hard work by thousands of individuals over the last decade since initiation of the planning process for Lake Champlain.

Combined federal and state funding has made a difference. Municipal wastewater discharges to the Lake have been dramatically reduced, agricultural best management practices have been introduced on farms throughout the Basin, and local watershed associations have coordinated unprecedented community involvement in pollution reduction. The states and the federal government are working together on programs to reduce the impacts of aquatic nuisance species, including lamprey control measures and water chestnut harvesting. New York Bond Act funds supported the successful cleanup of Cumberland Bay. The phosphorus reduction targets established in *Opportunities for Action* in 1996 have provided a sound basis for the new bistate load reduction programs to achieve the water quality goals of the federal Clean Water Act. Special attention is being given to the Missisquoi Bay area through a phosphorus reduction agreement between Québec and Vermont.

This revised *Opportunities for Action* presents several emerging priorities not included in the original plan, including the priority of human health protection from bacterial contamination and toxins associated with blue-green algae. New actions are recommended to identify conditions causing toxic blue-green algae blooms quickly, and new emphasis is being placed on ecosystem indicators to monitor change within the Lake's ecosystem. The Plan also recommends increased coordination among Vermont, New York, and Québec on cultural heritage tourism and improved recreational access.

Implicit in our approval of the revised Plan is a continuing commitment to direct the resources of our respective agencies towards the implementation of recommendations set forth in this plan, and recognition that adequate funding will be crucial to the continued success of *Opportunities for Action*. We also look forward to the continued commitment of citizens throughout the Basin to achieve cleaner water and a healthier economy so that future generations may enjoy Lake Champlain as fully as the current generation.

We congratulate the Lake Champlain Basin Program, its Steering Committee, advisory committees, and staff for their work on the revisions of *Opportunities for Action*. We look to continued cooperation among all parties to foster its actions and goals.

Howard Dean, MD
Governor of Vermont - January 2003

James H. Douglas
Governor of Vermont - April 2003

George E. Pataki
Governor of New York - April 2003

Robert W. Varney
Regional Administrator, EPA New England

Jane M. Kenny
Regional Administrator, EPA Region 2

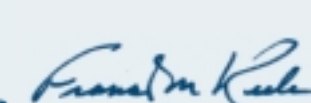
The Lake Champlain Steering Committee members are pleased to recommend to the Governors of New York and Vermont and the Administrators of the U.S. Environmental Protection Agency these revisions of *Opportunities for Action*.



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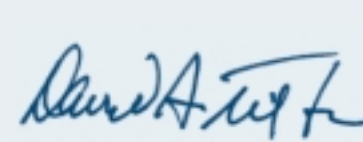
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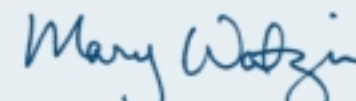
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Gouvernement du Québec

Message du premier ministre

*Management of Lake Champlain:
a model for international cooperation*

Québec is proud to be associated with the states of Vermont and New York, in the implementation of this new action plan whose objective is to protect Lake Champlain. Lake Champlain is an eloquent example of the integrated management of an international hydrographic basin, and the model of an extraordinary partnership that has passed the test of time.

Quebecers are particularly interested in this action plan since there are residents living on both Missisquoi Bay and the Richelieu River fed by Lake Champlain. The quality of the water and of these ecosystems depend on the decisions made regarding the drainage basin as a whole.

So we can only rejoice in seeing that the actions already undertaken are being reviewed and extended. This will surely lead to better water quality in the lake and in the protection of our natural heritage, in addition to ensuring the continued practice of the many activities carried out in the lake's drainage basin, all in a spirit of sustainable development.

It is with great joy that the government of Québec once again takes up the challenge and puts its shoulder to the wheel in an internationally recognized partnership. We trust that future generations will be able to benefit from the numerous advantages of the majestic Lake Champlain thanks to the joint action of all the partners involved in its management.



Jean Charest



Gouvernement du Québec

Message du premier ministre

*La gestion du lac Champlain :
un modèle de coopération internationale*

Le Québec est fier de s'associer à ses partenaires des États du Vermont et de New York afin de mettre en œuvre ce nouveau plan d'action visant la protection et la mise en valeur du lac Champlain. Exemple éloquent de gestion intégrée d'un bassin hydrographique international et d'un partenariat exceptionnel qui dure depuis de nombreuses années, la gestion du lac Champlain constitue un modèle de coopération internationale.

Les Québécoises et les Québécois sont doublement intéressés par ce plan d'action puisqu'ils sont riverains de la baie Missisquoi et de la rivière Richelieu, celle-ci alimentée par le lac Champlain. La qualité de ces eaux et de ces écosystèmes est tributaire des décisions prises dans l'ensemble du bassin versant.

Nous ne pouvons que nous réjouir de l'actualisation du programme d'action déjà en cours. Il nous permettra d'améliorer la qualité des eaux du lac, de mieux protéger le patrimoine naturel, en plus d'assurer le maintien des nombreuses activités pratiquées dans son bassin versant et cela, dans une perspective de développement durable.

C'est avec enthousiasme que le gouvernement du Québec renouvelle son engagement au sein de ce modèle de coopération dont la qualité est mondialement reconnue. Nous espérons que, grâce aux actions conjuguées de tous les partenaires, les générations futures pourront aussi profiter des nombreux attraits qu'offre le majestueux lac Champlain.



Jean Charest

VISION STATEMENT

The Lake Champlain Management Conference represents a broad-based diverse group of interests that share a common goal of developing a management program to protect and enhance the environmental integrity and the social and economic benefits of Lake Champlain and its watershed.

The Management Conference envisions a Lake Champlain which supports multiple uses—including commerce, a healthy drinking water supply, 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 agricultural sector is an integral part of the balanced management of the Lake Champlain Basin. Implementing a comprehensive management plan will ensure that the Lake and its Basin will be protected, restored, and maintained so that future generations will enjoy its full benefits.

The Lake Champlain Steering Committee continues to support the vision statement, prepared in 1996 by the Lake Champlain Management Conference, exactly as written.

The Lake Champlain Steering Committee is pleased to dedicate this edition of Opportunities for Action to Ron Manfredonia of USEPA, New England (retired) who chaired the Lake Champlain Management Conference with great skill, wisdom, and foresight. The excellent work of the Management Conference is greatly appreciated by the Steering Committee.

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SOMMAIRE EXÉCUTIF

LES RESSOURCES DU BASSIN DU LAC CHAMPLAIN

La réputation du bassin du lac Champlain n'est plus à faire. Reconnu comme l'une des plus belles ressources naturelles du continent nord-américain, il s'étend des cimes des Adirondacks aux Montagnes Vertes et fait même une incursion au Québec dans sa section nord (figure 1, couverture intérieure). La région est habitée depuis longtemps par les autochtones et compte maintenant plus de 600 000 résidents. Le bassin accueille chaque année des millions de visiteurs qui viennent profiter de ses eaux et de tous ses autres attraits naturels et historiques.

Les ressources du lac sont exploitées à des fins multiples dont l'approvisionnement en eau potable, les activités récréatives, l'agriculture, les activités industrielles et le rejet des déchets. Comme le lac contribue grandement à l'essor économique de la région, il importe de préserver la qualité de son eau et de toutes les ressources naturelles qui y sont reliées. L'évaluation économique de la diversité biologique et de la beauté des paysages s'avère complexe, il reste néanmoins que la préservation de cet environnement constitue

une préoccupation d'intérêt public majeure et demeure un enjeu prioritaire au niveau de l'allocation des ressources. Gérer les ressources de manière à soutenir tous les usages actuels et futurs, voilà le défi de taille que les gouvernements américains et québécois se sont engagés à relever.

OPPORTUNITIES FOR ACTION

Le 5 novembre 1990, le Congrès américain entérinait la loi sur la désignation spéciale du lac Champlain (" Lake Champlain Special Designation Act " (Annexe A). Destinée à protéger le bassin versant du lac Champlain, cette loi reconnaissait le principe de confier à des personnes aux intérêts divergents la responsabilité d'élaborer un plan concerté de prévention de la pollution, de suivi et de restauration. Rendu public pour la première fois en 1996, le plan intitulé "*Opportunities for Action: An evolving Plan for the Future of the Lake Champlain Basin* " a permis la réalisation de nombreux projets.

En tant que membre du Comité mixte sur la gestion du lac Champlain (PBLC), le Québec est appelé à jouer un rôle important dans la protection du lac. Plusieurs ministères, municipa-

lités et organismes non gouvernementaux se sont engagés dans la planification de l'avenir du lac Champlain. Le point de vue des citoyens est aussi considéré. Plusieurs centaines de Québécois(es) ont d'ailleurs pu exprimer leur avis lors de rencontres publiques d'information. L'implication concrète du Québec se traduit par la participation de représentants dans divers comités, dont le Comité consultatif des citoyens, le Comité pour l'éducation et la sensibilisation, le Comité consultatif technique et le Comité consultatif pour le patrimoine culturel et les loisirs.

THÈMES GÉNÉRAUX ABORDÉS DANS LE PLAN

- Approche basée sur le partenariat
- Approche par bassin versant
- Prévention de la pollution
- Approche concertée de prise de décision
- Approche écosystémique
- Intégration des objectifs environnementaux et économiques
- Souplesse

PRIORITÉS D'ACTION

Le plan *Perspectives d'actions* identifie des objectifs et des actions visant à protéger et à remettre en état les ressources écologiques et culturelles du bassin tout en maintenant la vitalité de l'économie régionale. À la suite des commentaires émis lors des rencontres publiques et des recommandations des comités consultatifs, les objectifs suivants ont été désignés prioritaires:

Selon le Conseil directeur du lac Champlain, ces objectifs constituent les quatre champs d'action les plus importants pour le maintien à long terme de l'intégrité du bassin du lac Champlain. La faune, les activités récréatives et le patrimoine culturel ainsi que l'éducation

OBJECTIFS

- 1) Réduire les apports de phosphore dans le lac Champlain afin de favoriser l'intégrité et la diversité de l'écosystème ainsi que l'utilisation durable du lac pour les usages humains et la satisfaction procurée lors de sa fréquentation.
- 2) Réduire la contamination par les produits toxiques dans le but de protéger la santé publique et l'écosystème du lac Champlain.
- 3) Contrôler l'introduction, la prolifération et les effets des espèces nuisibles étrangères dans le but de préserver l'intégrité de l'écosystème du lac Champlain.
- 4) Minimiser les risques à la santé humaine causés par les dangers potentiels liés à l'eau dans le bassin du lac Champlain.

et la sensibilisation en sont d'autres. Pour chaque secteur, les actions ont été énumérées en fonction du niveau de priorité qui leur a été attribué: très grande priorité, grande priorité, priorité et autres actions à considérer.

Les niveaux de priorité sont sujets à des modifications selon les problèmes qui surviendront. Le plan fera l'objet d'une mise à jour constante et la mise en œuvre des actions, peu importe leur niveau de priorité, dépendra de la disponibilité des fonds.

UN PLAN EN ÉVOLUTION CONSTANTE

Depuis 1991 un grand nombre de rencontres publiques, de sondages, de discussions ciblées et d'ateliers techniques ont eu lieu dans le cadre du Programme de mise en valeur du lac Champlain. Des projets de recherche, de suivi et de démonstration ont été menés annuellement. Selon les informations fournies par le public au moment d'entreprendre l'élaboration du plan, les éléments suivants du plan doivent être maintenus:

- *Le plan ne devrait inclure que les projets bénéficiant de subventions.*
- *Le plan devrait mettre l'accent sur l'éducation au lieu de la réglementation accrue.*
- *Le plan devrait encourager et stimuler la vitalité des organismes actuels.*

QUE CONTIENT LE PLAN?

Le plan *Perspectives d'actions* comporte six chapitres. Le premier présente l'ensemble des thèmes et des priorités du plan. Le chapitre 2 porte sur les actions visant la protection et l'amélioration de la qualité de l'eau du lac Champlain. Le chapitre 3 examine les ressources naturelles vivantes et le chapitre 4, les ressources culturelles et récréatives du bassin. Le chapitre 5 répertorie les stratégies pour la mise en place du plan, dont les recommandations pour un cadre institutionnel pour l'avenir. Il comprend également des sections traitant de l'engagement local, de la sensibilisation et de la participation du public, du suivi et de la mesure du taux de réussite ainsi que de l'obtention de subventions. Ces sections ont été regroupées dans le chapitre de la mise en place du plan, car c'est principalement par elles que les recommandations seront mises de l'avant. Le chapitre 6 décrit les conditions économiques qui prévalent dans le bassin et l'importance des questions économiques pour la mise en place du plan. Le document contient en dernier lieu des références, un glossaire, des abréviations et des annexes.

Pour de plus amples informations ou pour obtenir un exemplaire des documents du PBLIC, veuillez communiquer avec le Programme de mise en valeur du lac Champlain au (802) 372-3213. Des informations sont également disponibles à la Corporation Bassin Versant Baie Missisquoi (CBVBM) au (450) 248-0100.

CHAPTER ONE

INTRODUCTION

City of Burlington



Lake Champlain's 587 miles of scenic shoreline include wide, sandy beaches, secluded bays, bustling harbors, and rocky outcrops.

LAKE CHAMPLAIN BASIN RESOURCES

The Lake Champlain Basin, stretching from the peaks of the Adirondacks to the Green Mountains and north into Québec, is renowned as one of North America's most beautiful and valued resources (See Figure 1, inside front cover). Long home to Native Americans and inhabited by more than 600,000 people today, the Basin draws millions of visitors to its waters and other natural and historic features. Virtually everyone in the Basin depends on the resources the Lake provides for a wide variety of uses, from drinking water and recreation to agriculture, industry, and waste disposal. The challenge is to manage our resources in a way that sustains all of these uses now and in the future.

The importance of the Basin's healthy natural resources to many of the region's industries and to the economy as a whole is indisputable. Agriculture in the Basin, for example, which requires land for production and clean water for animals, generated about \$526 million in sales of agricultural products—such as milk, cheese, maple syrup, and apples—in 1997. Recreation-related industries also depend on a clean lake. Sport fishing generates tens of

millions in revenues annually. Bird and other wildlife viewing activities generate more than \$50 million a year in Vermont (Vermont Agency of Natural Resources, 1996). Tourism brought an estimated \$3.8 billion dollars overall to the Basin in 2000.

Dollar figures alone cannot convey the full value of Lake Champlain's resources. The biological riches of the area and unparalleled beauty of the mountains, historic resources, agricultural landscapes, small towns and villages, and rivers that flow into the magnificent Lake provide experiences and opportunities unique to the Lake Champlain Basin. While the benefits of healthy resources are difficult to quantify, they are equally important to any evaluation of the costs and benefits of resource management decisions.

RESOURCE ISSUES FACING LAKE CHAMPLAIN

Although Lake Champlain remains a vital lake with many assets, there are several serious environmental problems that demand action. Phosphorus levels in parts of Lake Champlain, such as those found in Missisquoi Bay, are so high that they cause excessive algal growth.

This turns the water green and increases growth of aquatic plants, which in turn inhibits recreational use of the water, reduces oxygen levels, and causes other problems for the aquatic life in the Lake. The phosphorus that is causing these problems is coming from both sewage treatment plant discharges and stormwater runoff from land in agricultural, residential, and urban uses. Although much progress has been made in the last five years to reduce phosphorus, primarily at sewage treatment facilities and on agricultural lands, phosphorus inputs from point and nonpoint sources must be further reduced to promote a healthy ecosystem and full human use and enjoyment of the Lake. This Plan presents strategies to achieve these reductions.

LCBP



Vermont Governor Jim Douglas and New York Governor George Pataki signing Lake Champlain documents on Earth Day, April 2003.

Toxic substances, such as polychlorinated biphenyls (PCBs) and mercury, have resulted in health advisories about consuming certain fish from Lake Champlain. There are also three areas in Lake Champlain (Cumberland Bay, Inner Burlington Harbor, and Outer Malletts Bay) known to be contaminated with toxic substances at levels that cause problems for aquatic biota or human health. Over the last five years, hazardous waste cleanup and containment projects have been undertaken on the Burlington waterfront at the Pine Street Barge Canal, and in Cumberland Bay near the City of Plattsburgh. Additional research and monitoring efforts are also being undertaken to better understand the extent and causes of mercury contamination in the Basin environment. This Plan presents ways to reduce toxic contaminants like mercury and PCBs and to identify

appropriate restoration strategies for contaminated sections of the Lake.

The fish, wildlife, and other living resources of the Lake Champlain Basin have been negatively impacted by the introduction of nonnative aquatic nuisance species, such as sea lamprey, water chestnut, Eurasian watermilfoil, zebra mussels, and most recently alewives. Each of these species interferes with the recreational use and ecological processes of the Lake. Zebra mussels, for example, can clog residential, municipal, and industrial water intake pipes, foul boat hulls and engines, and obscure priceless underwater archeological artifacts. The first edition of *Opportunities for Action* (1996) called for a comprehensive action strategy to protect ecologically valuable habitats and to control the spread of these nuisance species. An Aquatic Nuisance Species Management Plan was approved by New York and Vermont in 1999 and accepted by the National Aquatic Nuisance Species Task Force in 2000. Implementation of this management plan is in progress throughout the Basin and results are being carefully monitored.

Other resource issues face the Lake Champlain Basin as well, including continued wetland loss and habitat fragmentation, inadequate public access to the Lake, recreational user conflicts, and loss of cultural resources. *Opportunities for Action* also outlines strategies to address these issues.

Quality of life provided by abundant and diverse natural resources is a major reason why many Basin residents choose to live here. Research shows there is a clear connection between the economy and the health of the

Lake's resources. If investments in plan implementation are not continually made, the cleanup costs will be far greater in the future. Continuing to work to protect and improve Lake Champlain and its natural resources sustains past investments, expands the Basin's economic potential, and improves the quality of life for all Basin residents.

LAKE CHAMPLAIN SPECIAL DESIGNATION ACT

On November 5, 1990, the Lake Champlain Special Designation Act was signed into law (See Appendix A). Sponsored by Senators Leahy and Jeffords from Vermont and Senators Moynihan and D'Amato from New York, this legislation designated Lake Champlain as a

resource of national significance. The goal of the Special Designation Act was to bring together people with diverse interests in the Lake to create a comprehensive pollution prevention, control, and restoration plan for protecting the future of Lake Champlain and its surrounding watershed. The act specifically required examination of water quality, fisheries, wetlands, wildlife, recreational, and cultural resource issues. The challenge has been both to identify particular problems requiring

LAKE CHAMPLAIN BASIN PROGRAM

The Lake Champlain Basin Program (LCBP) is a partnership among the States of New York and Vermont, the Province of Québec, the USEPA, other federal and local government agencies, and many local groups, both public and private. Created by Congress through the Lake Champlain Special Designation Act of 1990 (Public Law 101-596), the LCBP works cooperatively with many partners to protect and enhance the environmental integrity and the social and economic benefits of the Lake Champlain Basin. The program is guided by the Lake Champlain Steering Committee, a board comprised of a broad spectrum of representatives of government agencies, the chairs of advisory groups representing citizen lake users, scientists, and educators. These advisory groups include: a Technical Advisory Committee, composed of resource managers, physical and social scientists, and business and economic experts; Citizens Advisory Committees from New York, Vermont, and Québec; an Education and Outreach Advisory Committee; and a Cultural Heritage and Recreation Advisory Committee.

The LCBP is jointly administered by the USEPA, the States of Vermont and New York, and the New England Interstate Water Pollution Control Commission. Other cooperating agencies include the US Fish and Wildlife Service, the US Department of Agriculture, the US Geological Survey, the National Oceanographic and Atmospheric Administration, and the National Park Service. Formal involvement of Québec occurs through the Lake Champlain Steering Committee, which meets four times a year to coordinate Lake-related management activities.

The actions of the LCBP and Lake Champlain Steering Committee are guided by the comprehensive long-term management plan *Opportunities for Action: An Evolving Plan for the Future of the Lake Champlain Basin*. Successful implementation of the plan is achieved by developing many joint partnerships among natural resource agencies, citizens, and other lake and watershed stakeholders throughout the Basin. Over the past five years, the LCBP has sponsored a variety of projects to educate and involve the public and gather information about Lake issues. The LCBP has also provided funding for education, planning, demonstration, research, and monitoring projects to help prepare *Opportunities for Action*. This Plan, now in its second edition, is scheduled for updates every five years so that it remains current and relevant to ongoing and emerging issues.



LCBP

The LCBP's main office is based in the historic Gordon Center House in Grand Isle, Vermont.

management action and to chart an integrated plan for the future of the Lake Champlain Basin. *Opportunities for Action* covers a broad range of issues and incorporates the views of citizens, economic advisors, scientists, and lake users throughout the Basin.

LCBP



In a successful partnership between TNC and the VTDEC, volunteers have hand-pulled hundreds of tons of water chestnuts to prevent the plant's spread. Water chestnut control efforts throughout the Basin have received funding from the LCBP, USACOE, NYSDEC, NYSCC, QC MENV, and nonprofit organizations.

OVERALL THEMES OF THE PLAN

Opportunities for Action is an evolving blueprint for coordinated action to restore and protect water quality and the diverse natural and cultural resources of the Lake Champlain Basin. The first edition of *Opportunities for Action* (1996) was based largely on a five-year program of plan development reflecting the best available scientific and economic data and informed by an extensive program of public involvement.

In updating *Opportunities for Action* in 2001, a program of public involvement through public meetings, Citizen Advisory Committee forums, and written comments has continued to inform the planning process. The ongoing work of the Education and Outreach Committee, the Cultural Heritage and Recreation Advisory Committee, and the Technical Advisory Committee brought the experience of many community representatives and agencies throughout the Basin to this process.

Partnership Approach

Numerous agencies and organizations are currently involved in successful programs to manage the resources of the Basin. Implementation of the Plan relies upon these groups to continue their successful efforts and expand their capabilities through the formation of partnerships. Partnerships can increase communication and coordination among various levels of government, the private sector, and citizens. Partnerships also reduce duplication of efforts; increase efficiency and effectiveness in the use of human and financial resources, evolve as needed, contribute to an informed and involved citizenry, accomplish important goals without the use of new regulations or new layers of government, and ensure a sharing of responsibility for implementing the Plan.

Ecosystem-Based Approach

Opportunities for Action calls for an ecosystem-based approach to planning and management that considers the Lake and its entire drainage basin as a whole, interconnected, complex system. Each component of the system, including humans, affects other parts of the system. For instance, increased phosphorus levels in the Lake cause algal blooms that deplete oxygen levels, thereby affecting fish populations and populations of other Basin species that depend on fish as a food source. Sound resource management must take into consideration the ways in which various actions will affect other resources in the ecosystem.

Watershed Approach

More than 95% of the water in Lake Champlain passes through the 8,234 square miles of the Basin as surface and subsurface runoff before reaching the Lake. As a result, land use activities and pollution sources throughout the Basin have a tremendous impact on the Lake and its ecosystems. Restoration or protection based on watershed boundaries rather than political boundaries better address polluted or threatened areas. In addition to applying the watershed approach on a basin-wide level, *Opportunities for Action* encourages the watershed approach at a more local level. This offers opportunities for citizens to improve water quality based on their knowledge of their local area and for neighboring communities to develop innovative ways to solve pollution problems within their local watersheds. Empowering local communities and their organizations to collaborate gives any effort a better chance of real, sustained success. Implementation of the Plan continues to use a watershed approach that links the Lake with activities in its watershed.

Integration of Environmental and Economic Goals

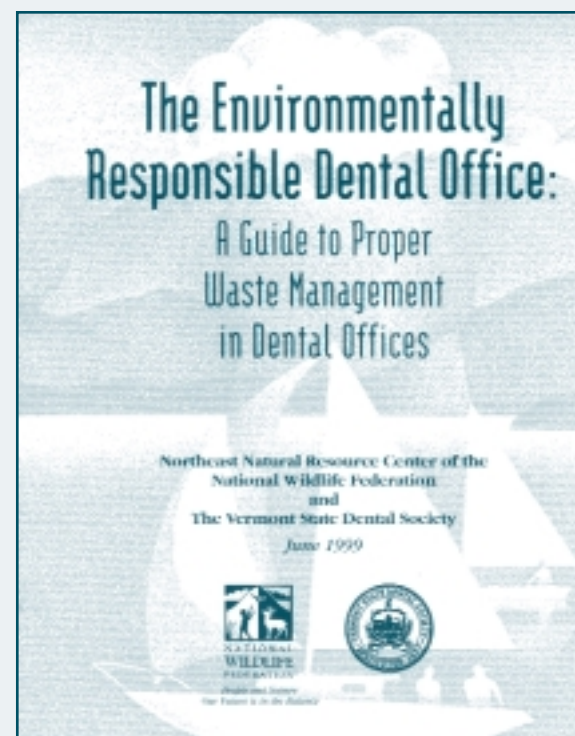
A healthy Lake Champlain is crucial to a strong regional economy, and a strong economy is good for the Lake. This Plan recommends actions to protect and restore the ecological and cultural resources of the Basin while ensuring economic benefits for long-term positive change in the Lake.

Finding the most cost-effective actions to protect and enhance the quality of the Lake while maintaining the economic health of the region is an extremely important and difficult task in implementing the Plan.

Opportunities for Action includes recreational and cultural heritage interests in its basin-wide approach to watershed protection. Protecting and expanding opportunities for Basin residents to enjoy clean water and encouraging public appreciation of the rich cultural heritage associated with the Lake are integral elements of both watershed protection and regional economic goals.

Pollution Prevention

Pollution prevention focuses on reducing or eliminating the generation of pollutants at their sources. Pollution prevention efforts often cut industrial and public costs in the long run by reducing the need for expensive waste treatment, hazardous waste disposal, and cleanup. Such efforts can also reduce the need for regulatory compliance measures, which are costly and time consuming. Pollution prevention is often more economically feasible than subsequent remediation of polluted sites and is a prime method for deterring future harm to ecosystems.



The LCBP funded an innovative program by the National Wildlife Federation to inform dental offices about properly managing waste from mercury and other toxic substances. The program also collected 40 lbs. of mercury.

Consensus-Based, Collaborative Approach to Decision-Making

Opportunities for Action is the result of numerous cooperating agencies, organizations, and individuals combining their efforts to protect and enhance the resources of the Lake Champlain Basin while solving identified problems. Implementing the Plan continues to involve a broad range of participants in a consensus-based approach to decision-making. Encouraging numerous stakeholders to provide input strengthens the outcomes of the decision-making process and broadens the base of citizens and organizations responsible for and active in Plan implementation.

Flexibility

Opportunities for Action is an evolving plan to restore and protect water quality and the remarkable natural and cultural resources of the Lake Champlain Basin. Building flexibility into programs and organizations ensures that this evolution continues to be responsive to public needs throughout the Basin. Successful program implementation relies on feedback loops among policy development, implementation, existing legal requirements and available funding, and requires adaptable organizations that can change their programs accordingly.

PRIORITIES FOR ACTION

Opportunities for Action identifies specific goals and recommended actions to protect and restore the ecological and cultural resources of the Basin while maintaining a vital regional economy. Based on comments from citizens and other stakeholders at public

meetings and the recommendations of advisory committees, four goals have been designated as the highest priorities of the Plan:

Goal: Reduce phosphorus inputs to Lake Champlain to promote a healthy and diverse ecosystem and provide for sustainable human use and enjoyment of the Lake.

(See Actions 1 through 11 in “Reducing Phosphorus Pollution,” pp. 17-22). Priority sub-basins have been identified through extensive research on phosphorus loadings to the Lake from major tributaries. These actions suggest comprehensive ways to reduce point and nonpoint phosphorus loads from these tributaries and their watersheds to achieve the in-lake phosphorus concentration standards established in 1996.

Goal: Reduce toxic contamination to protect public health and the Lake Champlain ecosystem.

(See Actions 1 through 8 of “Preventing Pollution from Toxic Substances,” pp. 26-30). These actions will offer a comprehensive strategy to restore areas of the Basin where pollution from toxic contaminants, such as mercury and PCBs, is a problem and to prevent future pollution from these contaminants.

Goal: Minimize the risks to humans from water-related health hazards in the Lake Champlain Basin.

(See Actions 1 through 6 of “Protecting Human Health,” pp. 34-36). These actions address potential health threats associated with poor water quality in Lake Champlain. They are designed to reduce risks from drinking water, eating fish and wildlife, and swimming in the Lake, and to support the protection of drinking water sources throughout the Basin.

Goal: Control the introduction, spread, and impact of nonnative nuisance species in order to preserve the integrity of the Lake Champlain ecosystem.

(See Actions 1 through 12 of “Managing Nonnative Aquatic Nuisance Plants and Animals,” pp. 55-60). These actions are designed to restrict the spread and reduce the populations of invasive species through a cooperative effort among agencies, organizations, and individuals.

The Lake Champlain Steering Committee considers these four goals to be the most important for addressing the long-term health of the Lake Champlain Basin and recommends that agencies and organizations strive to make these their top priorities for action in managing and enhancing the resources of the Basin.

In addition to these highest priorities, the Lake Champlain Steering Committee has selected several high priority actions in each of the

issue areas. The Committee finds that these actions are needed to accomplish the goals of each issue area and should be implemented as soon as possible. Priority actions have also been designated for each issue area. These priority actions are considered important to a management program that addresses the issues facing the Lake Champlain Basin. Complementing the priority actions are other actions for consideration. The Lake Champlain Steering Committee feels that these actions contribute to the comprehensive nature of the Plan but are less crucial to the present health of the Lake and its Basin.

As time progresses and the Plan is updated as new issues emerge, the priority status of these actions will be re-evaluated.

In each of the issue areas, the actions have been listed according to their designated priority status: Highest Priority, High Priority, Priority, and Other Actions for Consideration. Implementation of all actions, regardless of priority status, is contingent upon the availability of funds. Refer to Chapter 5 for information on funding strategies for the Plan.

AN EVOLVING PLAN

Since 1991, the LCBP has been working hard to involve the public and respond to current research in developing and implementing this Plan. Numerous public input meetings, citizen perception surveys, focus group discussions, technical workshops, research, monitoring and demonstration projects have been conducted. All of these actions have helped identify the issues and priority actions presented in this Plan. Guidance from the public in the initial

plan formulation process has been reinforced through public comments during the first five years of implementation. According to this guidance, the following core elements should be maintained in the Plan:

- *The Plan should be written so that it is understandable by the general public who will help implement it. Actions presented in the Plan should be prioritized.*
- *Summary economic information should be presented with the Plan. Chapter 6 focuses specifically on this issue and provides additional economic information. A supplemental economic analysis of "Opportunities for Action" (1996) is also available.*
- *The Plan should oppose any inclusion of unfunded mandates. The Plan does not establish any regulations or unfunded mandates.*
- *The Plan should emphasize education rather than expanded regulation. The Steering Committee holds that education is preferable to regulation and has emphasized that educational programs be incorporated into the implementation of all parts of the Plan.*
- *The Plan should promote and foster the vitality of existing organizations. The Steering Committee intends that actions taken at the local level be an important means for implementing the Plan. Nearly 500 local implementation grants awarded by the LCBP in the first decade of operations underscore this commitment to support existing organizational and civic infrastructure (see Chapter 5).*

Over the last ten years, the public has played an integral role in the development and implementation of *Opportunities for Action*. Readers should find most of their concerns and suggestions incorporated into this revision, and feel welcome to continue to provide input into the planning process. Please contact the LCBP at 1-800-468-5227 or (802) 372-3213, or visit www.lcbp.org, for more information on public meetings and other informational sessions, and to receive copies of LCBP materials.



Gary Randorf

Fort Ticonderoga

WHAT IS IN THE PLAN?

Opportunities for Action is divided into six chapters. This chapter presents the overall themes and priorities of the Plan. Chapter 2 presents actions to protect and enhance water quality in Lake Champlain. Chapter 3 concerns living natural resources, and Chapter 4 focuses on recreation and cultural resources of the Basin. Chapter 5 identifies strategies for Plan implementation, including recommendations for an institutional framework for the future. Chapter 5 also includes sections concerning local-level involvement in Plan implementation, informing and involving the public, measuring and monitoring success, and securing funding. These sections identify the primary means through which Plan recommendations will be implemented. Chapter 6 describes the economic conditions in the Basin and the importance of economic considerations in the course of plan implementation. A list of references, glossary, acronyms, and appendices are presented at the end of the document.



Carolyn Bates

A cyclist enjoys a Lake Champlain sunset.

CHAPTER TWO

WATER QUALITY AND THE HEALTH OF THE LAKE

In the last 25 years, water quality has improved largely due to state, federal, provincial, municipal, and private efforts to improve wastewater treatment facilities. Additional cleanup must further address pollutants from urban and agricultural areas, including nutrients, low levels of toxins, and pathogens.

Lake Champlain serves as a catch basin for pollutants entering directly into it and those washed from the land or air into nearby rivers by stormwater or snow-melt. Indicators of the health of the Lake show nutrient enrichment, which leads to overaccumulation of aquatic plant and algae growth; PCB and mercury contamination, which leads to fish consumption advisories; and bacterial contamination, which leads to beach closings.

La qualité de l'eau

Au cours des 25 dernières années, la qualité de l'eau s'est améliorée, principalement grâce aux efforts conjugués de tous (New York, Vermont, Québec, fédéral américain, municipalités, le privé) avec la construction de stations de traitement des eaux usées. Les efforts d'amélioration doivent maintenant être axés sur la réduction de la pollution d'origine urbaine et agricole, incluant les substances nutritives, les faibles taux de toxines et les pathogènes.

Le lac Champlain sert de bassin récepteur aux polluants qui y entrent directement ou, par le biais de ses affluents, lors du lessivage de son bassin versant à la suite de pluies ou de la fonte des neiges. Celui-ci a d'ailleurs tendance à accumuler les polluants, si l'on se fie aux indicateurs d'intégrité du lac: croissance accrue des plantes aquatiques et des algues en raison de l'apport de nutriments; avertissements de non-consommation de poissons dont la chair contient des BPC et du mercure; avis de fermeture de plages résultant d'une contamination bactérienne.

THIS CHAPTER INCLUDES:

Reducing Phosphorus Pollution
Preventing Pollution from Toxic Substances
Protecting Human Health

REDUCING PHOSPHORUS POLLUTION

GOAL

Reduce phosphorus inputs to Lake Champlain to promote a healthy and diverse ecosystem and provide for sustainable human use and enjoyment of the Lake.

Although phosphorus, nitrogen, and other nutrients are needed by the plants that form the base of the food chain in the Lake, nutrients are fertilizers that can promote the rapid growth of algae and plants. Human activities can greatly increase nutrient inputs to the Lake. These nutrient sources accelerate eutrophication, the natural aging process of lakes, and pose the greatest threat to water quality, living organisms, and human use and enjoyment of Lake Champlain. When the amount of nutrients, particularly phosphorus, entering Lake Champlain increases and remains high over time, the Lake becomes over-fertilized and produces excessive amounts of algae and other aquatic plants. Algal blooms turn water green, reduce water transparency, and create odor problems. When the algae die and decompose, the oxygen in the water that sustains fish and other organisms is depleted. Ultimately, these blooms alter fish and wildlife habitat, impair scenic views, reduce recreational appeal, impair water supplies, and lower property values.

Phosphorus levels continue to be at unacceptable levels in many parts of Lake Champlain. In some areas levels are comparable to those found in the most polluted parts of the Great Lakes (Saginaw Bay and the western end of Lake Erie) during the 1970s. Missisquoi Bay, St. Albans Bay, and the South Lake are the segments of Lake Champlain with the highest phosphorus levels (see Figure 2). Nuisance algal conditions exist nearly half of the time in these areas.

Gary Randorf



Algae blooms, a result of excess nutrients in the Lake, impede recreation.

Sources of Phosphorus

Wastewater treatment and industrial discharges are the main point sources of phosphorus, and now contribute about 20% of the total phosphorus entering Lake Champlain. Nonpoint sources, which account for about 80% of the phosphorus loading, include lawn and garden fertilizers, dairy manure and other agricultural wastes, pet wastes, and exposed or disturbed soil, including construction areas and eroding streambanks. At the local scale, nonpoint sources of phosphorus may include malfunctioning septic systems.

The major categories of land use within the Lake Champlain Basin are agricultural land (15% of Basin area), forested land (75% of Basin area), and urban and other developed land (6% of Basin area). Agricultural activities contribute approximately 55% of the annual nonpoint phosphorus load to the Lake. Forests cover a majority of the Basin's surface area but contribute only an estimated 8% of the average annual nonpoint source phosphorus load. Urban land covers only a small portion of the Basin, yet it produces approximately 37% of the average annual nonpoint source phosphorus load to the Lake—much more phosphorus per unit area than either agricultural or forested land (Hegman et al. 1999). Earlier estimates indicate that natural background sources of phosphorus account for only 24% of the present day total load, indicating that human activities in the Basin have increased phosphorus loading to Lake Champlain fourfold over the original predevelopment levels (VTDEC and NYSDEC 1994).

Significant Reductions and Phosphorus Management

While phosphorus loads to Lake Champlain were not well monitored in the 1970s and 1980s, Vermont point source loads have been reduced by an estimated 40% between the 1970s and 1991 as a result of banning phosphate detergents and regulating wastewater treatment plants and industrial discharges (Vermont Department of Water Resources and Environmental Engineering 1981). Additional reductions are presumed to have resulted from New York's phosphate detergent ban, although amounts were not documented. The 1992 Vermont phosphorus reduction statute (requiring improved phosphorus treatment at larger municipal treatment plants), along with decreased phosphorus discharges from several New York communities, resulted in an additional 43% (107 metric tons per year) reduction between 1991 and 1995. USDA Natural Resource Conservation Service models estimate that phosphorus loads from nonpoint sources have been reduced by more than 65 metric tons per year (approximately 10%) since the 1970s through voluntary pollution control efforts on farms supported by USDA cost-share funds. The agricultural community strongly supports these cooperative conservation programs. Many of the recommended actions in this section build on these past successes.

In 1993, New York, Vermont, and Québec signed a Water Quality Agreement committing the three entities to using a consistent approach to phosphorus management. The agreement defined in-lake phosphorus concentration criteria (goals) for thirteen lake segments (see Figure 2). The states of Vermont

and New York subsequently completed a study to measure point and nonpoint source phosphorus loads to the Lake, developed a whole-lake phosphorus budget, and developed a load reduction strategy to attain the in-lake criteria (Vermont Department of Environmental Conservation and New York State Department of Environmental Conservation 1997). The results of this study (called the *Lake Champlain Diagnostic-Feasibility Study*) and subsequent analyses indicate that the annual phosphorus load to the Lake must be reduced by another 77 metric tons (relative to the 1995 load) to attain the in-lake criteria. This represents about 15 percent of the estimated 1995 total of 496 metric tons introduced each year. The challenge is to continue to reduce phosphorus loads from both point and nonpoint sources and to allocate load reductions throughout the Basin in a fair, efficient, and cost-effective manner.

In 1995, Holmes and Artuso developed an optimization procedure to determine the cost-effectiveness of various strategies for attaining the in-lake phosphorus criteria (Holmes and Artuso 1995). Designed for use with the *Diagnostic-Feasibility Study*, the optimization procedure takes into account the costs of potential phosphorus reductions achievable from point and nonpoint sources, as well as the manner in which changes to phosphorus levels in each lake segment are expected to affect phosphorus levels in all other lake segments. The procedure enables sorting through the multitude of possible combinations of point and nonpoint source reductions that are predicted to attain the in-lake criteria.

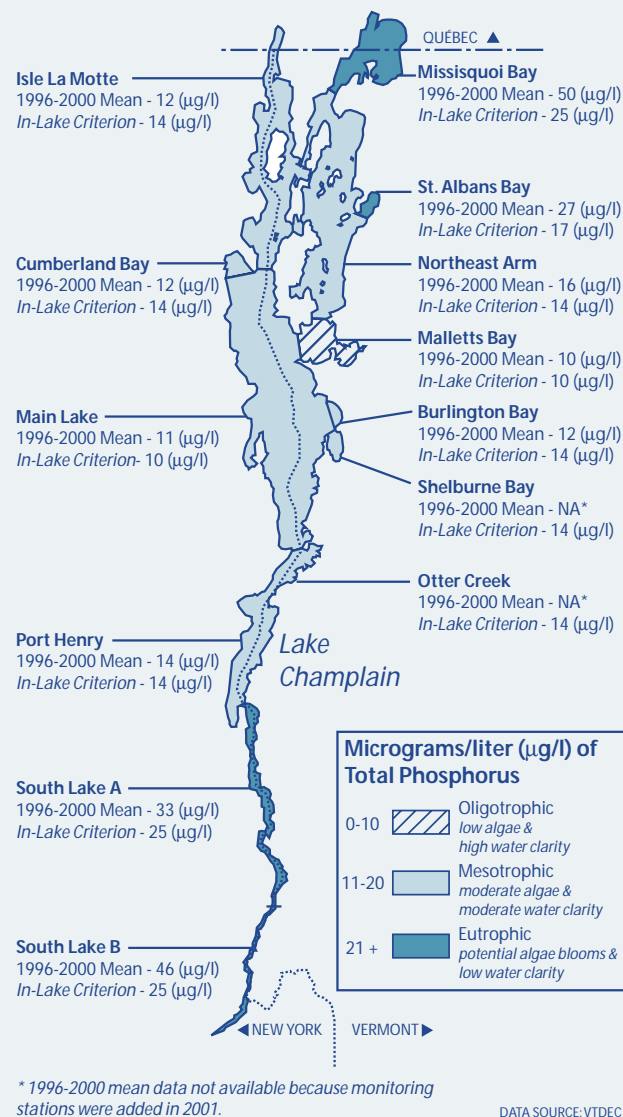


Figure 2. Lake segment boundaries with current phosphorus concentrations and in-lake criteria.

NOTE: The South Lake B in-lake criterion in the 1993 Water Quality Agreement is 25 µg/l, as reflected in this figure. The modeling used to generate phosphorus loading targets for the Lake are based on the Vermont Water Quality Standards, which is 54 µg/l. The in-lake concentration achieved by the phosphorus reduction strategy will fall somewhere between the two values.

Following careful analysis of several reduction scenarios, representatives from the states of Vermont, New York, and the USEPA used the phosphorus criteria, model, and optimization procedure to develop load reduction targets considered both fair and cost-effective. The agreed upon process distributes the responsibility for phosphorus reductions among 12 of the 19 watersheds shown in Figure 2 and was endorsed by the Lake Champlain Management Conference when the original *Opportunities for Action* was completed in 1996.

Table 1 presents the point and nonpoint source phosphorus loading targets for lake segment watersheds. Vermont and New York have committed to reducing the difference between the 1995 loads and the target loads in each lake segment watershed by at least 25% for each five-year period during the next twenty years, pending available federal and/or state funds to support implementation. The states also have committed to identifying specific nonpoint source control actions or specific point source permit modifications that would result in meeting the initial five-year interim goal.

Table 1 also shows the 1995 phosphorus loads, along with phosphorus loading targets, generated by the targeting procedure, as well as the reductions required (relative to 1995 loads) to attain the target loads for each lake segment. While Table 1 shows that most watersheds are targeted for some level of phosphorus reduction, the majority of the reduction is targeted to Missisquoi Bay (52 mt/yr). The State of Vermont and the Province of Québec have developed an agreement dividing responsibility for phosphorus reductions in this segment. Other watersheds targeted for substantial

reductions include South Lake B (Vermont portion), Otter Creek (Vermont portion), and the Main Lake (both New York and Vermont portions). The locations of all watersheds targeted for some level of reduction are shown in Figure 3. No change is required for some watersheds, reflecting excess capacity at several wastewater treatment plants. For a more complete explanation of how point source load targets were calculated, refer to Appendix C.

In 2000, the LCBP released a *Preliminary Evaluation of Progress toward Lake Champlain Basin Program Phosphorus Reduction Goals*. The report, which was prepared by a team of scientists and managers working on phosphorus issues in the Lake Champlain Basin, evaluated progress toward the twenty-year phosphorus reduction goal and investigated the feasibility of accelerating phosphorus reduction efforts to achieve that goal sooner. The report predicts that Vermont, New York, and Québec will have reduced the phosphorus inputs to Lake Champlain by about 38.8 mt/yr by 2001, far exceeding the five-year interim reduction goal. For individual lake segment watersheds, Missisquoi Bay is the only lake segment that may fall slightly below a 25% reduction in the first five years.

The report also concluded, however, that not all lake segments can be brought to the loading targets needed to meet the in-lake phosphorus criteria by relying solely on existing reduction programs. By 2002, most of the planned reductions from wastewater treatment plant upgrades have been funded, leaving the remaining phosphorus reductions to come from nonpoint source reductions, especially from agricultural lands. The report estimated

VERMONT

Lake Segment Watershed	1991 Loads (mt/yr)			1995 Loads	Target Loads	Required Changes Relative to 1995
	Point	NPS	Total	Total	Total	
South Lake B	3.2	24.8	28.0	27.6	20.8	-6.8
South Lake A	0.1	2.4	2.4	1.2	0.6	-0.6
Port Henry	0.0	0.4	0.4	0.2	0.1	-0.1
Otter Creek	62.8	58.9	121.7	61.2	56.1	-5.1
Main Lake	27.7	60.3	88.0	80.7	76.6	-4.1
Shelburne Bay	5.3	11.1	16.4	11.8	12.0	none
Burlington Bay	11.2	0.3	11.5	2.5	5.8 ¹	none
Malletts Bay	3.1	29.8	32.9	29.7	28.6	-1.1
Northeast Arm	0.0	3.2	3.2	1.4	1.2	-0.2
St. Albans Bay	0.8	7.2	8.0	8.9	9.5	none
Missisquoi Bay	6.9	94.2	101.1	89.5 ²	58.3 ²	-31.2
Isle LaMotte	0.0	0.6	0.6	0.3	0.3	none
TOTAL	121.1	293.2	414.2	315	269.9	-49.2 (net)

QUÉBEC

Lake Segment Watershed	1991 Loads (mt/yr)			1995 Loads	Target Loads	Required Changes Relative to 1995
	Point	NPS	Total	Total	Total	
Missisquoi Bay	8.5	57.7	66.2	59.6 ³	38.9 ³	-20.7

NEW YORK

Lake Segment Watershed	1991 Loads (mt/yr)			1995 Loads	Target Loads	Required Changes Relative to 1995
	Point	NPS	Total	Total	Total	
South Lake B	3.9	24.3	28.2	27.0	26.2	-0.8
South Lake A	9.6	3.5	13.1	10.1	9.4	-0.7
Port Henry	1.8	2.6	4.3	4.5	2.5	-2.0
Otter Creek	0.0	0.1	0.1	0.1	0.0	-0.1
Main Lake	7.1	31.8	38.9	37.5	35.0	-2.5
Cumberland Bay	29.2	8.8	38.0	20.2	25.5	none
Isle LaMotte	7.4	20.9	28.3	22.0	21.5	-0.5
TOTAL	59.0	92.0	150.9	121.4	120.1	-6.6 (net)

¹ Revised from first *Opportunities for Action* (October 1996) with currently permitted point source loads in the *Lake Champlain Phosphorus TMDL Draft* (June 2001), VT DEC.

² Reflects 60% of the *Opportunities for Action* 1995 loads and target loads for Missisquoi Bay. Source: *Missisquoi Bay Phosphorus Reduction Task Force Report* (June 2000).

³ Reflects 40% of the *Opportunities for Action* 1995 loads and target loads for Missisquoi Bay. Source: *Missisquoi Bay Phosphorus Reduction Task Force Report* (June 2000). 1995 loads for comparison only.

Table 1. Phosphorus loading targets in metric tons per year (mt/yr), shown in comparison with the 1991 and 1995 (estimated) phosphorus loads for contributing watersheds.

Source: The 1991 base year loads were measured by the *Lake Champlain Diagnostic-Feasibility Study* (VTDEC and NYSDEC 1997). The 1995 loads were adjusted to reflect expected reductions resulting from point and nonpoint source controls implemented through 1995.

that after implementation of agricultural Best Management Practices (BMPs) on all of the remaining farms in the Vermont and Québec portions of the Basin needing treatment, the loads would still exceed the twenty year non-point source target for the Vermont and Québec parts of the Basin, not accounting for any other changes within the Basin. Accelerating the timeframe for meeting the reduction targets will require new techniques and higher annual funding commitments than in the past.

CONSIDERATIONS FOR IMPLEMENTATION

Land Use Change Impacts on Phosphorus Loads

Based on the 2000 LCBP report of the Phosphorus Reduction Team, it appears that phosphorus loads generated by land use changes in the Basin are offsetting some of the gains achieved by point and nonpoint source reduction efforts. As the population within the Basin increases, more land is becoming developed. Because developed land generates more phosphorus than other land uses, non-point source phosphorus loads may be increasing in parts of the Basin where the land use is changing. Potential options for achieving the additional phosphorus reductions necessary to account for these increases include both additional point and nonpoint source treatments. Emerging technologies may be applied to further reduce point source phosphorus loads and additional nonpoint source reductions may be achieved through

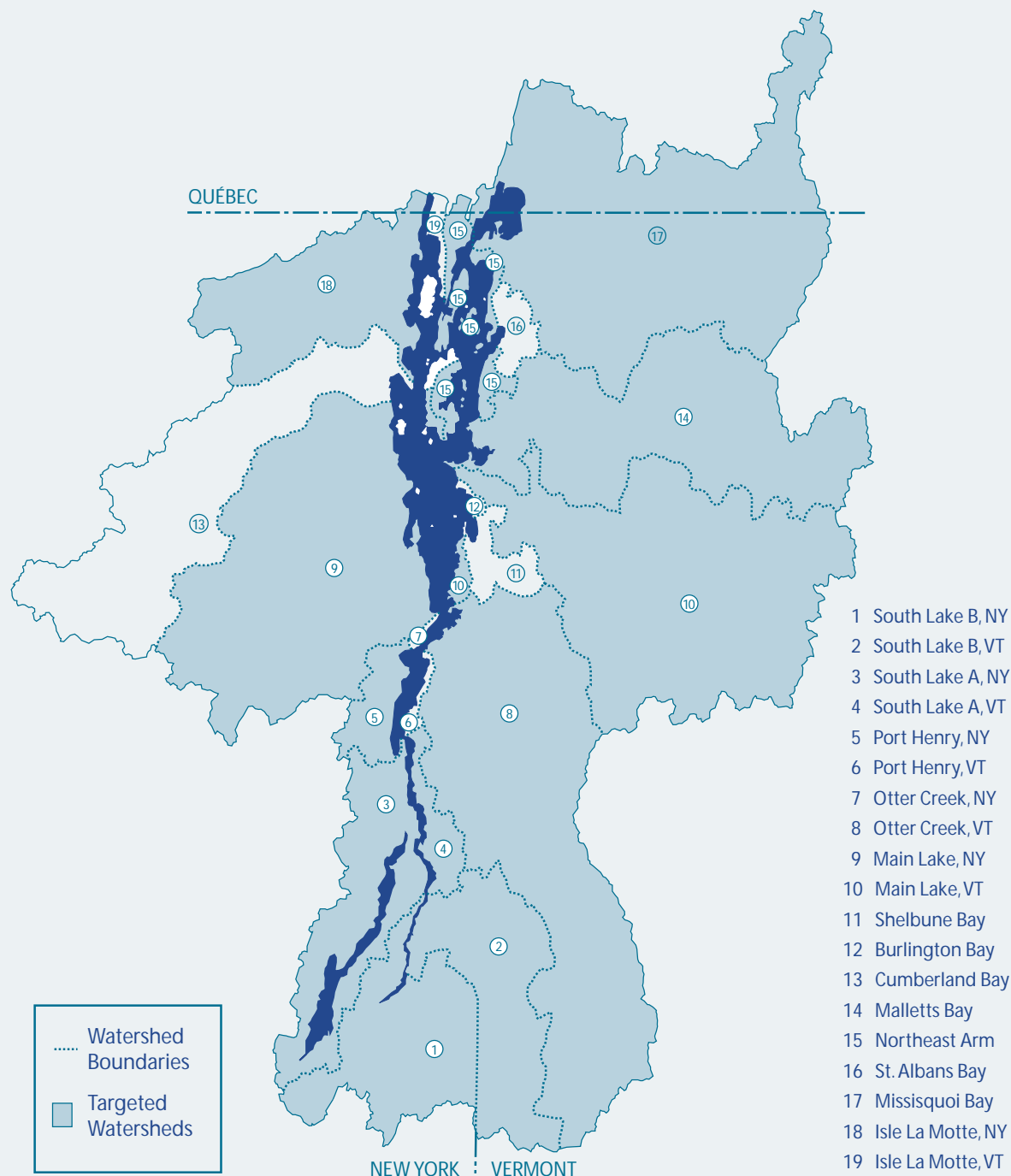


Figure 3. Drainage by lake segment and targeted watersheds for phosphorus reduction.

OBJECTIVES

(not listed in priority order)

- 1) Attain phosphorus loading targets for lake segment watersheds that are consistent with the 1996 New York, Vermont, and USEPA phosphorus reduction agreement.
- 2) Attain the in-lake phosphorus criteria specified in the 1993 New York, Québec, and Vermont Water Quality Agreement.

QC MENU



The Québec Ministry of Agriculture, Fisheries, and Food is working with farmers in the Québec portion of the Missisquoi Bay watershed on many best management practice (BMP) initiatives to reduce nonpoint source pollution.

actions such as implementing innovative BMPs and site designs, building conservation buffers, and supporting a whole-farm approach to agricultural nutrient planning.

Phosphorus Total Maximum Daily Load (TMDL)

The Federal Clean Water Act requires Vermont and New York to develop Total Maximum Daily Loads (TMDLs) for lakes and rivers that are not meeting water quality goals. A TMDL is an estimate of the amount of pollution that a body of water can receive without impairing vital uses, such as drinking water supply or aquatic life support. Because phosphorus is impairing water quality in many parts of Lake Champlain, Vermont and New York are required to prepare a phosphorus TMDL for the Lake. The bistate TMDL is based on the loading and in-lake concentration targets described in this section. Implementation of the TMDL will be consistent with the actions described in this Plan.

Focusing Phosphorus Reduction Resources on Targeted Watersheds

Twelve lake segment watersheds have been targeted for phosphorus load reductions (see Table 1). While basic statewide phosphorus reduction activities—such as implementation of Vermont's mandatory Accepted Agricultural Practices—should continue, phosphorus reduction actions should be targeted to these watersheds to the extent possible. Many of the recommended actions in this section are directed to targeted watersheds.

Preventing Increases in Phosphorus Loads to the Lake

For watersheds where no additional reduction is targeted, management efforts should focus on preventing increases in phosphorus levels. For targeted watersheds, management efforts should focus on both the reduction from existing sources and the prevention of increases from new sources. One way to minimize loading increases is to ensure that new development complies with appropriate management practices to control phosphorus export. Preventing phosphorus discharges at the initial stage of development is much less expensive than reducing phosphorus runoff after project completion. Both New York and Vermont have programs in place to control erosion, sedimentation, and stormwater runoff from new development. There are opportunities for strengthening these programs and for much more local government involvement in stormwater management.

Improving Nutrient Management on Farms

While it is important to continue with effective structural improvements to farms (such as the construction of manure pits and barnyard runoff systems), all farms can benefit from comprehensive nutrient management planning (CNMP). CNMP is an integrated approach to maximizing the efficient use of plant nutrients. The agricultural community is becoming more aware of the economic benefits of improved nutrient management, and is demanding more nutrient management assistance than can be provided by existing trained consultants.

HIGHEST PRIORITY ACTION

1) Develop and Assess Options to Achieve the Remaining Targeted Phosphorus Loading Reductions Needed to Achieve the In-Lake Phosphorus Standards

a) Implement the Lake Champlain Phosphorus Total Maximum Daily Load (TMDL) for New York and Vermont.

b) Implement the Québec-Vermont Agreement on Phosphorus Reduction in Missisquoi Bay, establishing a division of responsibility for reducing phosphorus loads to Missisquoi Bay during 2002.

c) By October 1, 2002, New York, Vermont and Québec will commit to a specific set of actions that will accomplish at least the second 25% of the total necessary lakewide phosphorus load reductions by October 1, 2006.

d) Determine the additional actions necessary to achieve the load reductions on an expedited schedule-by 2009, the 400th anniversary of Samuel de Champlain's arrival on the Lake, instead of 2016.

- Identify technical challenges to achieving the phosphorus reductions necessary and outline plans to overcome them.*
- Estimate the costs of implementing the reductions needed and the options for securing those funds.*

- Work aggressively to secure the necessary federal, state, provincial, and other funds as appropriate.*

e) By October 1, 2003, New York, Vermont and Québec will identify and commit to the specific actions necessary to achieve the remaining load reductions necessary to achieve the in-lake phosphorus criteria. These commitments will reflect the results of the investigation described in "d" above, and will make clear the most timely schedule of reductions deemed possible.

Potential key LCBP partners: NYSDEC, NYSSWCC, VTDEC, NYDAM, VTDAFM, QC MENV, QC MAPAQ, USEPA
Cost estimate: \$100,000, in-kind services

Potential funding sources: LCBP, NYSDEC, VTDEC, USEPA, QC MENV

Timeframe: 2001-2006

Benchmark: Identification of specific actions

HIGH PRIORITY ACTIONS

(not listed in priority order)

2) Provide Funding for Point Source Phosphorus Reductions

Provide sufficient funding to make the improvements to wastewater treatment plants necessary to attain the point source reduction targets agreed upon through the TMDL process and the Québec-Vermont Agreement on Phosphorus Reduction in Missisquoi Bay.

a) In Vermont, continue to provide state funding for implementation of the state phosphorus reduction statute, which currently requires all treatment plants discharging more than 200,000 gallons per day (except aerated lagoon facilities) to lower effluent phosphorus concentrations to 0.8 mg/l or lower.

b) Because additional point source reductions may be an outcome of the TMDL process, investigate the feasibility of additional reductions at selected treatment plants.

c) In New York, continue to provide state funding for wastewater treatment plant upgrades necessary to obtain the load reductions required by the TMDL.

d) The Québec government, in partnership with local municipalities, will continue to support extending wastewater treatment through its CleanUp Wastewater program. Treatment facilities have been constructed in several towns; several others have been connected to the new or existing facilities. Additional facilities are being built or planned for all remaining point source discharges. In the Missisquoi Bay watershed, all current and planned wastewater treatment facilities use an aerated lagoon treatment process with a target effluent concentration of 1.0 mg/l or lower.

e) Investigate the feasibility of updating the Phosphorus Detergent Ban to include products, such as dishwashing detergents, that are now being used in quantities similar to laundry detergents.

Potential key LCBP partners: VTDEC, NYSDEC, QC MENV municipalities

Cost estimate: \$30 million or more

Potential funding sources: State, provincial, and federal appropriations

Timeframe: 2002-2015

Benchmark: Point source phosphorus reductions, which in combination with nonpoint source reductions, achieve at least 25% of the total targeted reduction for each watershed (see Table 2) per five-year period for the next twenty years

ACCOMPLISHMENTS

EXCEEDING FIRST REDUCTION TARGET

A June 2000 LCBP analysis estimated that Vermont, New York, and Québec have reduced phosphorus inputs to Lake Champlain by 38.8 metric tons per year, far exceeding the 2001 reduction target of 15.8 metric tons per year.

REDUCING POINT SOURCES

An estimated 22.7 metric tons per year reduction in phosphorus loads from point sources was achieved between 1995 and 2001. Upgrading and constructing wastewater treatment plants in Vermont, New York, and Québec with \$25 million in state, federal, and provincial funds accomplished these reductions.

- In Vermont, state and federal funds have provided 100% of the costs of upgrading phosphorus removal processes at wastewater treatment plants in 14 municipalities.
- In New York, funds for wastewater treatment improvements in 12 municipalities were provided through the Clean Air/Clean Water Bond Act.
- In Québec, wastewater treatment plants with phosphorus removal now serve 7 municipalities.

continued on page 19

3) Estimate the Nonpoint Source Phosphorus Load That Is Being Generated by Developed Land Uses (Urban and Suburban Land, Roads, etc.) in the Basin and Work Aggressively to Reduce This Load.

Based on an LCBP analysis in 2000, it appears that increased phosphorus loads generated by land use changes in the Basin are offsetting some of the gains achieved by point and agricultural nonpoint source reduction efforts. Other studies have shown that developed land typically contributes more phosphorus per unit area of land than other land use types. As the population within the Basin increases, there is the opportunity to encourage growth away from the land-intensive suburban sprawl-type development and to better manage the resulting polluted urban stormwater to minimize increases in phosphorus loads to the Lake.

- a) Collect and analyze land use information to estimate the increase in phosphorus load that occurs with new development and to help target improved stormwater management to those areas experiencing the most rapid growth.*
- b) Develop new options to offset the phosphorus load generated by new development.*
- c) Increase efforts to reduce phosphorus loadings from new development by assisting local efforts to promote land use planning and innovative subdivision practices that discourage urban and suburban sprawl.*

d) Implement retrofitted stormwater management systems and other measures to reduce phosphorus loads from existing urban and suburban areas.

e) Work with the state, provincial, and local stormwater management programs to minimize the phosphorus load generated by new development and reduce the phosphorus load from existing areas undergoing redevelopment, including providing assistance for local compliance with USEPA Phase II stormwater rules.

f) Increase training opportunities for local road supervisors and crews to encourage implementation of BMPs for road construction, repair, and maintenance, according to the standards in state backroads, stormwater management, and erosion and sediment control handbooks.

g) Encourage implementation of erosion and sedimentation control practices for construction activities.

h) Encourage nutrient management on commercial and residential properties.

Potential key LCBP partners: NYSDEC, NYS SWCDs, NYSDOT, VTDEC, municipalities, NY counties, professional organizations

Cost estimate: \$100,000 to \$500,000 per year

Potential funding sources: USEPA, state appropriations

Time frame: 2001-2006

Benchmark: Revisions to state stormwater control programs that improve their scope and/or effectiveness

4) Expand and Accelerate Implementation of Existing Federal, State, and Provincial Agricultural Nonpoint Source Pollution Programs

Provide sufficient funding to accelerate implementation of federal, state, provincial, and local programs that provide technical and cost-share assistance for best management practices on farms, emphasizing animal waste and nutrient management and pollution prevention. Ensure that allocation of funds is consistent with sub-basin strategies, where applicable. Continue development, coordination, and implementation of state agricultural nonpoint source programs. Specifically:

a) Continue state cost-share funds provided through Vermont's voluntary Agricultural Best Management Practices (BMP) program and New York's Environmental Protection Fund. These funds should be used, where appropriate, to supplement federal cost-share programs to reduce the farmers' share of project costs and increase participation rates.

b) Continue implementation of recommended state management practices. In New York, encourage implementation of appropriate practices through the Agricultural Environmental Management program (AEM). In Vermont, encourage voluntary implementation of the Natural Resource Conservation District's (NRCS) recommended management practices in targeted watersheds. These practices, which are referenced in Vermont's Agricultural BMP rules, go beyond the state's mandatory Acceptable Agricultural Practices. In Québec, continue to provide funds for efficient manure storage required by regulation through the Agroenvironmental Investment Assistance Program

and funding and technical support to encourage sustainable agriculture practices, including nutrient and manure management, agroenvironmental advisory services, erosion control, and infrastructure facilities.

c) Seek other sources of funding for agricultural cost-share projects basinwide.

Potential key LCBP partners: NYSSWCC, VTDAFM, NYS-DAM, NYSDEC, VTDEC, QC MENV, QC MAPAQ, USDA-NRCS & FSA, USEPA, NYSERDA, USFWS, US Army Corps

Cost estimate: \$500,000 to \$1,000,000 per year

Potential funding sources: State and provincial appropriations, USDA-NRCS & FSA, USEPA, NY Environmental Protection Fund

Timeframe: 1995-2015

Benchmark: Acceleration of on-farm implementation of phosphorus reduction measures. Improved implementation of recommended management practices and the provision of funds to increase participation in federal cost-share programs within targeted watersheds

5) Expand Programs for Streambank Restoration and the Installation of Vegetated Buffer Areas Along Eroding Streams and Rivers

Studies have shown that vegetated areas along streams and rivers can effectively filter sediment and phosphorus from runoff and reduce streambank erosion while creating habitat for wildlife. Use stream geomorphology to determine where and how to address problems with erosion so that the entire stream system remains more stable over time.

a) Use geomorphic assessment and other techniques to target reaches where significant phosphorus loading may be occurring as a result of erosion.

ACCOMPLISHMENTS

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- Several promising new technologies for point source phosphorus removal were tested in the Basin with LCBP funding. The city of Lake Placid constructed a tertiary water treatment process at a golf course. The Town of Willsboro, NY and researchers from Cornell University piloted a new technology that uses wollastonite, a local mineral, in constructed wetlands to remove phosphorus from wastewater.

REDUCING NONPOINT SOURCES

An estimated 16.1 metric ton reduction in annual phosphorus inputs was achieved through implementation of Agricultural Best Management Practices (BMPs) in the Basin 1995 to 2001.

- In New York, the Clean Air/Clean Water Bond Act funds supported 75 agriculture BMP projects from 1995 to 2000, for an estimated phosphorus reduction of over 9 metric tons per year.
- With about \$7 million from federal, state, and landowner sources, nearly 600 BMP cost-share projects were implemented in Vermont between 1995 and 2000, for an estimated phosphorus reduction of over 8 metric tons per year.

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ACCOMPLISHMENTS

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- Québec has provided over \$2.9 million in cost-share funds to farmers for 120 manure storage structures, resulting in an estimated phosphorus reduction of more than one metric ton per year. About 75% of Québec agricultural operations in the Missisquoi Bay Basin now have adequate manure storage facilities.

DEVELOPING ALTERNATIVE MANURE MANAGEMENT TECHNIQUES

The Winooski Natural Resources Conservation District and the University of Vermont are beginning a cold-climate test of a new manure management technique that uses electrical currents to accelerate composting. This process kills pathogens more quickly and reduces odors. The resulting product is less polluting to surface waters than raw manure and can be more easily transported to areas in need of added nutrients.

IMPLEMENTING LOCAL PROJECTS

The LCBP has funded a number of local projects that contribute to reducing phosphorus. These projects involve citizen volunteers, willing landowners, and state and federal agency staff. Examples include:

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b) Develop or expand programs that cost-share or offer tax incentives for voluntary restoration or protection of buffer strips on perennial streams, rivers, and lakes in the Basin.

c) Develop a GIS database of streams needing buffer areas for use by programs such as the NY and VT Conservation Reserve Enhancement Programs (CREP) and the USDA Environmental Quality Incentives Program (EQIP).

d) Continue to support Coopérative de Solidarité du bassin versant de la rivière aux Brochets in Québec, a group of volunteers with the Ministry of Agriculture, Fisheries, and Food of Québec (MAPAQ) working to restore stream-banks of the Pike River Watershed.

e) Continue to implement Québec's Protection Policy for Lakeshores, Riverbanks, Littoral Zones, and Floodplains, in cooperation with local and regional governments and the Ministry of Natural Resources for lands in the public domain. The Ministry of Environment implements and coordinates the application of this policy.

f) Increase programs aimed at informing professionals working on streams (e.g., municipal officials, landscape architects, etc.) about the value and importance of buffers and stable streams.

g) Identify additional funding sources for streambank restoration.

Potential key LCBP partners: USDA-NRCS & FSA, USFWS, NYSSWCC, VTDAFM, NYSDAM, NYSDC, VTDEC, QC MENV, QC MAPAQ, Québec municipalities, and professional organizations

Cost estimate: \$500,000 per year

Potential funding sources: State, federal, and provincial appropriations, USDA, NY Environmental Protection Fund, the Québec Agroenvironmental Investment Assistance Program, Soil and Water Conservation Program of MAPAQ

Timeframe: 1995-2015

Benchmark: Miles of continuous streambank stabilized and acres of riparian buffer zones established

PRIORITY ACTIONS

(not listed in priority order)

6) Enhance and Refine the Current System for Documenting Non-point Source Phosphorus Control Practices and Estimating the Resulting Load Reductions

Reductions in phosphorus loadings to Lake Champlain resulting from nonpoint source phosphorus control practices have been estimated by tracking the implementation of these practices and then assuming each practice will result in a particular amount of phosphorus load reduction. These reduction "credits" for practices are also used to predict which actions are needed to achieve the in-lake goals.

a) Document and credit nonpoint source phosphorus reduction practices in a comprehensive manner across the Basin, including those implemented by all federal, state, and local programs.

b) Refine the credits currently being applied to agricultural nonpoint source phosphorus control practices to estimate more accurately the true reductions in loadings likely to be achieved.

c) Develop a technically sound and equitable method of crediting the phosphorus reductions achieved by urban stormwater and other non-point source control practices.

Potential key LCBP partners: NYSDEC, VTDEC, NYS-DAM, VTDAFM, QC MENV, QC MAPAQ, USDA-NRCS, USEPA

Cost estimate: \$100,000 to \$150,000

Potential funding sources: LCBP, NYSDEC, VTDEC, USEPA, QC MENV

Timeframe: 2001-2002

Benchmark: Implementation of a refined tracking system

7) Promote the Implementation of Comprehensive Nutrient Management Planning (CNMP)

Effective ongoing nutrient management on the farm is essential to phosphorus reduction efforts. This action is to provide additional education and technical assistance on comprehensive nutrient management, a complete system of animal waste management practices, and to promote sustained implementation of nutrient management plans that should accomplish the following:

a) Implement nutrient management plans on farms with phosphorus limits by 2004, as required by law in Québec.

b) Promote the use of combined soil testing with manure analysis and risk assessment tools, such as the Phosphorus Index, to minimize the impacts of phosphorus loadings from agricultural areas on water quality.

c) Broaden the support (educational, financial, and technical) for integrated crop management services and promote accurate record-keeping.

d) Provide training to promote implementation and maintenance of buffer strips between croplands and surface water conveyances (see Action 6 above).

e) Encourage farmers to keep livestock out of surface water by providing additional technical and financial assistance for streamside fencing and alternative watering systems.

f) Support demonstration and evaluation of existing and new alternative manure management technologies (e.g., composting and methane generation), including identification of funding, to assist producers in addressing surplus nutrient issues on their farms.

g) Support grassland agriculture and rotational grazing as a means of reducing the demand for more intensively managed row crops and to reduce the reliance on phosphorus imports to the farm.

h) Explore ways to reduce the amount of phosphorus imported to the farm, such as the phosphorus contained in animal feed supplements and other products that ultimately enter the farm waste stream.

i) Promote the development and implementation of CNMPs on all animal feeding operations, including those covered by state regulatory programs.

j) Encourage farmers to reduce soil erosion to tolerable soil loss levels to the extent possible on fields that receive nutrients.

ACCOMPLISHMENTS

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- The Missisquoi River Basin Association has ongoing streambank stabilization projects. Activities include planting trees and other streamside vegetation, installing fencing to restrict animals to streams, and stemming erosion at recreational access sites.
- The City of Plattsburgh and the Saranac Lake River Corridor Committee have worked on bank stabilization along the Saranac River.
- The Friends of the Winooski River fenced livestock out of the Huntington River and added streambank revetments and plantings along Mill Brook.
- The Boquet River Association wrote *How to Hold Up Banks*, a guide for nonprofit groups on controlling stream erosion.
- The Lamoille County Regional Planning Commission, the Boquet River Association, and the Lewis Creek Association are cooperating with the VTDEC to conduct stream geomorphological assessments which help prioritize stabilization projects and ensure their success.
- The Vermont Youth Conservation Corps has completed projects along 29 rivers and streams, including planting, mulching, and seeding.

Potential key LCBP partners: Farmers, university extensions, SWCDs, NRCDs, CMAs/private consultants, USFWS, USDA-NRCS and FSA, NYSDAM, VTDAFM, fertilizer dealers, QC MENV, QC MAPAQ, agroenvironmental clubs

Cost estimate: For a) \$5 per acre; for b) and d) \$100,000 each beyond what is provided for in Action 5; for others, \$25,000 per year

Potential funding sources: NYSDAM, VTDAFM, University Extension & Sea Grant Programs, USDA-NRCS and FSA, USEPA, federal appropriations, QC MENV, and QC MAPAQ

Timeframe: Ongoing

Benchmark: Increased implementation of practices described above

8) Research and Demonstrate the Effectiveness of Nonpoint Source Pollution Control Practices

Research on nonpoint source pollution control practices has led to increased understanding of their effectiveness as implemented in the Lake Champlain Basin (Meals 1990; Vermont Rural Clean Water Program Coordinating Committee 1991; Meals 2001). Two ongoing, long-term studies will further document the effectiveness of BMPs, one in an urban watershed and the other in an agricultural watershed. These projects should be continued until completed and additional projects should be considered as the results become available.

Potential key LCBP partners: NYSDEC, VTDEC, NYSDAM, VTDAFM, USDA-NRCS, USEPA, USGS, LCRC, universities

Cost estimate: For the monitoring component, \$50,000 per demonstration site per year; costs for implementing the practices will vary depending on the site

Potential funding sources: Federal and state appropriations

Timeframe: 1995-2007

Benchmark: Completion of the research and demonstration projects listed above

OTHER ACTIONS FOR CONSIDERATION

(not listed in priority order)

9) Develop and Implement an Awards Program for Basin Farmers

Support existing and consider new awards programs to recognize farmers in the Basin who are voluntarily implementing management practices designed to improve water quality.

Potential key LCBP partners: NYSSWCC, VNRC, NYSDAM, VTDAFM, NYSDEC, VTDEC, farmers

Cost estimate: \$1,500 per year per state, and limited in-kind participation of agency staff

Potential funding sources: USDA-NRCS & FSA, USEPA, and private sponsors

Timeframe: Ongoing

Benchmark: Development of criteria, application, and evaluation procedures, and initial distribution of awards to at least one farmer in each state

10) Encourage Continued Implementation of State Management Practices for Forestry Activities

In Vermont, continue implementation of Acceptable Management Practices for forest harvesting activities developed by the Commissioner of the Vermont Department of Forests, Parks, and Recreation (VTDFPR). In New York, encourage implementation of the Silviculture Management Practices in the New York *Silvicultural Management Practices Catalogue* (1993).

a) Increase cost-share funding for forest management planning.

b) Seek additional funds from the USDA Forestry Incentives Program (FIP) for practices such as timber stand improvement, tree planting, and site preparation for natural regeneration, all of which enhance the sustainability of forest lands.

Potential key LCBP partners: NYSDEC, VTDFPR, landowners, loggers, VT Forest Products Association

Cost estimate: In-kind participation of agency representatives

Potential funding sources: Same as key partners

Timeframe: 1996 and Ongoing

Benchmark: Improved implementation of management practices

11) Demonstrate the Use of Constructed Wetlands for Treating Domestic Wastewater, Agricultural Wastes, and Urban Runoff

One alternative to treating wastewater is the creation of a “constructed” wetland that simulates the water quality functions of a natural wetland. The technology for constructing wetlands is currently in the experimental stage of development, yet still can be applied to enhance the treatment of domestic wastewater, agricultural wastes, and urban runoff.

Potential key LCBP partners: USEPA, NBS, state and local agencies, NY SWCDs, LCRC, Vermont NRCDs, universities

Cost estimate: \$25,000-\$50,000 per year

Potential funding sources: Federal appropriations

Timeframe: Ongoing

Benchmark: Completion of one or more demonstration projects

PREVENTING POLLUTION FROM TOXIC SUBSTANCES

GOAL

Reduce toxic contamination to protect public health and the Lake Champlain ecosystem.

Lake Champlain Committee



Storm drain stenciling helps inform Basin residents about properly disposing toxic materials.

Toxic substances are elements, chemicals, or chemical compounds that can poison plants and animals, including humans. Recent efforts to improve our understanding of toxic pollution in Lake Champlain suggest that while levels are low compared to more industrialized areas, such as the Great Lakes, there is still cause for concern. Certain toxic substances may come from natural sources. However, the increasing use and release of chemicals in our daily lives may threaten the high quality of our Lake environment.

Health advisories have been issued in both New York and Vermont regarding the consumption of fish species with elevated levels of mercury and polychlorinated biphenyls (PCBs). An extensive survey of lake-bottom sediments has revealed elevated levels of mercury in many parts of the Lake and several other toxic substances in specific locations. The presence of toxic substances raises concern about their impacts on the Lake ecosystem, as well as on drinking water and the Lake's other uses.

ISSUES

Focusing Efforts on Sites of Concern and Substances of Concern

Contaminants that are released and transported to the lake can accumulate in lake-bottom sediments. The levels of contaminants in these sediments at different depths provide a picture of the history of pollution at particular site. Initial research and sampling of lake sediments has demonstrated that sediments at three sites in Lake Champlain—Cumberland

Bay, Inner Burlington Harbor, and Outer Malletts Bay—had elevated levels of some toxic contaminants. Toxic reduction and prevention actions have been targeted to these areas, including completion of a \$35 million cleanup of sediments in Cumberland Bay and a follow-up ecological study in Burlington Harbor (Figure 4, page 26).

The LCBP has reviewed the substances found to date in Lake Champlain and has ranked them based on the extent and levels at which they are found and the risk that they may pose to human health and the ecosystem.

Groups 1 and 2 include toxic substances of concern (See Table 2) that merit highest priority for management action because they are found in Lake Champlain sediment, water, or biota at levels above appropriate standards or guidelines, indicating potential risks to human health or the ecosystem. The rankings must be periodically evaluated in light of new data.

Identifying Sources and Quantifying Loads of Toxic Substances

Although researchers have begun to identify sources of toxic substances within the Basin, they have identified few active sources. Major questions remain concerning the sources, routes of transport, and delivery of toxic substances within and outside the Basin. Current information suggests that regulated point source wastewater discharges are not the primary sources of PCBs and mercury—PCBs

have been banned from discharges and mercury limited to very low levels. Remaining questions include: 1) how much of these substances comes from outside the Basin, and 2) what role do historical sources and contaminated sediments play. These information gaps on sources and transport of toxic substances pose significant questions with respect to future management options. Recent monitoring suggests that urban stormwater and atmospheric sources may be more significant than previously thought. Additional investigation should focus on further characterizing and quantifying these sources. Post-cleanup monitoring planned for Cumberland Bay should provide critical information on the role of this formerly contaminated site as a source of PCBs to the rest of the Lake.

Limitations of Current Information on Fate and Effects of Toxic Substances

Even if all sources of toxic substances were eliminated tomorrow, it would take a very long time to rid the ecosystem of these pollutants. Toxic substances accumulate in lake-bottom sediments, where they remain for long periods if undisturbed. They may be resuspended, consumed, or absorbed directly into organisms and enter the food web. Since scientists do not know much about these interactions, additional research is needed.

Questions also remain about human and ecosystem health effects from toxic substances in the Basin environment. While some toxicity to aquatic animals has been observed in areas with elevated contaminant levels, the ecosystem effects of persistent, low-level exposure to toxic substances are not well understood. These unknowns, including the risk to humans from eating contaminated fish, complicate decisions regarding the appropriate public policy response. Public awareness and understanding of fish consumption advisories must be improved, along with coordination of state and federal fish tissue monitoring programs. The impacts of toxic substances on sites of concern and on the Lake's ecosystem also need to be evaluated. Important information can be gained from other ecosystems, including the Great Lakes and the Chesapeake Bay, that have benefited from long-term monitoring and research.

Priority	Toxic Substances	Criteria for Selection
Group 1	PCBs, mercury ¹	Persistent contaminants found Lake-wide (in either sediment, water, or fish) at levels above standards, indicating potential risk to human health, wildlife, or aquatic biota. These are highest priority for management action.
Group 2	Arsenic, cadmium, chromium, dioxins/furans, lead, nickel, PAHs, silver, zinc, copper, persistent chlorinated pesticides ²	Persistent contaminants found in localized areas (in either sediment, water, or fish) at levels above standards or guidelines, indicating potential risk to human health, wildlife, or aquatic biota. These are next highest priority for management action.
Group 3	Ammonia, phthalates, chlorinated phenols, chlorine, atrazine, alachlor, and pharmaceuticals	Contaminants found above background levels in localized areas of the Lake, but below appropriate standards or guidelines.
Group 4	VOCs, such as benzene, acetone, pesticides, strong acids and bases, and other potential pollutants, such as fluoride	Contaminants known to be used or known to occur in the Lake Champlain Basin environment.

¹ Based on US FDA standards

² Based on a variety of guidelines (NOAA, Ontario, USEPA) regarding toxics in sediments

Table 2. Toxic substances of concern found in the Lake's biota, sediment, and water.

Setting Appropriate Goals and Standards

Despite the success of current programs to reduce toxic substances in the environment, some problems, such as PCBs and mercury in fish, continue to defy easy solutions. These and other contaminants that are persistent and tend to bioaccumulate challenge the existing regulatory structure because: 1) existing programs were designed to deal primarily with fewer contaminants; 2) certain sources of these contaminants are unregulated; and 3) significant quantities of these substances have built up in the environment (in sediment, biota, etc.) and continue to cycle through the ecosystem.

Managers charged with solving pollution problems in the Great Lakes and Chesapeake Bay regions have adopted a general, long-term goal to “virtually eliminate” sources of certain high priority toxic substances with the participation and support of business and industry. Confronting the challenges posed by persistent and bioaccumulating contaminants in the Lake Champlain Basin requires establishing firm and defensible toxic reduction goals, identifying priorities to minimize or prevent contamination, and implementing actions capable of attaining these goals.

Adopting a Strategy to Prevent Pollution Rather than Manage It

Faced with the increasing costs and liabilities associated with end-of-pipe waste management practices, agencies and waste generators are turning to pollution prevention as a cleaner, safer, and more cost-effective strategy.

Pollution prevention means altering methods and processes so a pollutant is never generated, rather than treating or controlling the contamination after generation and disposal. It includes such techniques as reducing the use of toxic substances, substituting non-toxic raw materials, if available, and modifying manufacturing processes.

OBJECTIVES

(not listed in priority order)

- 1) Prevent pollution from toxic substances in the Lake Champlain Basin.
- 2) Focus management efforts on reducing those toxic substances (such as PCBs and mercury) found at or above levels known to exceed human health standards or adversely affect aquatic life.
- 3) Identify and target sites of concern for toxic contamination, and make these areas or watersheds high priorities for management activities.
- 4) Reduce all types of toxic substances from point sources.
- 5) Reduce nonpoint sources of toxic substances to the Lake.
- 6) Meet all existing human health standards for drinking water and guidelines for fish consumption.
- 7) Protect living resources from the effects of toxic substances by meeting all existing standards for aquatic life.
- 8) Improve public understanding of the impacts of toxic substances in Lake Champlain and the research and management programs related to toxics substances.

HIGHEST PRIORITY ACTION

1) Develop and Implement a Comprehensive Toxic Substance Management Strategy Emphasizing Pollution Prevention while Continuing to Mitigate Pollution Problems throughout the Lake

This action represents the commitment of the Steering Committee to 1) restoring areas where pollution is a problem, and 2) preventing future problems by reducing the use of toxic substances at their source. This Comprehensive Strategy will be developed through a stakeholder process facilitated by the LCBP and will include many of the specific actions and initiatives listed in this section. The comprehensive strategy will address:

- a) An iterative process for revising the list of Toxic Substances of Concern based on new data (using risk-based criteria).*
- b) An aggressive pollution prevention strategy that works to implement common-sense, "low cost/low tech" pollution prevention measures immediately.*
- c) Incentive programs for business and citizen participation in pollution prevention.*
- d) A focus on mercury, PCB's and other toxic substances of Basin-wide significance.*

e) A continued program of research to examine the impacts of new generation pesticides, endocrine disrupting chemicals, pharmaceuticals, and other chemicals in widespread use.

f) Coordination of ongoing pollution prevention programs.

g) Continued coordination of spill response activities between jurisdictions in the Basin, such as emergency response trials and training.

h) Coordination with regional programs to reduce atmospheric sources of contaminants, including mercury and acid rain.

Potential key LCBP partners: Partnership of federal, state, and local agencies, QC MENV, research institutions, LCRC, private and nonprofit entities

Cost estimate: \$90,000 per year for coordinator, with in-kind participation of agency and research representatives

Potential funding source: Federal appropriations

Timeframe: Ongoing

Benchmark: Adoption of toxic substances reduction strategy by key partners

HIGH PRIORITY ACTION

2) Continue Monitoring and Restoration Efforts in Sites of Concern

For sites of concern identified by ongoing research and monitoring (Inner Burlington Harbor, Outer Malletts Bay, Cumberland Bay,* and other sites as appropriate), characterize the extent of contamination, evaluate alternative remedial actions, and make recommenda-



DATA SOURCE: LCBP

NEW YORK VERMONT

Figure 4. Sites of concern and cleanup actions as of 2001.

tions to the states of New York and Vermont and the USEPA based upon findings.

Recommendations should:

a) Identify sites based on new research or monitoring data.

b) Characterize the extent and severity of contamination and effects.

c) Consider restoration alternatives that may be applicable to each site, including no action, source identification, pollution prevention, remediation, dredging, containment, in situ treatment and other alternatives.

d) Recommend the best management alternative to local governments, states, USEPA, and US Army Corps of Engineers (USACOE).

* The remediation project in Cumberland Bay is complete. See the Accomplishments sidebar in this section for more information.

Potential key LCBP partners: For a-b) LCRC with NYSDEC and VTDEC, USEPA, USFWS, and other federal agencies; for c-d) a partnership of interested parties

Cost estimate: For a-b) \$200,000 or more per site; for c-d) cost of supporting coordinating committee and studies.

Potential funding sources: USEPA, VTANR, NYSDEC, and federal appropriations

Timeframe: 3-5 years per site, with ongoing process for site identification

Benchmark: Report documenting above elements a-d

PRIORITY ACTIONS

(not listed in priority order)

3) Facilitate the Redevelopment of Contaminated Sites (Brownfields) in the Lake Champlain Basin

Former industrial sites that are either contaminated or suspected of being so are often not redeveloped because of liability or other concerns. Many of these sites are located in areas of importance to local communities, such as town centers, and their redevelopment could turn an eyesore into a community asset. Towns, local organizations, and businesses should be encouraged and offered assistance in seeking federal programs to assist with the cleanup and redevelopment of brownfields.

Potential key LCBP partners: NYSDEC, VTDEC, USEPA, interested local parties

Cost estimate: \$60,000 per year and \$500,000 per year for site assessments

Potential funding sources: USEPA

Timeframe: Ongoing

Benchmark: Successful redevelopment of sites

4) Further Characterize and Manage Toxic Substances In Urban Stormwater

Urban stormwater is a significant source of metals, combustion product contaminants, oil and grease, pesticides, and other toxic substances. Following on previous LCBP studies, the occurrence of these contaminants in urban stormwater should be better documented and their loads to the Lake estimated where appropriate. Sources of specific contaminants

ACCOMPLISHMENTS

CLEANING CUMBERLAND BAY

High levels of polychlorinated biphenyls (PCBs) were discovered near Wilcox Dock in Cumberland Bay, NY, during LCBP sponsored monitoring. In 2000, NYSDEC completed a three-year, \$35 million restoration project that removed contaminated sediment and restored affected shoreline and wetland areas. A temporary sediment dewatering and wastewater treatment facility was constructed onsite during hydraulic dredging operations, which removed more than 140,000 tons of PCB-contaminated sludge from the bottom of the bay. Also, 37,000 cubic yards of contaminated soil, 34,700 tons of PCB hazardous waste, and 80,200 tons of non-hazardous waste were disposed offsite. Follow-up monitoring will characterize the continued site influence on water quality lake-wide.

ASSESSING BURLINGTON HARBOR

LCBP monitoring found potentially harmful levels of contaminants in Burlington Harbor. A follow-up study, completed in 1999, measured sediment contaminant levels and tested whether or not the contaminants are harmful to aquatic animals. Study results indicate that long-term exposure to toxic substances in sediments may be affecting aquatic organisms living there, especially in the south-

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ACCOMPLISHMENTS

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ern harbor. The chemicals of concern are primarily hydrocarbons and metals, whose sources may include historic activities, stormwater runoff, and sewage treatment plant discharges. Cleaner, more recent sediments may be covering older, more contaminated sediments.

REMEDIATING TOXIC SITES

Plattsburgh Air Force Base, the Air National Guard site in Colchester, and the Pine Street Barge Canal have toxic remediation efforts underway. The Air Force Base and/or the Plattsburgh Airbase Redevelopment Corporation (PARC), for example, have removed 139 underground fuel tanks, installed a new 60,000-gallon fuel system, and developed an environmental management system that PARC and its tenants must follow.

IMPLEMENTING POLLUTION PREVENTION

- The nonprofit organization Lake Champlain Committee (LCC), completed several LCBP-funded projects in New York and Vermont to reduce the amount of toxic substances reaching Lake Champlain. Events included toxic reduction demonstration projects, community stream cleanups, and stormdrain stenciling programs.

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found at high levels should be identified. For example, sources of PCBs in tributaries to Cumberland Bay and sources of pesticides and metals in tributaries to Burlington Harbor need to be identified.

Potential key LCBP partners: NYSDEC, VTDEC, USEPA, LCRC

Cost estimate: \$200,000 per year

Potential funding source: USEPA

Timeframe: Ongoing

Benchmark: Completion of characterization and source identification

5) Support and Continue Programs to Encourage Homeowners, Industries, Businesses, and Public Institutions to Implement Pollution Prevention and Recycling Measures

Pollution prevention or source reduction measures include:

a) Switching to nontoxic or less toxic products and raw materials.

b) Promoting the development and implementation of pollution prevention plans and activities for direct and indirect dischargers of toxic substances of concern.

c) Conducting public education programs on source reduction, use of nontoxic alternatives, and recycling measures for residential properties, municipalities, and businesses, such as golf courses, marinas, homeowners, universities, and schools.

d) To reduce water and air pollution from inefficient 2-cycle motors, promote the general use of 4-cycle motors and fuel injected 2-cycle motors for boats and personal watercraft. All motors should comply with new federal regulations on or before the 2006 deadline.

Recycling measures include:

a) Recycling mercury from light switches and fluorescent light bulbs.

b) Initiating periodic collection programs for mercury and PCB-bearing substances.

Potential key LCBP partners: NYSDEC and VTDEC

(including Pollution Prevention and Solid/Hazardous Waste Management Divisions), QC MENV, municipalities, industries, nonprofit entities, USEPA

Cost estimate: \$50,000 to \$100,000

Potential funding sources: State, provincial, and federal appropriations.

Timeframe: Ongoing

Benchmark: Commitment from municipalities, businesses, and industries to prevent pollution

6) Continue Research and Monitoring of the Distribution, Fate, and Effects of Mercury, PCBs, and Other Toxic Substances

Major information gaps exist regarding the fate and effects of toxic substances in the Lake Champlain ecosystem. Initial results of research indicate that toxic substances, such as PCBs in lake-bottom sediments, can enter the food web. However, researchers do not fully understand the impacts of toxic substances on the Lake Champlain ecosystem. Specific studies include:

a) The assessment of mercury cycling in the basin. USGS and its partners are conducting the initial phase of this assessment. Funding should be continued and additional funding should be sought to support a comprehensive assessment.

b) Additional monitoring of current-use chemicals. A number of pesticides and other chemicals are in widespread use in the Basin, although their fate and effects in the environment are not monitored or studied regularly.

Other key research should include:

a) Assessment of the effects of chronic and low-level exposure on key food web components, particularly during vulnerable life stages.

b) Determination of how toxic substances, such as PCBs and mercury, cycle through the Lake and investigation of their potential effects on aquatic life, human health, and the Lake's ecosystem.

c) Coordinated, cooperative data exchange and analysis.

d) Continuation of sediment surveying and biological monitoring programs.

e) Continuation of atmospheric monitoring program for mercury.

f) Identification of and response to emerging issues.



The Cumberland Bay cleanup, led by the NYSDEC, removed 140,000 tons of PCB-contaminated sludge from the Bay.

ACCOMPLISHMENTS

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- The Northwest Vermont Solid Waste Management District teamed up with the VT Department of Agriculture, Food, and Markets and others to collect 80 mercury-containing manometers used by dairy farmers to monitor pressure in their milking systems. The manometers were replaced with non-mercury alternatives at no charge to the participating farmers. More than 40 pounds of mercury were collected.
- The National Wildlife Federation's Northeast Natural Resource Office has worked to inform Basin towns about effective stormwater management. They have produced workshops for nearly a dozen towns explaining stormwater issues, providing resources, and examining town policies. The NWF also held a workshop for town officials and planners focusing on "smart growth" strategies for protecting water quality.
- The Town of North Elba and the Village of Lake Placid, NY, along with the Mirror Lake Watershed Association and NYSDEC, are inventorying stormwater facilities for Mirror Lake. Volunteers are collecting information about stormwater discharge points. An engineering consultant will then develop recommendations for actions, such as cleaning, repairing, or replacing existing structures.

Potential key LCBP partners: Research institutions and the LCRC, in coordination with NYSDEC and VTDEC, USGS

Cost estimate: \$250,000 per year (minimum)

Potential funding sources: Federal and state appropriations

Timeframe: Ongoing

Benchmark: Completion of research elements a-b) and publication of results

OTHER ACTIONS FOR CONSIDERATION

(not listed in priority order)

7) Establish or Enhance Agricultural and Household Hazardous Waste Collection Programs

This action recommends that municipalities within the Basin collect and dispose of household hazardous waste properly and regularly. The action also recommends more effective disposal options for agricultural, lawn, and garden pesticides, herbicides, and metals.

Potential key LCBP partners: NYSDEC and VTDEC, VTDAFM, NYDAM, USEPA, QC MENV, municipalities, solid waste districts, nonprofit entities

Cost estimate: \$50,000 for seed money to New York communities, and \$50,000 for disposal costs in Vermont; \$50,000 for technical assistance, including staff support; in-kind participation of local, state, and federal agencies

Potential funding sources: USEPA, federal, and state appropriations

Timeframe: Ongoing

Benchmark: Establishment of several community-based collection programs

8) Continue to Review Discharge Data for Sources of Toxic Substances of Concern, Including Wastewater Treatment Plant Discharges

This action would include the following elements:

a) Screen all existing data for known or suspected sources of these substances.

b) Encourage enforcement of all existing programs.

c) Evaluate the Toxic Substances Release Inventory data for the Lake Champlain Basin for additional sources.

Potential key LCBP partners: NYSDEC and VTDEC, USEPA, Province of Québec

Cost estimate: In-kind participation of state and federal agencies

Potential funding sources: NYSDEC and VTDEC, USEPA

Timeframe: Ongoing

Benchmark: Completion of report detailing the identification and remediation/control of sources of toxic substances of concern

PROTECTING HUMAN HEALTH

GOAL

Minimize the risks to humans from water-related health hazards in the Lake Champlain Basin.

LCBP



Controlling bacterial contamination of public waters is essential to protect human health in the Basin.

Everyday we face a variety of voluntary risks (e.g., cigarette smoking or driving a car) and involuntary risks (e.g., breathing air of poor quality or being struck by lightning). Determining what is an acceptable level of voluntary risk is an individual decision based on knowledge of the risks. Many environmental regulatory actions are directed towards reducing involuntary risk from exposure to substances in air, water, and food. Such actions involve determining what is an acceptable level of risk and limiting exposure to that level.

This section focuses on potential health threats associated with poor water quality in Lake Champlain and is limited to assessing risks from drinking water, eating fish and wildlife, and swimming in the Lake, as well as source water protection programs mandated under the Federal Safe Drinking Water Act (SDWA). It does not otherwise address ground water quality, other surface water bodies in the Basin, or air quality issues in the Basin.

Controlling Bacterial and Pathogen Contamination of Public Waters

Pathogens are disease-causing agents such as bacteria, viruses, and parasites. Water-related pathogens cause gastrointestinal illnesses when ingested. Exposure to pathogens is primarily through ingestion, either accidentally while swimming, or when drinking water from the Lake. Drinking water suppliers depend on high quality source water to produce the highest quality drinking water as economically as possible. The presence of pathogens causes occasional beach closings around the Lake, most commonly in Chittenden County, VT. Many sources of pathogens are addressed

by recommendations included elsewhere in this Plan. For example, agricultural wastes, a significant source of bacterial pathogens, are also addressed in the phosphorus section. It is important to address failed septic tanks as sources of potential pathogen contamination and devise flexible solutions to the problems they pose. Combined sewer overflows and sanitary sewer overflows are sources of pathogens that degrade source water for drinking water supplies. Urban stormwater runoff is also a potential source of pathogens to surface waters.

Waters near the shores of Lake Champlain and many of its tributaries frequently exceed standards for coliform contamination. Although some strains of coliform bacteria are harmless

and live in the digestive tract of humans, other strains produce powerful toxins that can cause severe illness in humans, damaging the kidneys and intestinal tract.

Local health departments sample the water at public beaches to determine any potential threats to human health from pathogens. Elevated levels of fecal coliform present in the water is a common indicator. When pathogens are found in elevated levels, preventing potential disease transmission requires beach closures until sampling indicates that bacteria levels have been reduced to safer levels by wind and wave action or cooler water temperatures. A number of lakeshore communities has been required to close public beaches temporarily as a result of elevated bacteria levels. Other beaches serving motels, camps, and campgrounds can also be affected if they are close to stormwater discharges, municipal wastewater treatment plants, failing septic systems, agricultural runoff, or other pollutant sources. Because informal swimming areas and other locations where people may use the Lake for recreation are not tested for bacteria levels, the public should avoid swimming in areas immediately downstream from wastewater treatment plant discharges or where animal waste obviously drains from agricultural areas.

Because some harmful strains of the bacterium *E. coli* thrive in domestic animals, animal waste often is contaminated. Consequently, animal waste management is a vital component of the plan to control the associated risk to human health. Identifying the animal groups at the source of *E. coli* contamination through a technique known as DNA tracking offers

great potential to strengthen management strategies to control the problem, and should be applied at selected problem areas throughout the Basin. Actions to control bacterial pathogens at the source include agricultural and urban best management practices, and improved stormwater management.

Contamination of Public Waters by Blue-Green Algae Toxins

Blue-green algae, also known as cyanobacteria, are normally harmless and widely scattered through the surface waters of Lake Champlain. Under favorable conditions for growth, however, thick blue-green algae blooms develop, especially in calm and shallow waters. Some strains of common blue-green algae species can produce neurotoxins that can damage the nervous systems; others produce hepatotoxins harmful to liver functions. In both 2000 and 2001, both neurotoxins and hepatotoxins were detected in Lake Champlain. When the water surface temperature is high and the required nutrients are abundant, blue-green algae blooms may generate concentrations of toxins that pose a risk to human health.

The risk to the health of swimmers and those who ingest contaminated water is compounded by the locations of blue-green algae blooms, which tend to be close to shore and near areas tapped for public water supplies.

Although researchers have begun to identify the conditions which cause some blue-green algae to produce toxins, important questions remain. The LCBP and the Centers for Disease Control have funded the Vermont Department

of Health, the University of Vermont, and Syracuse University to monitor Lake Champlain for blue-green algae blooms and toxins, especially near drinking water intakes and beaches. Remaining questions include: 1) What is the frequency, distribution, and severity of algae toxins in the lake? 2) What role do microclimatic conditions and nutrient availability play in facilitating blue-green algae blooms and the production of toxins? 3) How can toxic conditions be monitored effectively to provide prompt public notification when hazards to human health develop? and 4) How can risks caused by contamination of drinking water and swimming areas be mitigated?

Availability of Comprehensive, Statistically Valid Fish Tissue Data

Mercury and PCBs, found in both sediment and biota, are of particular concern because of their tendency to bioaccumulate to high levels in some fish species, particularly the larger predators. The Federal Drug Administration sets "action levels" or tolerances for contaminants found in fish species. If fish tissue analysis indicates that levels of contamination exceed these action levels in a significant number of fish, a fish consumption advisory for that body of water is established by the State Health Department. As a result of mercury and PCB (polychlorinated biphenyls) contamination, health advisories exist for several species of fish caught in Lake Champlain. There is also an advisory for all yellow perch caught in Cumberland Bay and a ban on commercial sale of perch caught in the Bay. More restrictive guidelines exist in both states for women of childbearing age and children. Health advisories also exist for waterfowl consump-

tion. The fish sampling programs for Vermont, New York, and Québec are currently not well coordinated, and do not yet provide a comprehensive database. One reason the state programs are limited in scope is the high cost associated with sampling fish for the types of contaminants of concern. However, it is difficult to discover trends or provide statistically valid conclusions without a more extensive database. Efforts to expand the available database and to improve coordination of management efforts among partners should be coordinated with the Comprehensive Toxics Management Strategy called for elsewhere in the Plan.

Potential Human Health Risks to the Public, Including Those Related to Fish Consumption Advisories

Communicating risks is an important part of any effort to protect human health. New York and Vermont have worked together to inform each other of any press releases or health advisories before they are released and both states use similar methods of educating the public and communicating risks. For example, New York hands out information on all fish advisories with every fishing license issued; and Vermont has included information about the advisories in the *Digest of Game Laws* since 1994. However, some of the general advisories regarding the consumption of mercury—and PCB—contaminated fish flesh are not consistent and therefore pose a challenge when communicating health risks. For example, the New York health advisory for Lake Champlain includes general guidance for all fish species (no more than one meal per week) as opposed to six meals per month from all Vermont waters. The age at which

advisories apply to children and women of childbearing age also varies between jurisdictions.

As other kinds of contamination are recognized, for example, those due to the toxins sometimes produced by blue-green algae, or high bacterial pathogen levels in public waters due to agricultural or urban runoff, there should be effective means to alert the public about the associated health risks. Vermont, New York, and Québec are considering how to best coordinate communication on these issues.

Threats to Public Water Supplies

All Lake Champlain Basin Program partners and citizens throughout the watershed share the need to support federal, provincial, state, and local efforts to protect public water supplies from terrorist threats. Improved communications, risk management, spill response agreements, and citizen involvement will also help reduce accidental water supply contamination.



At Burlington's Blanchard's Beach, near the outlet of Englesby Brook, a sign recommends not to swim because of consistently high bacteria levels in the water.

LCBP

Protecting and Improving Public Water Supplies

Approximately 188,000 people, or 32% of the Basin population, depend on the Lake for their drinking water. Of the 99 water systems withdrawing supplies from the Lake, 64 are motels, trailer parks, businesses, restaurants, etc., and 35 are community supplies. Twenty-five of the community supplies serve less than one thousand people.

OBJECTIVES

(not listed in priority order)

- 1) Where a water quality related health risk is identified, communicate results to the public promptly and implement plans to reduce that risk.
- 2) Control sources of pathogens found in the Lake and its Basin to ensure drinkable and swimmable water and eliminate the need for closing beaches.
- 3) Improve public understanding of health issues related to water recreation and drinking water.
- 4) Identify potential human health risks from eating fish caught in Lake Champlain-including toxic substances of concern, populations of concern, and fish species of concern –and communicate these risks effectively to the public.
- 5) Identify potential human health risks from drinking water contamination caused by blue-green algae toxins.
- 6) Ensure that public water systems, especially small privately owned systems, are able to meet the technical and financial requirements of the Safe Drinking Water Act.

The Federal Safe Drinking Water Act (SDWA) presently requires all public water systems serving the same population for more than six months to monitor for 84 contaminants in drinking water. Public water systems serving a transient population are required to monitor for acute contaminants, including bacteria and nitrate. Of particular concern is the “surface treatment rule,” which requires filtration of all surface water sources unless the water supplier can meet certain strict criteria related to the protection of the supply from sources of contamination. This burden falls most heavily on small water systems, many of which are privately owned. Costs of treatment are difficult for small systems to bear, and technical

expertise is not as readily available to them. For drinking water systems not under the auspices of the SDWA, such as individual home-

owner systems, education can help protect the health of users. Surface water should always be properly treated before it is consumed.

HIGHEST PRIORITY ACTION

1) Improve Risk Communication by Making Appropriate Information Readily Available to the Public

This action would coordinate information about fish advisories, beach closings, and blue-green algae toxins, and include a public education and outreach effort to communicate with people in all three jurisdictions surrounding the Lake. This effort would also include an aggressive educational program regarding what the risks are to particular groups of individuals, and what an individual can do to minimize the risks from eating fish and wildlife or from contact with contaminated water. Care should be taken to ensure that risks are neither overstated nor understated.

a) New York, Vermont, and Québec should work together to develop common fish advisory standards.

Potential key LCBP partners: VTDOH, VTDEC, VTDAFM, NYSDAFM, NYSDOH, NYSDEC, QC MENV, QC RRSSS, local health units, private health organizations, municipalities

Cost estimate: \$60,000 per year

Potential funding sources: state and federal appropriations, USEPA

Timeframe: Ongoing

Benchmark: Risk communication approach developed and implemented

HIGH PRIORITY ACTIONS

(not listed in priority order)

2) Investigate Areas of Potential Pathogen Contamination and Devise Flexible Solutions to the Problems

In areas where faulty septic systems, wastewater treatment discharges, or nonpoint source runoff cause problems with pathogens in the water, or where there is reason to suspect contamination, this action recommends cooperating closely with municipalities to locate sources, devise solutions, and provide technical assistance where possible. This action focuses on human risks from pathogens, and especially addresses water supplies, beaches, and shoreline areas. This recommendation encourages the consideration of alternative solutions to bacterial pathogen problems. Municipalities should receive cost-sharing funds from state or federal agencies for any remediation or upgrades required. Elements of this action include:

a) Insure adequate monitoring of source water used for drinking water supplies and water at public recreation areas.

b) Improve monitoring data sharing, coordination, and communication.

c) Develop a public education and outreach program that focuses on individual citizen actions to reduce the risk of pathogen contamination of public water supplies and recreation areas, such as inserts in water bills and other appropriate outreach techniques.

d) Assist communities in finding technologies and resources to address pathogen contamination problems that impact community water supplies, beaches, and shoreline areas.

e) Support the study of water movements in the areas near wastewater treatment discharges and drinking water supply source areas to identify water flow patterns that affect water quality.

f) Determine the importance of failed septic systems as sources of pathogens and examine alternative sewage disposal technologies for existing sites.

Potential key LCBP partners: VTDOH, VTDEC, VTDAFM, NYSDAFM, NYSDOH, NYSDEC, QC MENV, QC RRSSS, local health units, private health organizations, municipalities
Cost estimate: \$60,000 per year for staffing and in-kind participation

Potential funding sources: State and federal appropriations, USEPA

Timeframe: Ongoing

Benchmark: Data sharing protocol, educational materials, technical assistance, and water movement research

3) Develop the Means to Quickly Identify Conditions Causing Toxic Blue-Green Algae Blooms and Provide Timely Information to Public Water System Managers

Isolated cases of toxic blue-green algae blooms in Lake Champlain have led to the death of dogs which drank lake water in the vicinity of the blooms.

a) Support improved sampling, identifying, and communication about blue-green algae bloom locations, progressions, and durations, and inform the public about potential dangers.

ACCOMPLISHMENTS

TRACKING BACTERIAL SOURCES

With the USEPA's help, Colchester and Winooski are using *E.coli* monitoring and DNA tracking to link bacteria samples from streams and beaches to species in the watershed (such as humans, dogs, cows, or waterfowl). If results can successfully identify sources, the USEPA will work with other agencies and the LCBP to assist municipalities with targeted measures to reduce bacteria levels.

MONITORING BLUE-GREEN ALGAE

In 1999, the temporary presence of toxins produced by blue-green algae, known as cyanobacteria, was confirmed on Lake Champlain. Warm surface temperatures augmented by calm winds and limited vertical mixing of the water column create favorable conditions for blue-green blooms that sometimes produce toxins. In response, the LCBP has provided financial support to a monitoring project being conducted by the University of Vermont, VT Department of Health, Syracuse University, and the Federal Centers for Disease Control. The Québec Ministry of the Environment has continued testing for blue-green algae on Missisquoi Bay since 1999. The data can be used to alert the public about the presence of blue-green algae blooms.

b) Develop a Basin-wide training and outreach program for water suppliers who draw Lake water to improve recognition of algae blooms, provide contacts for algal identification and analysis of samples for toxins, and suggest protocols for responding to bloom conditions.

Potential key LCBP partners: VTDOH, VTDEC, VTDAFM, NYSDAFM, NYSDOH, NYSDEC, QC MENV, QC RRSSS, Federal Centers for Disease Control and Prevention, local health units, academic institutions, private health organizations, municipalities

Cost estimate: \$40,000 for additional testing and response capabilities, and in-kind participation

Potential funding sources: State and federal appropriations, CWA Section 319 Program

Timeframe: Ongoing

Benchmark: Continued monitoring, established communication protocol

PRIORITY ACTIONS

(not listed in priority order)

4) Encourage the States and Federal Government to Provide Funds to Implement the Safe Drinking Water Act

The SDWA provides the mechanisms to protect human health; however, its requirements are expensive, particularly for small water systems. This action recommends that funds continue to be made available so that water systems, especially small water systems presently regulated under the SDWA, can implement source water assessments and protection.

Potential key LCBP partners: USEPA, VTDEC, NYSDOH, water system operators, citizens

Cost estimate: In-kind participation

Potential funding sources: Not applicable

Timeframe: Immediate

Benchmark: Letters to state and federal representatives documenting the difficulties faced in implementing the SDWA, followed up by phone calls, testimony, as appropriate

5) Undertake Further Focused Research and Risk Assessment Related to Fish Consumption

Assess the need for further research on fish consumption patterns in the Basin, focusing on the following four issues:

a) Comprehensive review of existing programs.

b) Following removal of PCB contaminants in Cumberland Bay, assess PCB levels in fish tissue to determine if this cleanup resulted in lower levels lakewide.

c) Because the first consumption survey focused only on licensed anglers, assess consumption patterns of other fish consumers, particularly local populations, including Native Americans and Asians who may consume larger amounts of fish from the Lake.

d) Because of the particular sensitivity of children and women of childbearing age to consumption of contaminated fish, assess their consumption patterns.

e) If average fish consumption rates are higher for Lake Champlain anglers than for the United States population as a whole, develop a risk assessment specific to the population around Lake Champlain.

Potential key LCBP partners: VTDEC, VTDOH, VTFWD, NYSDEC, NYSDOH, QC MENV, QC RRSSS, USEPA contractor support, private health organizations, universities

Cost estimate: \$50,000 to \$100,000

Potential funding sources: State and federal appropriations

Timeframe: 2001-2006

Benchmark: Completion of reports characterizing the fish consumption patterns of local populations and the associated risks; report assessing the level of contaminants in fish in Cumberland Bay

ANOTHER ACTION FOR CONSIDERATION

6) Provide Opportunities for Technology/Information Transfer Focusing on the Needs of Small Water Supply Systems

This action would provide a forum for a transfer of expertise from large water supply systems to smaller systems. This assumes that personnel at large systems may have had greater training and educational opportunities which would benefit individuals responsible for small systems. The VTANR provides mandatory free training to small system operators already, so this action may just expand the existing training. New York water system operators are required to be trained, so this may be incorporated into the existing training.

Potential key LCBP partners: VTDEC, NYSDOH, QC MENV, QC RRSSS, and water system operators

Cost estimate: In-kind participation of agencies

Potential funding sources: Same as key partners

Timeframe: Ongoing

Benchmark: Expanded training programs for water system operators which focus on the issues facing small systems

CHAPTER THREE

LIVING NATURAL RESOURCES

THIS CHAPTER INCLUDES:

Managing Fish and Wildlife
Protecting and Restoring Wetlands, Streams, and Riparian Habitats
Managing Nonnative Aquatic Nuisance Plants and Animals

The living natural resources of the Lake Champlain Basin are part of a complex ecosystem. Fish and wildlife, including non-native aquatic nuisance species, such as sea lamprey, occupy a mosaic of interconnected aquatic and terrestrial habitats. These habitats include the Lake's broad open waters, tributaries, wetlands, forests, agricultural lands, and other areas. The Basin's living natural resources can be divided into six major groups: fish, invertebrates, amphibians and reptiles, birds, mammals, and plants. Humans are also part of the ecosystem, and in many places, human activities and development have adversely impacted local ecosystems.

Les ressources naturelles vivantes

Les ressources naturelles vivantes du bassin du lac Champlain font partie d'un écosystème complexe. La faune, incluant les espèces aquatiques nuisibles comme la lamproie marine, occupe une mosaïque d'habitats aquatiques et terrestres étroitement liés. Ces habitats comprennent les eaux du lac, les affluents, les milieux humides, les forêts, les terres agricoles et les autres zones. Les ressources naturelles vivantes du bassin sont divisées en six grands groupes: les poissons, les invertébrés, les amphibiens et les reptiles, les oiseaux, les mammifères et les plantes. Les êtres humains font également partie de l'écosystème et, en de nombreux endroits, les activités humaines ont eu des effets négatifs sur les écosystèmes locaux.

MANAGING FISH AND WILDLIFE

GOAL

Restore and maintain a healthy and diverse community of fish and wildlife for the people of the Lake Champlain Basin.

Fish and wildlife provide tremendous social, economic, and environmental benefits to the Lake Champlain Basin. The structure and function of the food web affect water quality, bioaccumulation of toxins, and habitat suitability for fish and wildlife. Abundant fish and wildlife attract recreational hunters, bird watchers, and anglers, resulting in significant economic benefit to local communities. In 1997, people spent more than \$204 million on activities related to fishing on Lake Champlain (Gilbert, 2000). Bird and other wildlife viewing activities contribute to the Basin's economy, too, generating more than \$50 million a year in Vermont (Vermont Agency of Natural Resources, 1996). The complex array of plants and animals also provides other important benefits to humans, such as pollution filtration through wetlands and other vegetated areas, scenic beauty, and recreational opportunities. Natural species diversity is a highly valued part of the region's natural heritage and a critical component of the ecosystem that we, as humans, share.

ISSUES

Adaptive Resource Management

Adaptive resource management is an important process of adjusting management policies and actions in light of new information about the ecosystem, both social and scientific, and progress towards management goals. For example, there is a public concern that walleye populations have declined significantly and steadily in Lake Champlain over the past 40 years. Restrictive harvest regulations and other management actions, including a fry and fingerling stocking, have been initiated to curtail this perceived decline. While recent surveys indicate that the fishery has begun to show improvements in some areas of the lake, in Missisquoi Bay the walleye fishery has continued to decline. Additional information, such as assessing effectiveness of stocking and identifying life stages where high mortality is occurring, needs to be gathered to determine the future management actions for restoring the walleye fishery lakewide.

Enhancing Application of an Ecosystem Approach to Fish and Wildlife Management

Lake Champlain supports an abundance of fish and wildlife species, and current management efforts have achieved a measure of success. The Plan calls for management activities to be expanded and integrated to incorporate additional components of the Lake Champlain ecosystem. Recreational use and enjoyment of fish and wildlife resources will continue to be important features that need to be maintained.

A number of ongoing and proposed management actions for Lake Champlain may have significant effects on other natural communities. For example, stocking by the Fish and Wildlife Management Cooperative increases the numbers of predators, such as lake trout and walleye, feeding on forage fish in the Lake. Also, Basin-wide efforts to reduce phosphorus inputs into the Lake, will alter the phytoplankton food base available to zooplankton and smaller fish. It is important to predict and monitor how the Lake Champlain aquatic community responds to these changes (see Figure 5).

Managing Threatened and Endangered Species

Populations of some rare, threatened, and endangered plant and animal species and rare natural communities in the Lake Champlain Basin are declining as a result of habitat degradation, invasions of exotic species, collection, and other factors. Of the approximately 487 vertebrate species of fish and wildlife thought to be in the Basin, 30 species are officially listed by federal and state agencies as endangered and threatened. More information on the status of and threats to these species and natural communities, in addition to more public education, is necessary for their protection and restoration. A comprehensive inventory of these species and their habitats for the entire Lake Champlain Basin is critical, as is close coordination by various agencies on all aspects of protection and restoration.

Conserving, Enhancing, and Restoring Habitat

Although the Lake Champlain Basin provides a rich and varied habitat for aquatic and terrestrial species and natural communities, much habitat has been lost as a result of residential, agricultural, and commercial development, and because of the impacts of nonnative invasive species. Because of this, strategies to conserve, enhance, and restore habitat

OBJECTIVES

(not listed in priority order)

- 1) Manage fish and wildlife resources using a comprehensive ecosystem approach and adaptive management strategy.
- 2) Restore, enhance, and maintain natural communities and habitats necessary to support the fish and wildlife resources of the Lake Champlain Basin.
- 3) Restore, enhance, and maintain imperiled fish and wildlife populations (e.g., native mussels and lake sturgeon) when found to be biologically feasible and socially desirable.
- 4) Ensure efficient, coordinated fish and wildlife resource management among the institutions responsible for living resources conservation in the Lake Champlain Basin.
- 5) Manage nuisance native species to reduce human/wildlife conflicts and adverse affects on fish and wildlife resources, unique ecosystems, and preserve human use and enjoyment of the Basin.

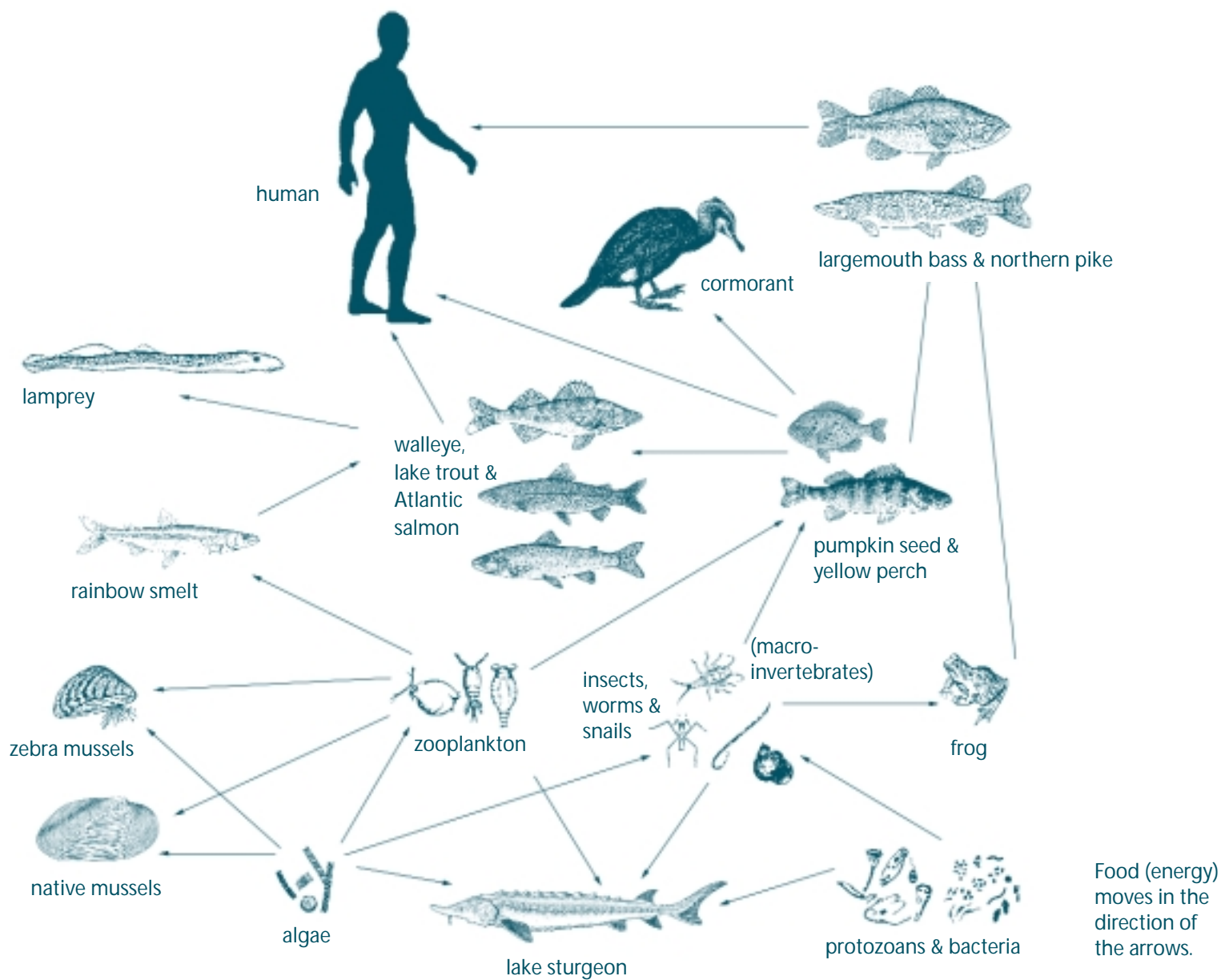


Figure 5. Lake Champlain aquatic food web.

should be implemented. Further study is needed to document land use practices that can cause adverse direct and indirect impacts to important habitats. The many agencies involved should share data and coordinate management efforts, especially with willing landowners who wish to conserve, enhance, or restore fish and wildlife habitat.

HIGH PRIORITY ACTIONS

(not listed in priority order)

1) Identify, Restore, Enhance, and Maintain Critical Habitats and Habitat Connections throughout the Lake Champlain Basin

This action favors nonregulatory measures with willing landowners and managers of public lands to prevent habitat loss, fragmentation, or degradation that may adversely affect threatened and endangered species, rare natural communities, and vulnerable habitat

corridors. For example, the removal of dams could restore the connection between lake and riverine spawning habitats for nonnuisance migratory fish. Another straightforward approach to habitat conservation is to acquire fee-title or long-term easements from willing landowners for important parcels of fish and wildlife habitat, and manage these lands primarily for the conservation of fish and wildlife resources they support. Elements of this action include:

a) Identify rare and environmentally sensitive habitats. Priority projects include:

- *Develop a list of high-priority terrestrial and aquatic communities in need of protection and conservation in the Lake Champlain Basin;*
- *Develop an aquatic natural community classification for Lake Champlain; and,*
- *Complete an aquatic natural community inventory for Lake Champlain.*

b) Work with agencies and other key stakeholders to identify criteria and an approach (e.g., priority watersheds) for targeting high-priority habitat areas for conservation. Criteria should include, but not be limited to identification of:

- *Present and former habitats of state and federally listed threatened and endangered species in the Lake Champlain Basin;*
- *Habitats critical to imperiled species whose decline may be halted or reversed through habitat restoration and conservation;*
- *Habitats vulnerable to destruction;*
- *Habitats supporting high biological diversity; and,*

- *Parcels that link critical habitats in the Lake Champlain Basin.*

c) Initiate an outreach program designed to assist and recruit landowners interested in habitat restoration and conservation. Priority projects include the development of a brochure outlining habitat conservation and restoration programs available through government agencies and conservation organizations.

d) Coordinate acquisition or other long-term protection decisions with existing "open space" and federal, state, and local habitat protection programs.

e) Work with willing landowners to conserve and protect habitats for high-priority terrestrial and aquatic communities through acquisition, easements, or other long-term protection measures. Develop other strategies when these methods are not desirable or practical.

f) Restore degraded habitats for high-priority terrestrial and aquatic communities by working with willing landowners and managers of public lands to promote natural community restoration with native plants from local seed sources.

g) Design and construct fish passage facilities and stream flow management regimes at existing dams to provide access and connectivity between lake and riverine habitats for nonnuisance migratory fish.

h) Remove dams to provide access and connectivity between lake and riverine habitats for nonnuisance migratory fish, if found to be biologically feasible and socially acceptable.

Mark LaBarr



The spiny softshell turtle is listed as a threatened species in Vermont and Québec.

i) Encourage residential and commercial landscaping practices that benefit living resources and their habitats.

j) Explore opportunities to provide tax incentives to landowners in exchange for beneficial land management practices, including affording access for bird watching, hunting, fishing, and trapping by the general public.

Potential key LCBP partners: USDA-NRCS, USDA-FSA, USFWS, NYSDEC, VTANR, QC MENV, QC MAPAQ, QC SFP, LCFWMC, VTDAFM, TNC, Sea Grant, other academic and private sector cooperators

Cost estimate: \$500,000 per year and additional funds for large projects

Potential funding sources: Federal, state, and provincial appropriations

Timeframe: Ongoing

Benchmark: Identify habitat needs of listed species and recommend specific conservation measures; develop protection and recovery plans for select species and community types within the Basin

2) Develop Management Strategies for Native Species that Become Nuisances

Fish and wildlife populations in most natural situations occur in a healthy balance within their ecosystem. Certain conditions can alter this balance, causing native species to become nuisances, overabundant, or problematic. Double-crested cormorant populations in the Lake Champlain Basin, for example, are at historic highs. Pollution control has lowered concentrations of toxic contaminants in their food supply; food is ample throughout their winter and summer ranges; construction of reservoirs and impoundments have created favorable habitats; and federal and state laws protect

them. These factors have allowed cormorant populations to increase to levels that may be in conflict with other ecosystem management objectives and human activities. This action supports minimizing human/wildlife conflicts while ensuring the sustainability, natural diversity, and productivity of the ecosystem. Elements would include:

a) Work cooperatively with the public, non-government organizations, and government agencies to identify fish and wildlife conflicts.

b) Assess the impacts of native nuisance populations through rigorous scientific investigation.

c) Develop and implement techniques to control and mitigate nuisance fish and wildlife damage and conflicts.

d) Assess public satisfaction with management of nuisance native species and determine mechanisms for enhancing this satisfaction.

e) Develop and disseminate scientifically valid information about nuisance native species.

f) Implement appropriate rules and regulations to facilitate the resolution of problems associated with native fish and wildlife species that become nuisances.

Potential key LCBP partners: USFWS, NYSDEC, VTANR, LCFWMC, QC MENV, QC MAPAQ, QC SFP, USDA Animal Damage Control

Cost estimate: Staff biologist/coordinator, \$50,000 per year, and continued in-kind services of participating agencies

Potential funding sources: USFWS (e.g., federal aid funds), state, and federal appropriations

Timeframe: Ongoing

Benchmark: Approve species management plans and plan implementation

3) Use Biological Indicators to Monitor Ecosystem Change

Monitoring biological indicators helps detect ecosystem change and enables adaptive resource management. It can also guide future management decisions leading to the goals and objectives in this plan. For example, data demonstrating declines or increases in indicator species or communities could provide information about the expected trends of associated species and provide early notice of the need for management action. Specific elements of this effort include:

a) Identify and link biological and ecological indicators to management goals and objectives identified in Opportunities for Action, including quantifiable benchmarks.

b) Develop a long-term monitoring program that incorporates a complete set of biological and ecological indicators for the Basin.



Rising double-crested cormorant populations, as pictured here on Young Island, may be in conflict with other fish and wildlife management objectives and human enjoyment of the Lake.

ACCOMPLISHMENTS

RESTORING HABITAT

Partners of the US Fish and Wildlife Service (USFWS) have completed more than 100 habitat restoration projects in recent years. These projects involve installing fencing to keep livestock out of streams, stabilizing streambanks using natural materials and plantings, and creating in-stream habitat. Public-private partnerships have been key to habitat restoration. Partners include the Natural Resources Conservation Service, Vermont Agency of Natural Resources, New York Department of Environmental Conservation, The Nature Conservancy, Natural Resource Conservation Districts, local watershed groups, and private landowners.

MANAGING DOUBLE-CRESTED CORMORANTS

Double-crested cormorants are migratory birds that nest in many locations throughout North America, including Lake Champlain. The USFWS is preparing a national management plan to address impacts caused by population and range expansion of these birds. In the meantime, the USFWS has issued permits to Vermont to control Lake Champlain's cormorant population on state-owned Young Island. Lake Champlain Sea Grant is also supporting a study of the diet and feeding range of cormorants.

c) Present the indicators in an understandable manner, allowing them to be used to track and report progress toward management goals to both the management community and the public.

d) Use this information, along with public input, to guide future management decisions.

Potential key LCBP partners: USFWS, NYSDEC, VTANR, LCFWMC, LCRC, NBS, USEPA, QC MENV, QC MAPAQ, QC SFP, universities

Cost estimate: \$150,000 per year for a, c, and d (for staff and operating expenses); \$300,000 to \$400,000 per year in subsequent years for b

Potential funding sources: State and federal appropriations

Timeframe: Ongoing

Benchmark: Selection of appropriate indicators, development of indicator presentation, implementation of long-term biological indicator monitoring

PRIORITY ACTIONS

(not listed in priority order)

4) Refine Current Management of Lake Champlain's Fish and Wildlife Resources to Enhance the Application of an Ecosystem Approach

Recreational hunting and fishing and the species they affect have been managed and regulated effectively by the states of Vermont and New York and the US Fish and Wildlife Service (USFWS) under the Lake Champlain Fish and Wildlife Management Cooperative (LCFWMC). To ensure the ongoing success of interjurisdictional fish and wildlife management programs that mutually benefit both game and nongame species, coordination among resource agencies needs to continue.

Elements of this action include:

a) Continue adaptive resource management in collaboration with the LCFWMC to ensure laws, policies, and management practices are responsive to changes in social values, environmental conditions, public interest, available data, and knowledge. This process should include the following elements:

- Facilitate a dialogue among scientists, managers, and the public to identify problems, define sustainable goals and objectives, and develop appropriate management policies and actions;*
- Implement management actions to achieve socially desirable conditions and long-term sustainable ecological functions (e.g., wall-eye access to critical spawning habitat);*
- Develop and implement a monitoring program to support understanding resources, refining management goals and objectives, revising management actions, and setting additional monitoring priorities;*
- Refine the management approach based on the information obtained.*

b) Investigate the feasibility for a fishing license agreement between the states of New York and Vermont that would not reduce revenues for either state.

c) Review FERC hydropower relicensing proposals to ensure that management objectives for upstream and downstream fish passage, fish and wildlife habitat, and habitat connectivity above and below hydropower dams are considered.

d) Review current fish and wildlife management plans and reports for consideration of the long-term sustainability of fish and wildlife resources.

e) Assess the broader ecological effects of fish stocking programs in the Basin.

f) Examine the relationships among management programs, salmonids, bass, walleye, pike, and other important recreational species.

g) Ensure that management approaches sustain healthy populations of both game and nongame species.

h) Incorporate appropriate additional key species—such as white perch, yellow perch, and cormorant—into the management of Lake Champlain fisheries.

Potential key LCBP partners: USFWS, NYSDEC, VTANR, LCFWMC, USDA Animal Damage Control, QC MENV, QC MAPAQ, QC SFP

Cost estimate: Staff and coordinating, \$75,000 per year; continued in-kind services of participating agencies

Potential funding sources: USFWS (e.g., federal aid funds), state, and federal appropriations

Timeframe: Ongoing

Benchmark: Ecosystem-based management decisions for key species in the Lake Champlain watershed

5) Integrate Aquatic Food Web Models into Fisheries Management Decisions

Food web or “bioenergetic” models allow managers to predict how changes in populations of one species or community of species affect other components of the ecosystem. Ideally these models support and enhance management decisions, such as adjusting salmonid stocking rates to meet both forage base and angler needs. The LCBP has funded two initial food web model studies, focusing on the top predators and the base of the food web. These and other models could be used to study the impacts of fish stocking, zebra mussels, and efforts to reduce nutrient levels among other factors. Food web models may be used to assist with the following specific activities:

a) Fill informational gaps between top-down and bottom-up bioenergetic models by modeling food web linkages between zooplankton and small fish.

b) Link the management of point and nonpoint sources of nutrients entering Lake Champlain with food web management activities.

c) Determine the effects of human activities on the food web.

d) Determine the effects of zebra mussels on both higher and lower trophic-level fish and wildlife species.

Potential key LCBP partners: USFWS, NYSDEC, VTANR, QC MENV, QC FAPAQ, QC SFP, LCFWMC, LCRC, USGS, universities

Cost estimate: \$100,000 per year

Potential funding sources: State and federal appropriations

Timeframe: 3 to 5 years

Benchmark: Food web models completed and used in management programs

6) Improve Protection Strategies for Managing Threatened and Endangered Species and Rare Natural Communities

To ensure that threatened and endangered species and rare natural communities in the Lake Champlain Basin are protected adequately, coordinate the implementation of recovery strategies. This effort would be carried out by, and in coordination with, appropriate state and federal agencies and regulatory committees. Elements of this effort would include the following activities:

a) Compile a list of all species and natural communities occurring in the Lake Champlain Basin and their status (threatened, endangered, rare, native, nonnative, nuisance, etc.).

b) Compile a summary of federal, state, and provincial laws protecting threatened and endangered species.

c) Seek consensus on endangered and threatened species, listing criteria for Lake-related species.

d) Identify new cooperative efforts to ensure enforcement of applicable threatened and endangered species protection laws.

e) Identify new cooperative efforts to promote projects that identify, restore, enhance, and create habitats for selected threatened and endangered species.

f) Identify new cooperative efforts to resolve the status of potentially threatened or endangered species.

g) Establish a mechanism to identify threats and set priorities for species and natural community protection and restoration efforts.

h) Include threatened or endangered species as key species in the management of Lake Champlain fisheries.

Potential key LCBP partners: USFWS, NYSDEC, VTANR, QC MAPAQ, QC SFP, LCFWMC, natural heritage programs, TNC, other academic and private sector cooperators

Cost estimate: \$150,000 per year and staff implementation

Potential funding sources: State and federal appropriations

Timeframe: Ongoing

Benchmark: Completion of Basin-wide species list; develop a task force under the LCFWMC on endangered species management.

7) Evaluate Whether the Broad Priorities Outlined in *Opportunities for Action* Are Consistent With Ecosystem Objectives for Managing Fish and Wildlife Resources

Fish and wildlife resources do not exist in biologically distinct units, but are interconnected through complex relationships and processes. Sound resource management must consider how various actions within *Opportunities for Action* could affect fish and wildlife populations and other resources in the ecosystem. Elements of this action include:

a) Examine the appropriateness of in-lake phosphorus concentration criteria for ecosystem health and sustainability of fish and wildlife populations.

b) Evaluate the ecological benefits and biological consequences of dam removal (e.g., zebra mussel and lamprey expansion into areas where they were previously excluded).

c) Examine whether nonnative invasive species control strategies are conducive to sustainable fish and wildlife populations and ecological functions.

Potential key LCBP partners: USFWS, NYSDEC, VTANR, LCFWMC, QC MAPAQ, QC SFP

Cost estimate: \$50,000 per year; in-kind services of participating agencies

Potential funding source: LCBP, state, and federal agencies

Time frame: Ongoing

Benchmark: Completed assessments



Mark Labarr

Osprey have recently made a comeback in the Lake Champlain Basin.

PROTECTING AND RESTORING WETLANDS, STREAMS, AND RIPARIAN HABITATS

GOAL

Protect, conserve, and restore Lake Champlain Basin wetlands, streams, and riparian habitats and the functions and values they provide.



A viewing platform at the NYSDEC's AuSable Marsh Wildlife Management Area was developed with a LCBP Local Implementation grant and Pittman-Robertson funds.

Wetlands are a vital part of Lake Champlain's ecosystem. In addition to providing critical habitat and nourishment for fish and wildlife, the more than 300,000 acres of wetlands in the Lake Champlain Basin improve water quality by filtering sediments, pollutants, and nutrients. Wetlands also help control flooding, protect groundwater and drinking water supplies, stabilize shorelines, prevent erosion, and provide recreational opportunities. Lake Champlain wetlands support extensive wildlife and fisheries resources. For example, Lake Champlain is part of the Atlantic Flyway, a migratory corridor for waterfowl and other wetland birds. Between 20,000 and 40,000 ducks and geese that depend on the Lake for critical resting and feeding sites have been counted during October flights. The Lake Champlain Basin includes some of the highest quality wetlands in the northeastern United States, including exceptional and extensive lakeside wetland complexes and the red maple-northern white cedar swamps along Otter Creek in Vermont. The Basin also includes many rare or declining natural wetland communities, including riverine and lakeside floodplain forests, wet valley clayplain forests, fens, and buttonbush swamps. Despite federal, state, and local wetlands protection regulations, threats to wetlands in the Lake Champlain Basin persist. Many people remain unaware of the function and benefits of wetlands; as a result, wetlands are often drained or filled for agricultural, residential, or commercial purposes.

Human impacts on stream and riparian habitats have also been severe and wide ranging. The view many people have of local streams is sometimes a distorted one because they often see unstable conditions altered by a history of continuous human impacts. For the last three centuries, people have altered the landscape and the flow of streams and rivers for flood control, bridges and roads, power generation, agriculture, development, and even erosion control or bank stabilization. Adverse impacts include loss of historic floodplain, increased river channel instability, degradation of water quality, decreased water storage and conveyance capacity, loss of habitat for fish and wildlife, and decreased recreational and aesthetic value. Unfortunately, most past stream manipulation did not take into consideration the natural dynamic processes at work in the stream channel, riparian habitat, and floodplain, or the need for streams and rivers to transport both flow and sediment. Stream and riparian habitat restoration is a complex effort that requires

an understanding of the structure and functions of the natural stream system, recognition of the human induced disturbances preventing recovery to a sustainable condition, and effective implementation of a broad range of actions designed to enable streams to recover as much of their natural functions as possible. Important considerations in this process include watershed and sub-watershed level assessment, identification of reference sites, developing clear and achievable goals, eliminating or remediating indirect impacts, establishing pre- and post-project monitoring, and minimizing the need for ongoing site maintenance.

Adequate riparian buffers are one of the most effective tools for limiting nonpoint sources of pollution and promoting the long-term stability of streambanks and channels. The pollution prevention capacity of buffers is enhanced through land grading, planting of additional vegetation, and protecting and maintaining a river's access to its floodplain. Planting and maintaining riparian buffer strips help protect wildlife corri-

dors by providing food, cover, and thermal protection to the stream. Well-vegetated riparian areas trap and filter sediments, nutrients, and chemicals and help maintain the hydrologic and ecological integrity of the stream channel and streambank. The amount of light striking the stream surface also greatly affects the type and amount of algal production in a stream. Streams in deforested areas contain a different community of plants and animals,

including different fish species. Tree removal results in loss of root systems that stabilize the streambank. This can increase sedimentation, which then degrades fish spawning habitat and limits growth and reproduction rates.

ISSUES

Wetland Restoration and Permanent Protection

Because wetlands provide critical functions which range from improving water quality in the Lake Champlain Basin to providing important habitat for wildlife, existing wetland acreage needs protection. Nationally, more than 50% of the wetlands resource base has been lost. Approximately 35% of Vermont's wetlands have been lost since European settlement, and an estimated 40 acres continue to be lost each year. Estimates of wetland loss in the New York portion of the Basin are similar to national trends except within the Adirondack Park, where less than 10% of the wetlands have been lost. However, in some areas of New York significant wetlands loss has been documented. A study of Lake George shoreline wetlands for the period of 1950-1978 indicated that more than half the wetlands had been lost. The acquisition and restoration programs currently underway in the Basin are an important nonregulatory approach to wetlands protection and conservation.



Projects such as this streambank planting by volunteers from the Missisquoi River Basin Association are vital to restoring riparian habitats and reducing erosion.

Implementation of Effective Stream Restoration Projects

Flooding, channel straightening, agriculture, and transportation have long impacted the streams and rivers of the Basin. A coordinated Basin-wide stream restoration program is needed to ensure that projects are completed using the best science available and that the highest priority projects are undertaken first. Restoration and stabilization of streams requires an understanding of physical stream dynamics, as well as the needs and requirements of people living in the Basin.

Successful stream channel and riparian management efforts can benefit from a four-stage approach: 1) protection of stable stream sections where the river channel is relatively undisturbed and the riparian vegetation relatively intact; 2) identification and management of strategic sites that could, if disturbed, result in widespread instability or erosion within a watershed; 3) restoration of stream sections that have a high potential for recovery; and 4) education of the public and agencies on river processes. Stream and riparian restoration projects should be based on local data that describe stream drainage area, channel geometry, stream velocity and discharge, and background data on stable local stream systems that can be used for reference in the design of restoration projects.

OBJECTIVES

(not listed in priority order)

- 1) Achieve no net loss of the remaining Lake Champlain Basin wetlands and increase the quantity and quality of the wetlands resource base over the long-term.
- 2) Complete an up-to-date and standardized inventory and classification of wetlands in the Lake Champlain Basin.
- 3) Develop a coordinated approach to protecting and managing wetlands, streams, and riparian habitats in the Lake Champlain Basin.
- 4) Expand wetlands acquisition, riparian habitat protection, and stream restoration programs in cooperation with willing landowners in the Lake Champlain Basin.
- 5) Restore rivers, streams, and surrounding floodplains using approaches that work with natural stream processes and dynamics and emphasize natural community restoration by using native species from local sources.
- 6) Promote the development of regional or local watershed plans that build upon advanced identification and protection of wetland and riparian habitats.
- 7) Understand the role of wetlands, floodplains, and riparian habitat in improving water quality, stream stability, fish and wildlife habitat, erosion control, and other functions; the impacts of land use on the ability of wetlands, streams, and riparian habitats to provide important functions; and the cumulative impacts of habitat loss and alteration in the Lake Champlain Basin.
- 8) Improve public understanding of the importance of wetlands and riparian habitats, natural communities, and the programs designed to protect these resources.
- 9) Improve understanding of state and federal wetland regulations and their impact on landowner activities.

Restoration and Maintenance of Riparian Habitat

Riparian corridors are an important component of lake, stream, and river ecosystems. They help maintain stable rivers and streams, provide important functions for wildlife and aquatic organisms, and enhance the aesthetics of the rural landscape. These corridors have been degraded over time by agriculture, forestry, and development. Sufficient financial and technical incentives need to be established to encourage private landowners throughout the Basin to restore these ecosystems. A coordinated effort is needed to identify and set priorities for stream and river reaches in need of restored riparian buffers.

Stream channel stability and ecological function depend on the condition of the adjacent riparian habitat. Streams with wide and mature riparian vegetation (likely forested) exhibit greater levels of river channel stability, lower rates of bank erosion, and are often narrower and deeper. These characteristics provide optimal enhanced habitat for aquatic organisms. Restoration of moderate or severely degraded sites involves changes to channel and floodplain structure and function to achieve stream stability. Incentive-based initiatives, working in conjunction with private landowners, municipalities, regional planning commissions, and others are ideal for protecting and restoring riparian habitat.

Adopting Local Watershed Approaches to Protecting Wetlands, Restoring Streams, and Creating Riparian Buffers

Because wetland loss, stream degradation, and loss of riparian habitat are often incremental, involving a series of changes to natural systems which add up to a significant loss over time, municipalities need to be fully aware of the locations, functions, and values of wetlands, streams, and riparian corridors within their communities. Local watershed approaches should increase public awareness of the values of wetland and stream habitat, improve their protection, and provide more certainty and local expertise to communities in local planning and permitting processes.

HIGH PRIORITY ACTIONS

(not listed in priority order)

1) Continue to Secure Funding and Implement the Lake Champlain Wetlands Acquisition Strategy

Additional funds should be sought through the North American Wetlands Conservation Act for the Lake Champlain Wetlands Acquisition Strategy. Funding applications should be submitted to implement the strategy fully. Wetland acquisitions resulting from this action will be consistent with the New York State Open Space Conservation Plan in the New York portion of the Basin and the Vermont Wetlands Conservation Strategy in Vermont. Public agencies, private nonprofit organizations, and willing landowners have a role in implementation.

Potential key LCBP partners: TNC, NYSDEC, VTANR, QC MENV, USFWS

Cost estimate: \$1.1 million has been spent to date on this effort; an additional \$1.1 million is needed for completion of the acquisition strategy

Potential funding sources: USFWS (North American Wetlands Conservation Act funding), various state and private funding sources, such as the Migratory Bird Stamp Fund and EQBA/EPF (NY)

Timeframe: Ongoing

Benchmark: Protection of 9,000 acres of wetlands

2) Update Wetland Inventory Maps Using Current Land Cover Data

Because the National Wetlands Inventory (NWI) maps for many areas of the Lake Champlain Basin are almost 20 years out of date, an ongoing program to update these maps to reflect changes in the distribution of wetlands needs to be established over time. There is also a need to inventory, map, and classify unique wetland habitats which fall below the NWI threshold throughout the Basin. Substantial progress has been made on wetlands inventory mapping in New York. The LCBP has funded updates of maps to NWI standards for wetlands in New York outside of the Adirondack Park. Completion of digitized wetlands maps within the Park remains a high priority. In Vermont, outstanding issues regarding the consistency of updated NWI maps and older regulatory maps—should be addressed through map updates. This program should be implemented using up-to-date remote sensing imagery and related technologies, assisted by field verification.

Potential key LCBP partners: NYSDEC, APA, VTANR, USFWS, LCRC

Cost estimate: \$50,000 per year

Potential funding source: Federal appropriations

Timeframe: Ongoing

Benchmark: An updated wetland inventory map showing, where possible, changes in wetland distribution over time

3) Expand Wetland Restoration Efforts in the Basin

The Lake Champlain Basin Program began sponsoring a Basin wetland restoration project in 1993. The project is modeled after the USFWS Partners for Fish & Wildlife program, and is being implemented with funding from the USEPA and technical assistance from the USFWS, NYSDEC, and VTANR (see Figures 6 and 7). Under this action, an expanded wetland restoration program should be carried out through cooperative efforts among government agencies and private partnerships. The expanded program should focus on the conservation of biological diversity through careful selection, design, and implementation of wetland restoration projects. Future efforts will require securing adequate funds and continuing to identify willing landowners. The program should also include development of maps that identify potential candidate sites for restoration projects. The US Department of Agriculture's (USDA) Natural Resource Conservation Service (NRCS) has been implementing the Wetland Reserve Program in both Vermont and New York since 1996. Similar projects are slated to be developed in Québec through cooperative efforts among government agencies, local associations, private partnerships, and municipalities.

Potential key LCBP partners: USFWS, NYSDEC, VTANR, USDA-NRCS, USACOE, QC MAPAQ, QC MENV, QC SFP, TNC, Ducks Unlimited, watershed associations, landowners

Cost estimate: \$80,000 to \$100,000 per year for projects; \$50,000 per year for project oversight and technical assistance by a staff biologist

Potential funding sources: USFWS (Partners for Fish & Wildlife Program), USDA (Wetlands Reserve Program and Conservation Reserve Program)

Timeframe: Ongoing

Benchmark: Restoration of 100 to 500 acres of wetlands annually

4) Expand NRCS/FSA, USFWS, and Other Agency Cost-Sharing Programs for Stream Restoration, Riparian Habitat Protection, and Installation of Riparian/ Wetland Buffer Strips

Develop or expand programs that cost-share or offer tax rebates for the voluntary restoration or protection of buffer strips on perennial streams, rivers, and lakes.

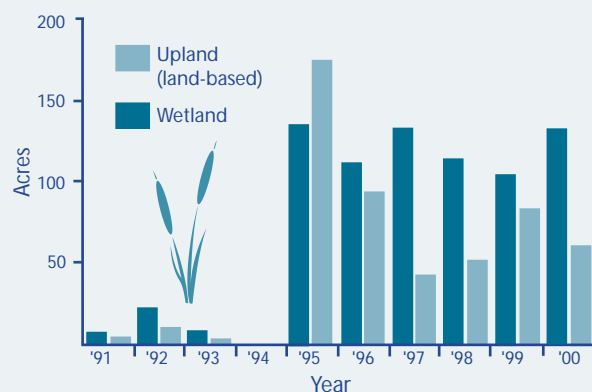


Figure 6. Upland and wetland habitat restoration in the Lake Champlain Basin through the USFWS Partners for Fish and Wildlife Program, 1991-2000. Source US Fish & Wildlife.

Potential key LCBP partners: USDA-NRCS, USDA-FSA, USFWS, USACOE, NYSDEC, VTDEC, VTDAFM, NYSAM, QC MENV, QC SFP, QC MAPAQ, municipalities, conservation districts, watershed associations

Cost estimate: \$500,000 to \$1 million per year

Potential funding sources: Federal appropriations, community development grants, land trusts, EQBA/EPF (NY)

Timeframe: Ongoing

Benchmark: Identification and provision of funding for streambank restoration and the installation of buffer strips

5) Develop and Provide Training in Field Assessment Protocols for Managers and Local Watershed Organizations

Effective geomorphic assessment requires consistent protocols that can be used by managers and citizen groups with minimal technical assistance and training. These protocols should provide instructions for: a) identifying stable stream reference sites; b) locating unstable stream channels in need of restoration; and c) setting priorities for stream corridors and floodplains in need of protection.

Potential key LCBP partners: USDA-NRCS, USDA-FSA, USFWS, USFS, NYSDEC, VTDEC, VTFWD, QC MAPAQ, QC MENV, LCRC, municipalities, NY counties, conservation districts, watershed associations

Cost estimate: \$50,000 for training program; \$100,000 to develop regional database

Potential funding sources: Federal and state appropriations

Timeframe: Ongoing

Benchmark: Development of a stream geomorphic handbook, based on regional hydrologic geomorphic data; Basin-wide shared database for river restoration practitioners; regularly scheduled training on stream morphology assessment techniques to agency personnel, watershed organizations, and other parties

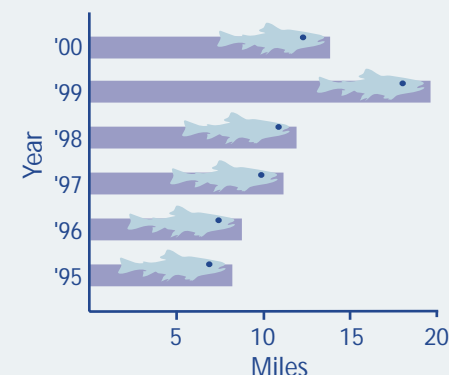


Figure 7. Miles of stream banks restored in the Lake Champlain Basin through the USFWS Partners for Fish and Wildlife Program, 1995-2000. Source US Fish & Wildlife.

6) Promote Local Watershed Planning throughout the Basin

Local approaches at the watershed level can be used to identify and protect wetlands, stream, and riparian habitats in advance of permit applications. This approach should include:

a) Assess wetland and stream functions and values, current conditions, and sensitivity to change.

b) Use results of natural heritage and biological surveys of the Basin to determine important and unique wetlands, stream segments, and riparian habitats, including those that provide vital habitats for rare, threatened, and endangered species; birds, reptiles, amphibians, and invertebrate species (such as mussels); and significant natural communities. Complete surveys as necessary.

ACCOMPLISHMENTS

ACQUIRING WETLANDS

The LCBP sponsored a wetland acquisition strategy that laid the groundwork for a four-phase, multiyear program to permanently protect almost 9,000 acres of wetlands in the Champlain Valley. The Nature Conservancy is the lead agency for the project. To date, the North American Waterfowl Conservation Act, administered by the US Fish and Wildlife Service, has provided \$1.4 million to the project, which has conserved 4,000 acres of wetlands and surrounding areas in close cooperation with local communities in New York and Vermont.

ESTABLISHING ECOLOGICAL PRESERVES

In Québec, volunteers have worked with the Ministry of Agriculture, Fisheries, and Food to restore streambanks along the Pike River. The first phase of the Pike River Ecological Preserve was also initiated, and included working with local landowners to protect more than 311 acres (126 hectares) of wetlands in the delta of the Pike River in Missisquoi Bay.

RESTORING STREAM HABITAT

In New York, a major stream restoration effort is being conducted on the AuSable River under funding through the State Clean Water/Clean Air Bond Act.

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c) Assess the impacts of cumulative wetland, stream, and riparian habitat gains/losses in the watershed.

d) Assist communities with local planning, model wetland protection ordinances, and local zoning regulations for protecting wetlands and other critical habitats.

e) Provide funding for implementation projects by watershed organizations.

Potential key LCBP partners: Federal, state, provincial, and local agencies, as well as nonprofit watershed organizations

Cost estimate: \$50,000 to \$100,000 per year

Potential funding sources: USEPA, VTDEC, NYSDEC, federal appropriations, in-kind services

Timeframe: 3 to 5 year demonstration projects

Benchmark: Development of watershed level geomorphic assessment handbook (see Action #5 above); completion of one local watershed plan per year

PRIORITY ACTIONS

(not listed in priority order)

7) Develop Incentives for Local Municipalities and Private Landowners to Restore, Enhance, and Maintain Wetlands and Stream Corridors

Tax incentives are another way to encourage private wetlands and stream protection and restoration efforts. Under this option, a task force would be established to develop legislation to alleviate part of the tax burden for landowners who practice habitat conservation.

Potential key LCBP partners: NYSDEC and VTANR

Cost estimate: In-kind services of state agencies

Potential funding sources: Federal and state appropriations

Timeframe: Ongoing

Benchmark: A task force report identifying draft state legislation to alleviate tax burden for landowners

8) Increase Funds and Technical Resources for Local Governments to Implement BMPs for New Development Which Will Protect Wetlands, Stream Corridors, and Riparian Habitat

Encourage local governments to:

a) Improve stormwater management through local zoning and subdivision regulation, and appropriate use of the National Pollutant Discharge Elimination System (NPDES) and State Pollution Discharge Elimination System (SPDES) including EPA Phase II stormwater regulations.

b) Emphasize erosion hazards, floodplain functions, sedimentation controls, habitat protection, and use of natural vegetation as requirements in local zoning and subdivision regulations.

c) Apply infiltration and other BMPs in new developments.

d) Apply surface water setbacks and buffer strips in new developments.

e) Employ appropriate growth management options.

f) Assess cumulative impacts of new development.

g) Promote innovative site design that reduces creation of impervious surfaces.

h) Promote road maintenance standards for sediment control and initiate training programs for town highway departments to minimize impacts of road maintenance activities on water quality, streambank stability, and native wetland species.

Potential key LCBP partners: Municipal governments, NYSDEC, VTDEC, regional planning commissions, county planning offices, private developers

Cost estimate: In-kind participation of agency representatives

Potential funding sources: Federal and state appropriations, in-kind services from state and local government

Timeframe: Ongoing

Benchmark: Improved implementation of BMPs at the local level

9) Encourage Cooperative Development of Local Shoreland Restoration and Protection Tools

Encourage continued coordination among government, academic, and private institutions to develop and publicize shoreland restoration and protection methods that can be adapted to the local level. A number of the activities listed here are currently underway (e.g., within the VT Department of Environmental Conservation Water Quality Division). This action is to support the continuation and expansion of these activities in both Vermont and New York.

Elements could include:

a) Convene various groups with expertise to summarize the best management practices and shoreland protection and restoration tools available.

b) Publicize and distribute guidelines for communities, organizations, and individual landowners on how, when, and where to use different methods and techniques.

c) Make available model shoreland management plans that can be used by private landowners, municipalities, and state agencies for individual properties.

d) Encourage the formation of watershed associations.

e) Support the development of volunteer programs for shoreland restoration.

f) In Québec, continue to support Coopérative de Solidarité du bassin versant de la rivière aux Brochets, a group of volunteers with the Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec (MAPAQ) to restore streambanks of the Pike River Watershed.

Potential key LCBP partners: NYSDEC, VTDEC, LCRC, Soil & Water Conservation Districts, USACOE, QC MAPAQ, Coopérative de Solidarité du Bassin Versant de la Rivière aux Brochets, LCRC, local governments and planning boards, universities

Cost estimate: \$120,000 per year for staff support and printing manuals

Potential funding sources: USEPA, USACOE, state appropriations

Timeframe: 2001-03

Benchmark: Provision of technical assistance to shoreland communities, watershed associations, and landowners in shoreland protection

ACCOMPLISHMENTS

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Under the Bond Act, \$15 million has been dedicated to implementation of the Lake Champlain management plan, with a portion of the funding allocated to habitat restoration efforts. A segment of the AuSable River in Keene was selected for habitat restoration funds. The project is in the planning phase with assessment of stream morphology and design of restoration techniques.

ASSESSING STREAM STABILITY

With multiple federal, state, and local partners, the LCBP supported a stream stability assessment and demonstration project on the Trout River, an area severely affected by a 500-year flood in 1997. The project and subsequent follow-up work used natural channel design techniques to reduce future habitat loss, erosion, and flooding downstream. Similar projects have also begun in other parts of the Basin, including portions of Lewis Creek and the Boquet River.

10) Assess the Contribution of Sediment Transport from Stream-bank Erosion and Shoreline Construction Activities to the Phosphorus Loads Entering Lake Champlain

Shoreline erosion and sediment transport add phosphorus to Lake Champlain. However, current research is inconclusive regarding how much of this phosphorus contribution affects water quality. Much of the nutrient load reaching the Lake may be bound to sediment particles and may not be available within the food chain. Additional research will help us better understand how sediment adds to phosphorus loads to the Lake, how much of this phosphorus contributes to algae growth, and how nutrients are dispersed by wave and water movement within and between lake segments.

Potential key LCBP partners: VTDEC, NYSDEC, USEPA, QC MENV, research community

Cost estimate: \$80,000 to \$150,000 for initial research on sediment transport

Potential funding sources: Federal and state appropriations

Timeframe: Ongoing

Benchmark: Improved phosphorus modeling capabilities and targeting of priority streambank stabilization and shoreline erosion control projects

11) Develop Sediment and Temperature TMDL Implementation Strategies for Rivers That Contribute Major Sediment Loading to Lake Champlain or Which Have Been Identified on the States' Lists of Impaired Waters Due to Water Temperature Problems

A number of tributaries entering Lake Champlain are impaired due to sediment and/or temperature levels. The VTDEC has initiated identification of a Total Maximum Daily Load (TMDL) to reduce water temperature in the Poultney River. The VTDEC and NYSDEC need to collect data, assess alternatives, and initiate mitigation strategies for other tributaries impaired by sedimentation or other negative impacts. Elements of this action include:

a) Develop an improved means of measuring and predicting bank erosion and related sediment loading of streams in the Basin.

b) Develop a strategy for protection of riparian habitat integrity that considers current stream conditions, and that recognizes likely future responses to modifications of the character of the floodplain or stream channel.

c) Complete the development of TMDL documents concerning sediment loads and/or temperature problems in the Basin.

d) Support the implementation of sediment and temperature TMDLs with demonstration projects where appropriate.

Potential key LCBP partners: VTDEC, NYSDEC, USEPA, NRCS, watershed organizations

Cost estimate: \$100,000 each for demonstration projects in New York and Vermont

Potential funding source: Federal and state appropriations

Time frame: Ongoing

Benchmark: Completion of temperature and sediment TMDLs where required in the Lake Champlain Basin

12) Assess Potential Impacts of Dam Operation and Removal on Stream and Wetland Structure and Functions

Operation of hydropower and other dams can have major impacts on habitat and fish survival and migration to upstream habitats if they do not adequately take into account how water withdrawal and release impacts stream conditions. Removal of old dams can also create negative impacts by releasing large amounts of sediments that have collected behind the dam over many years. These sediments may contain contaminants. Carefully assessing how human-made impoundments impact the natural processes and functions of streams and rivers and ensuring that the natural system is restored as soon as impoundments are removed are important.

Potential key LCBP partners: VTDEC, NYSDEC, USFWS, USACOE

Cost estimate: \$50,000 per year in each state

Potential funding sources: Federal and state appropriations

Timeframe: Ongoing

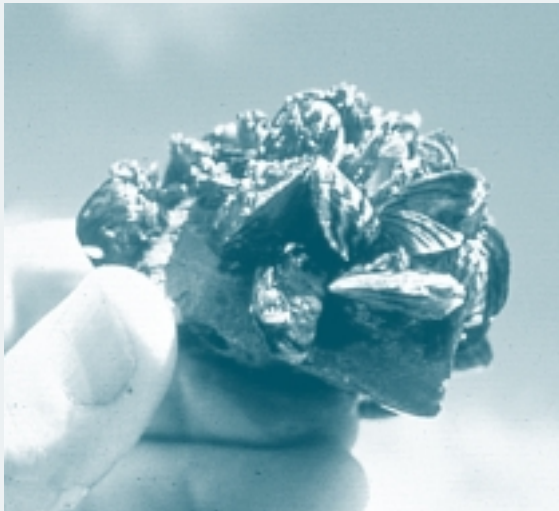
Benchmark: Completion of Basin-wide assessment of power generation and dam removal, and removal of dams where feasible

MANAGING NONNATIVE AQUATIC NUISANCE PLANTS AND ANIMALS

GOAL

Control the introduction, spread, and impact of nonnative aquatic nuisance species in order to preserve the integrity of the Lake Champlain ecosystem.

Sea Grant



Since they were first discovered in Lake Champlain in 1993, zebra mussels have spread throughout nearly all of the Lake.

At least 22 nonnative aquatic nuisance species are known to have been introduced and dispersed into waters of the Lake Champlain Basin. Nonnative aquatic nuisance species that become established in the Basin can pose serious threats to indigenous fish and wildlife populations and impede recreational activities. In some cases, they have substantial ecological and economic impacts. These “nuisance” species typically enter Lake Champlain through interconnected waterways, such as the Champlain Canal and Richelieu River, and overland through human activities, such as boating and bait transport. The interconnected waterways involved transcend the authority of any single state or jurisdiction, necessitating coordination among the different management agencies. Examples of nonnative aquatic nuisance species include zebra mussels, Eurasian water-milfoil, water chestnut, alewives, and sea lamprey. Gizzard shad and white perch are also examples of recent nonnative fish introductions to the Basin that could become nuisances.

ISSUES

Implementing a Comprehensive Management Program

The *Lake Champlain Basin Aquatic Nuisance Species Management Plan* was approved by the Aquatic Nuisance Species National Task Force in May, 2000. The plan identifies priority actions to be implemented within its first two years. Ongoing implementation of the nonnative aquatic nuisance species plan should reduce and slow the introduction and spread of nonnative aquatic nuisance species to the Basin. This

plan is an important companion document to *Opportunities for Action*, as priority actions in both documents are closely aligned.

The *Aquatic Nuisance Species Management Plan* calls for technical and financial assistance to local groups working in partnership with regional, state, provincial, and federal resource management agencies, as well as strong public involvement. Elements of this program include selecting target nonnative aquatic nuisance species in the Basin or with the potential to enter it, filling information gaps, evaluating management alternatives, and implementing controls.

Improving the Information Base

Management of nonnative aquatic nuisance species is complicated by limited knowledge concerning the presence and extent of many of these species within the Basin and the impact that introduced species have on indigenous species, habitats, and the food web. Adequate information, based on surveys and monitoring programs, is essential to forming effective management strategies for nonnative aquatic nuisance species.

Evaluating technologies that exclude or eliminate these species and coordinating with research and management efforts in areas outside the Basin are also important in implementing the *Aquatic Nuisance Species Management Plan*. A central nonnative aquatic nuisance species database is essential to these pursuits. The LCBP maintains a current list of known aquatic nuisance species found in the Basin on its website. This information has been compiled with input from the VTDEC, NYSDEC, and Québec Ministry of Environment. The Adirondack

Park Agency's Invasive Aquatic Plant Monitoring Program, which includes plant inventories and related data for the Adirondack Park, is one of several nuisance plant monitoring projects in the Basin.

Evaluating and Demonstrating New and Existing Control Technologies

Understanding the effectiveness, cost, and secondary impacts of control strategies provides a

sound basis for management decisions. Sea lamprey are primitive parasitic fish that feed on the body fluids of other fish, resulting in reduced growth and even death of the host fish. Although the status of the sea lamprey as a marine invader is the subject of some scientific debate, a substantial body of evidence collected on Lake Champlain indicates sea lamprey have a profound negative impact upon the fish populations. Their presence has thwarted efforts to establish and restore new and historical sport fisheries. In 1990, the USFWS, NYSDEC, and VTFWD—which together form the Lake Champlain Fish and Wildlife Management Cooperative (LCFWMC)—initiated an eight-year experimental sea lamprey control program. It included monitoring and assessing of the effects of sea lamprey reduction on certain fish populations, the sport fishery, and the regional economy. The LCFWMC developed a long-term sea lamprey control program. The new program widens the scope of sea lamprey management to include additional infested tributaries and additional management techniques to strengthen the biological and economic benefits of sea lamprey reduction.

Zebra mussels obstruct residential, municipal, and industrial intake pipes; foul boat hulls and engines; colonize recreational beaches and lake bottoms; obscure underwater and archaeological artifacts; and damage native mussel populations. Since their arrival in the Great Lakes in 1988, the combined impacts of zebra mussels have resulted in millions of dollars of damage and lost revenues. Zebra mussels may also have long-term effects on the aquatic food web by disrupting the food base of fish, fish-eating birds, and mammals. Zebra mussel

USFWS



Sea lamprey attacks on the Lake's sport fish have limited the fishery and impaired recreational and associated economic opportunities.

densities have increased dramatically since their discovery in Lake Champlain in 1993. Zebra mussel studies have yet to yield effective strategies for controlling zebra mussel populations within waterbodies. Management actions have focused on controlling the mussels' attachment to surfaces and water intake pipes and on preventing further spread. Additional effort is needed in each of these areas, particularly in educating people about zebra mussel issues. The impacts of zebra mussel infestations on the ecosystem are also not well understood.

Eurasian watermilfoil, first discovered in the Basin in 1962, now occupies an extensive range throughout the Lake and at least 40 other waterbodies in the Basin. Detailed watermilfoil surveys have been conducted for many Lake Champlain bays and other lakes, but many areas have little or no study regarding the presence and extent of infestation. New infestations of Eurasian watermilfoil are discovered nearly every year. Because Eurasian watermilfoil is spread by plant fragments transported by waves, wind, currents, people, and to some extent, animals, its spread is not easily controlled. Water clarity improvements resulting from the spread of zebra mussels may have improved growing conditions for Eurasian watermilfoil, especially in the southern Lake, and may contribute to the plants' rapid growth and spread. Controls include mechanical harvesting, diver-operated suction harvesting, hydro-raking, installation of bottom barriers, lake level drawdown, fragment barriers, biological controls, and hand-pulling. An experimental program to control Eurasian watermilfoil with the chemical Sonar was conducted in the Lake Champlain Basin on Burr Pond and Lake Hortonia in 2000. Results are currently being evaluated.

Like Eurasian watermilfoil, water chestnut displaces other aquatic plant species, is of little food value to wildlife, and forms dense vegetative mats that change habitat and interfere with recreational activities. The VTDEC conducts regular surveys in Lake Champlain, and established populations have been found as

OBJECTIVES

(not listed in priority order)

- 1) Document the extent of infestation for nonnative aquatic nuisance species in the Lake Champlain Basin.
- 2) Prevent the introduction and the spread of nonnative aquatic nuisance species and control, where possible, nonnative aquatic nuisance species that currently or potentially may damage to the social or biological benefits of the Lake Champlain Basin.
- 3) Manage nonnative aquatic nuisance species using current and new technologies.
- 4) Through education and signage, increase public understanding of, and involvement in, spread prevention and control of nonnative aquatic nuisance species.



NYSDEC

In 2000, a new mechanical water chestnut harvester, jointly funded by the NYSDEC and NYSCC, began operating in the South Lake.

far north in the Lake as Charlotte, Vermont; watermilfoil has also been found in a few other lakes in the Basin. The most extensive infestations are limited to southern Lake

Champlain. In 1998, a population was discovered in the South River, a tributary of the Richelieu River in Québec. In 1999, small amounts of water chestnut were discovered in the Richelieu River, and in 2001, in the Pike River, which flows into Missisquoi Bay. Despite a lakewide spread prevention and control program of surveying, mechanical harvesting, and handpulling of water chestnut since 1982 on Lake Champlain, budget constraints in the 1990s impaired the effective management of the plant (see Figure 8). The South Lake infestation severely restricts boat navigation and other recreational use. Water chestnut continues to spread in the Basin.

Biological controls can provide a cost-effective, environmentally safe means of managing some invasive species. However, use of biological control agents requires a systematic review and understanding of the complexities of this management tool, its reliability and predictability, and any undesirable consequences. Use of biological controls creates the potential to introduce nonnative aquatic species that may become invasive or create other problems. Once introduced, these agents may not be easily removed or controlled. While promising, widespread use of biological control agents poses unique challenges to the ecosystem-based approach in place in the Lake Champlain Basin. Each potential biological control agent should be thoroughly evaluated before a control program is implemented. The VTDEC has conducted experimental research on Eurasian watermilfoil control in some Vermont lakes in the Basin using a native aquatic weevil. The LCBP is funding research currently underway to assess the effectiveness of a native aquatic moth for watermilfoil control.

HIGHEST PRIORITY ACTIONS

Implement the Lake Champlain Basin Aquatic Nuisance Species Management Plan, including the following:

1) Prevent the Spread and Control the Population of Water Chestnut Within Lake Champlain and Elsewhere in the Basin

Since 1991, the LCBP has allocated funds to support the water chestnut management program coordinated by VTDEC to prevent the spread of

this species lakewide and to reduce existing populations through mechanical controls and handpulling in Lake Champlain and other waters of the Basin (see Figure 8). Because water chestnut populations pose challenges in New York and Québec as well as Vermont, effective management, coordination, and consistent funding are keys to long-term results.

Potential key LCBP partners: VTDEC, NYSDEC, QC MENV, TNC, QC SFP, USFWS, LCRC, USACOE, academic institutions, NYS Canal Corporation, volunteers

Cost estimate: \$700,000 per year

Potential funding source: State and federal appropriation, private foundations

Time frame: Ongoing

Benchmark: Decrease water chestnut in the Lake and reduce their spread from the south or the north, conduct demonstration projects, and control water chestnut in Québec before it spreads into northern Lake Champlain

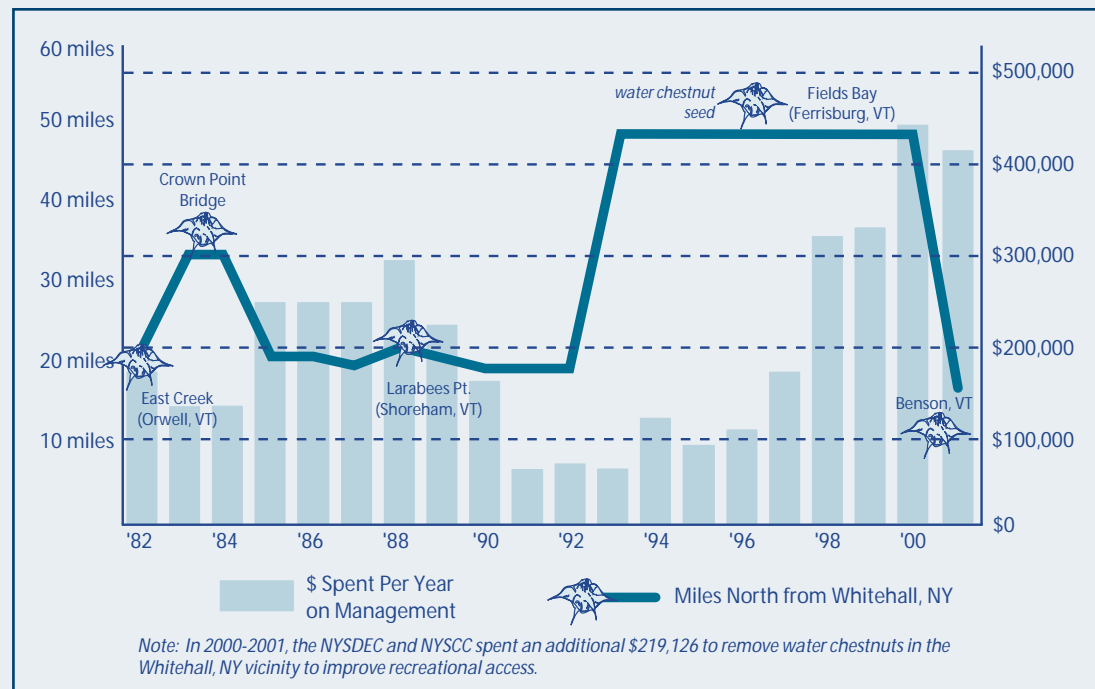


Figure 8. Lake Champlain water chestnut management: annual funding and northernmost mechanical harvesting site. Data source: VTDEC.

2) Support Implementation of a Long-term Sea Lamprey Control Program

This action supports aggressive implementation of a long-term control program that integrates adaptive management techniques and encourages multiple control strategies, including lampricides in appropriate locations. Sea lamprey management is a tool to protect and enhance the Lake Champlain ecosystem while providing public benefit through the reestablishment of native fish populations. Decreasing the deleterious effects of sea lamprey is a critically important part of the natural resources conservation management effort to improve the form, function, and structure of the Lake Champlain ecosystem. Successful efforts to reduce sea lamprey populations in the Lake were implemented in an eight-year experimental control program initiated by the bistate Lake Champlain Fish and Wildlife Management Cooperative (LCFWMC) in 1990. In 2001, the LCFWMC released a Supplemental Environmental Impact Statement (SEIS) in accord with the National Environmental Policy Act (NEPA). The NEPA Record of Decision supported the preferred alternative of implementing an extensive integrated long-term sea lamprey control program. The SEIS evaluated the feasibility of lampricides, barrier dams, trapping, pheromone attractants, and other control strategies. To date, the LCBP has funded the installation of two barrier dams on Lake Champlain tributaries, and the implementation of state-of-the-art sea lamprey assessment methodology and analysis of control alternatives for the Poultney and Pike Rivers. Opportunities to evaluate and demonstrate new and existing control technologies will also be developed.

Potential key LCBP partners: USFWS, NYSDEC, VTANR, SFP, LCFWMC, QC MENV, LCRC, academic institutions, TNC
Cost estimate: \$633,000 per year

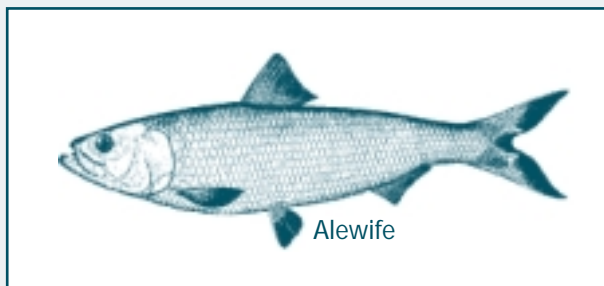
Potential funding sources: State and federal appropriations

Timeframe: Ongoing

Benchmark: Implementation of long-term control program beginning in 2002

3) Prevent the Spread of Alewives Within and Beyond the Lake Champlain Basin

Alewives were discovered in 1997 in Lake St. Catherine, which is connected to Lake Champlain by 30 miles of outlet flow and canal. This aquatic nuisance species poses a serious threat to other fish species in Lake Champlain. The VT Fish and Wildlife Department has reviewed several potential control strategies and is evaluating their applicability to Lake St. Catherine. Educational outreach is needed to prevent the accidental and/or intentional overland spread of alewives to other waterbodies in the Basin, including Lake Champlain. If alewife populations become established in Lake Champlain, it will be important to assess their potential impacts on ecosystem health and recreation. Elements of this action include:



a) Assess the potential control strategies identified by the VTFWD and their applicability to Lake St. Catherine. Implement appropriate strategies in as timely manner as possible.

b) Evaluate the ecosystem impacts of a potential alewife infestation in Lake Champlain.

c) Identify potential management strategies that could be considered if alewives spread throughout Lake Champlain.

d) Assess the potential economic impacts on recreation of an alewife infestation in Lake Champlain.

e) Design and implement educational and outreach activities to curtail the spread of alewives within and beyond the Lake Champlain Basin.

Potential key LCBP partners: VTFWD, USFWS, VTDEC, LCFWMC, LCRC, academic institutions, USACOE, Sea Grant, USEPA, QC MAPAQ, QC FAPAQ, local groups (i.e. lake/fishing groups) and marinas

Cost estimate: To be determined

Potential funding sources: State and federal appropriations

Timeframe: Immediate

Benchmark: Curtail the spread of alewives to the extent possible

4) Prevent the Spread of Zebra Mussels to Other Basin Lakes

While research and technologies to control and/or eradicate zebra mussels are continuously under development, preventing their spread to other lakes in the Basin is also critically important. Since their discovery in 1993, zebra mussels have rapidly colonized the entire Lake (Figure 9) and spread to other waterbodies.

ACCOMPLISHMENTS

COMPLETING ANS MANAGEMENT PLAN

The highest priority for aquatic nuisance species (ANS) prevention and control in 1996 was development of a Basin-wide aquatic nuisance species management plan for VT, NY, and Québec. With financial and technical support from LCBP, the *Lake Champlain Basin Program ANS Management Plan* was adopted in 2000. This plan has made Vermont eligible for USFWS funds to implement it. So far, \$205,000 has been received.

REDUCING WATER CHESTNUTS

Five years of consistent funding from multiple sources have reduced the extent of the Lake's dense water chestnut population by 40 miles from Fields Bay to Benson, VT. Only handpulling controls are now needed north of Benson, instead of mechanical harvesting. Average annual funding of more than \$475,000 came from the states of Vermont and New York, Québec, LCBP, US Army Corps of Engineers, and The Nature Conservancy.

CONTROLLING SEA LAMPREY

In 2001, the Lake Champlain Fish and Wildlife Management Cooperative

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Potential Key LCBP partners: VTFWD, USFWS, VTANR, NYSDEC, LCRC, academic institutions, USACOE, Sea Grant, USEPA, local groups

Cost estimate: \$50,000 per year

Potential funding sources: State and federal appropriations

Timeframe: Immediate

Benchmark: Reduce rate of spread of zebra mussels to other waterbodies

5) Update the *Lake Champlain Basin Aquatic Nuisance Species Management Plan* Regularly

This plan, cooperatively developed by partners from Vermont, New York, and Québec, was approved by the Lake Champlain Steering Committee in 2000. It needs to be periodically revised to remain current and to reflect changing priorities.

Potential Key LCBP partners: VTFWD, USFWS, VTANR, NYSDEC, LCRC, academic institutions, USACOE, Sea Grant, USEPA, local groups

Cost estimate: \$60,000 per year

Potential funding sources: State and federal appropriations

Timeframe: Ongoing

Benchmark: Biennial plan revisions

HIGH PRIORITY ACTION

6) Create a Central Database for Nonnative Aquatic Nuisance Species and Establish a Process for Coordination and Data Sharing

Create a central repository of information on nonnative aquatic nuisance species of concern

to the Lake Champlain Basin, including emerging control strategies. Establish and maintain communication with experts and citizen groups in other locations.

Potential key LCBP partners: NYSDEC, VTANR, QC MENV, USFWS, LCRC, academic institutions, Sea Grant, USGS

Cost estimate: \$60,000 per year

Potential funding sources: State and federal appropriations

Timeframe: ongoing

Benchmark: Creation of an up-to-date database at a central location

PRIORITY ACTIONS

(not listed in priority order)

7) Investigate the Ecological Implications of Nonnative Aquatic Nuisance Species in the Basin

Conduct research regarding the ecological role of nonnative aquatic nuisance species, including sea lamprey and zebra mussels, to understand ecosystem links with a focus on developing and employing effective control strategies. Assess the potential ecological consequences and impacts of nonnative aquatic nuisance species on native plants and animals, and recreation and cultural heritage resources. Specifically assess the potential effects of the proliferation of zebra mussels on the Lake Champlain food web, nutrient levels, and water clarity.

Potential key LCBP players: NYSDEC, VTANR, USFWS, LCRC, academic institutions, Sea Grant

Cost estimate: \$125,000 to \$250,000 per year

Potential funding sources: State and federal appropriations

Timeframe: Ongoing

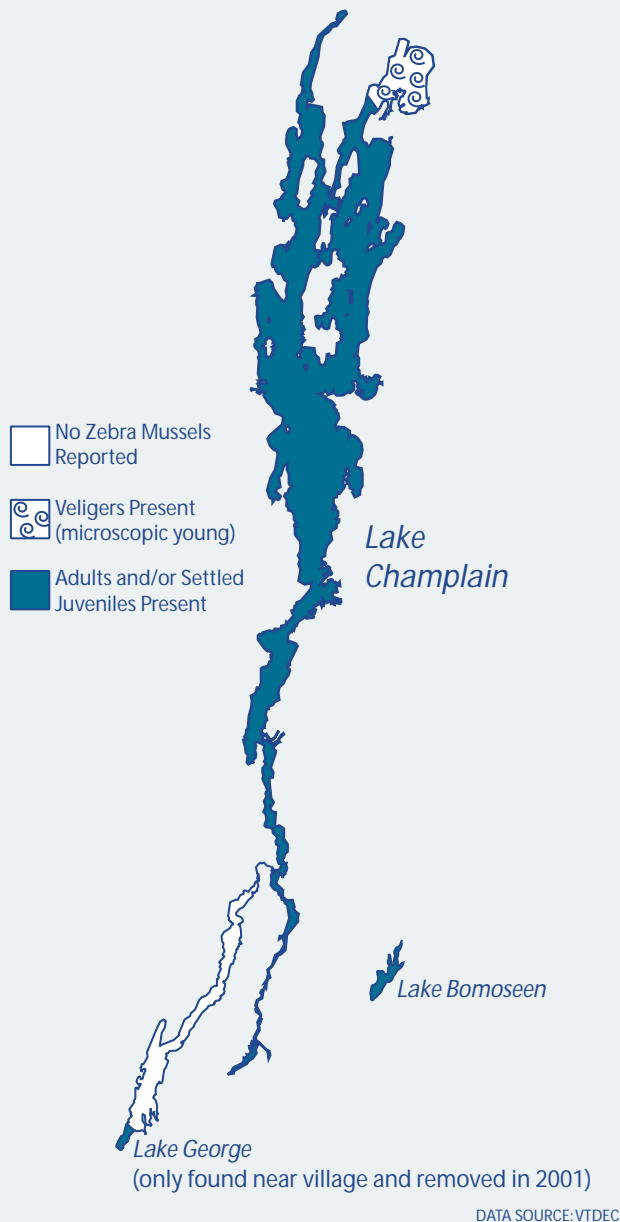


Figure 9. Zebra mussel distribution in the Lake Champlain Basin.

Benchmark: Increase knowledge of ecological role and innovative control techniques for aquatic nuisance species

8) Evaluate and Demonstrate Zebra Mussel Control Strategies

Investigate the economic and environmental costs and benefits of existing zebra mussel anti-fouling and other population control strategies, and new technologies as they become available.

Potential key LCBP partners: USFWS, NYSDEC, VTANR, QC MENV, LCRC, academic institutions, Sea Grant, lake groups, marinas, water supply and wastewater treatment facilities

Cost estimate: \$100,000 per year

Potential funding sources: State and federal appropriations

Timeframe: Ongoing

Benchmark: Implementation of control projects

9) Evaluate and Demonstrate Eurasian Watermilfoil Control Strategies

Continue to implement Eurasian watermilfoil control techniques, such as use of the naturalized aquatic moth, *Acentria ephemerella*, and the native aquatic weevil, *Euhrychiopsis lecontei*. Investigate new Eurasian watermilfoil population control technologies as they become available. Include Eurasian watermilfoil in lakewide surveys for nonnative aquatic nuisance species.

Potential key LCBP partners: NYSDEC, USFWS, VTANR, LCRC, academic institutions, lake groups, Sea Grant

Cost estimate: \$175,000 per year

Potential funding sources: State and federal appropriations

ACCOMPLISHMENTS

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completed an assessment of long-term sea lamprey control strategies. This program identifies a comprehensive, integrated approach to sea lamprey control and provides for cooperative federal-state management to reduce the impact of sea lamprey parasitism on fisheries.

EXPLORING BIOLOGICAL SOLUTIONS

Since 1999, the LCBP has funded research on biological controls for nonnative aquatic nuisance species as an alternative to chemical treatment. For three years, research has been conducted in NY on a moth larva that eats watermilfoil.



Cornell University

The Lincoln Pond watermilfoil project in Elizabethtown, NY evaluated the ability of moth larva to reduce watermilfoil biomass and enhance native plant diversity.

Timeframe: Ongoing

Benchmark: Discovery of new feasible control methods

10) Evaluate the Effectiveness of Biological Controls for Nonnative Aquatic Nuisance Species

Mike Hauser



Zebra mussels compete with the native mussels in Lake Champlain for food. They also encrust native mussel shells, resulting in their demise.

Investigate biological control agents, such as leaf-eating insects, aquatic weevils, beetles, and moths. Because biological control agents may have unanticipated negative effects on native species, their use must be carefully evaluated prior to introduction, and introductions should only be permitted following a clear determination of net benefit.

Potential key LCBP partners: USFWS, NYSDEC, VTANR, QC MENV, LCFWMC, LCRC, USEPA, academic institutions

Cost estimate: \$50,000 per year

Potential funding sources: State and federal appropriations

Timeframe: Ongoing

Benchmark: Completion of demonstration projects and slowing the spread of nonnative aquatic nuisance species

OTHER ACTIONS FOR CONSIDERATION

(not listed in priority order)

11) Encourage Voluntary Efforts and Enforcement of Existing Laws to Control the Transport of Nonnative Aquatic Nuisance Species

a) Coordinate new legislation controlling the propagation, sale, collection, importation, pur-

chase, cultivation, distribution, and introduction of nonnative aquatic nuisance species.

b) Review and improve consistency of existing nonnative aquatic nuisance species laws among the applicable jurisdictions in the Basin.

c) Encourage voluntary boat and trailer washing, and cleaning of vegetative debris by hand, to reduce transport of nonnative aquatic nuisance species to and from boat launch areas.

d) Encourage enforcement of existing laws regarding the transportation or spread of nonnative aquatic nuisance species.

Potential key LCBP partners: USFWS, NYSDEC, VTANR, SFP, local government, NYSDOT, VTrans, VTDAFM, NY State Police, VT State Police, lake groups, local law enforcement officials, QC MENV, sporting groups

Cost estimate: In-kind participation

Potential funding sources: Same as potential key partners

Timeframe: Ongoing

Benchmark: Reduction in the number and spread of nonnative aquatic nuisance species in the Basin

12) Evaluate and Demonstrate Exclusion Devices for Nonnative Aquatic Nuisance Species

Investigate the broad applicability of electronic and other control alternatives, such as exclusion devices, for nonnative aquatic nuisance species in the Lake Champlain Basin.

Potential key LCBP partners: NYSDEC, USFWS, VTANR, LCRC, academic institutions, USACOE

Cost estimate: \$150,000 per year

Potential funding sources: State and federal appropriations

Timeframe: Ongoing

Benchmark: Development and demonstration of the effectiveness of exclusion techniques

CHAPTER FOUR

RECREATION AND CULTURAL RESOURCES

THIS CHAPTER INCLUDES:

Managing Recreation Resources
Protecting Cultural Heritage Resources

MANAGING RECREATION RESOURCES

GOAL

Manage Lake Champlain, its shorelines, and its tributaries for a diversity of recreational uses while protecting its natural and cultural resources.

The history of humans in the Lake Champlain Basin spans more than 10,000 years. It includes Native American and early Euro-American settlements, French and British explorations and occupations, pivotal military conflicts, and a dynamic period of 19th century commerce. Many archaeological and historic sites provide a context and sense of place to people today. Although strong stewardship exists, public awareness and understanding of cultural heritage resources is often limited. The Basin also provides many recreational and tourism opportunities, such as swimming, boating, skiing, hiking, birding, and fishing. Unfortunately, in some areas recreational activity has created congestion, conflicts between different types of users, and safety concerns.

Les ressources récréatives et culturelles

L'histoire de la présence humaine au lac Champlain remonte à plus de 10 000 ans. Elle s'étend de la venue des Amérindiens puis des Européens, à l'exploration et à l'occupation par les Français et les Britanniques, aux nombreux conflits militaires, au commerce florissant du XIXe siècle. Les nombreux sites archéologiques et historiques donnent à la population actuelle du bassin un contexte stimulant son sentiment d'appartenance. Bien qu'il existe de nombreux organismes s'occupant du patrimoine culturel, il reste encore des efforts à fournir afin d'aviser le public sur l'existence de ces ressources culturelles et de toute la valeur que représente cet héritage.

Le bassin du lac Champlain rend également possible la pratique d'activités récréatives et touristiques comme la baignade, la voile, le ski, la marche, l'ornithologie et la pêche sportive. Malheureusement, les activités récréatives ont entraîné des conflits entre différents usages et, suscité par endroits, des craintes liées à la sécurité des usagers.

Lake Champlain is a popular resource for Basin residents and visitors alike. Swimming, fishing, scuba diving, and boating are just a few of the activities enjoyed on the Lake. Popular shoreline activities include bicycling, hiking, sightseeing, and bird watching. Recreation also contributes to the local economy. Total tourism-related expenditures in the Basin were estimated at \$3.8 billion in 1998-99. Lake Champlain recreationists affect, and are affected by, the state of the natural, cultural, and historic resources in the Lake Champlain Basin. Protection and enhancement of the environment and cultural and historic resources is clearly important to recreationists—as these resources are often the main focus of their experience. Fostering more opportunities to access and enjoy the Lake will encourage more people to value it and support water quality protection, ultimately increasing the number of people engaged in Lake stewardship.

ISSUES

Promoting Economically and Ecologically Sustainable Tourism

The overall management issue in addressing tourism in the Lake Champlain Basin is to support initiatives that promote ecologically sustainable economic activity utilizing natural, cultural, and historical resources in the Basin. In 1999, Lake Champlain Byways produced a *Corridor Management Plan* and a *Celebration Champlain!* proposal. *Celebration Champlain!* will celebrate the 400th anniversary of Samuel

de Champlain's arrival and the cultural diversity that characterizes the Basin today. This multi-year event (2003-2009) will focus on regional scenic byways as the means of travel between the various venues and events of the Celebration. The Celebration will help identify the scenic byways as key elements of the regional tourism, and contribute to byway sustainability. Also, in 1999, the National Park Service completed a study of the Champlain Valley that assessed the potential of establishing a national heritage corridor in the region. Currently, the LCBP is

embarking on a follow-up project of this initial study to develop a framework for heritage tourism in the region that is compatible with local interests. Other initiatives—the Lake Champlain Birding Trail, the Lake Champlain Paddlers' Trail, Lake Champlain Walkways, the Lake Champlain Underwater Preserve System, and Lake Champlain Bikeways—have also

made notable progress in promoting low-impact tourism in the Basin.

The Waterfront Revitalization Program in New York has focused on enhancing water-related tourism, improving lake access, and strengthening community centers along Lake Champlain and Lake George. Local plans for parks, improvements, preservation, and reuse of historic buildings, public access enhancements, museum development, and community revitalization have been developed as part of this program.

Continuing and expanding these and similar initiatives in a more coordinated manner fosters stewardship for the Lake and its surrounding natural, cultural, recreational, and historic resources within the Basin. It also presents tremendous opportunities to enhance the economic vitality of the region.

Expanding or Enhancing Public Access

“Public access” is defined as those places where the general public may enjoy the Lake. Public access sites accommodate both water and non-water recreational activities and include: boat launch areas, shoreline parks, marinas, beaches, campgrounds, scenic overlooks, fishing piers, and shoreline walking and bicycling trails. The overall management issue concerning public access on Lake Champlain is how to expand and enhance access opportunities in a manner that allows for a variety of recreational activities while minimizing congestion, user conflicts, and impacts to the natural environment. In providing better access, the challenge is to accommodate a diversity of

Courtesy UVM Special Collections



Scene on Lake Champlain with the ruins of Fort Ticonderoga. Engraving by Welstood & Kirk from an original drawing by J.Kirk, published in the Ladies Repository, 1851.

users. Many of the problems associated with public access are caused by conflicts between the various user types. Options for addressing such conflicts include designing and organizing sites to meet a variety of needs, or separating different uses by establishing designated use areas. Another challenge is to provide opportunities for people with low incomes and those with disabilities to take advantage of public access facilities.

Alleviating Congestion and Conflicts of Use

Certain areas of Lake Champlain experience high levels of congestion and conflicts of use. These issues can be addressed through user cooperation, education, or a combined approach on a site-by-site basis, depending on the severity of the problems and the nature of the conflicts. Rather than attempting to establish a carrying capacity for the Lake (which research has shown to be ineffective), communities develop overall management objectives for areas of concern. In 1995, the LCBP funded a demonstration project that identified solutions to the boating congestion and other problems in Malletts Bay. The *Malletts Bay Recreation Resources Management Plan* addresses ways to manage the public waters in Malletts Bay, the density of moorings and marinas, and the allocation of recreational uses to reduce conflicts among the various boaters, swimmers, paddlers, etc., who frequent the bay area. This plan should serve as a model for addressing similar issues in other parts of the Lake.

Improving Safety and Enforcement

Boating safety and related concerns can be addressed by increasing the number of enforcement officers on the Lake. The US and Canadian Coast Guards, and state and provincial enforcement entities, need adequate resources to ensure public safety and law enforcement in view of increased recreational

OBJECTIVES

(not listed in priority order)

- 1) Support initiatives that promote sustainable recreational activity using natural, cultural, and historical resources in the Basin.
- 2) Increase and improve public access opportunities to the Lake for a diversity of water and non-water activities.
- 3) Minimize congestion and conflicts of use in high-use areas by developing management strategies appropriate to the locale.
- 4) Develop a public education and information program that emphasizes recreational user ethics, boating safety, and wise use of resources.
- 5) Increase resources available to enforcement agencies; improve coordination among all enforcement entities.
- 6) Identify appropriate locations for shoreline recreational uses that do not adversely impact shoreline environments.
- 7) Secure funding to achieve recreation management objectives.



Gary Randorf

Sunset on Lake Champlain.

ACCOMPLISHMENTS

DEVELOPING A BIRDING TRAIL

The Lake Champlain Birding Trail began in 1999 as a project of the George D. Aiken Resource Conservation and Development Council. In 2001, the Birding Trail published a brochure highlighting 87 bird watching sites in the Basin.

IMPLEMENTING LAKE CHAMPLAIN BIKEWAYS

With LCBP support, Lake Champlain Bikeways (LCB) created the Champlain Bikeway, a 350-mile loop encircling the Lake, and 27 shorter interpretive theme loops, totaling 1,100 miles. LCB also published 8 guidebooks on the network of routes. Through an LCBP grants program, LCB implemented 17 bicycle enhancement projects. In 1999, the Whitehouse Millennium Trails Council designated Lake Champlain Bikeways as Vermont's Millennium Legacy Trail.

IMPLEMENTING PUBLIC ACCESS GRANTS

Since 1997, the LCBP has funded 26 public access projects, totaling \$97,500, to support local communities in improving and enhancing public access on Lake Champlain.

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activity on the Lake. Another need is to increase boating safety education through schools and other means. Finally, improved coordination among various enforcement entities on the Lake is key to addressing safety.

HIGH PRIORITY ACTIONS

(not listed in priority order)

1) Encourage New Opportunities for Ecologically Sustainable Recreation in the Lake Champlain Basin

Recreational opportunities are essential in the development of tourism in the Lake Champlain Basin. Review regional tourist promotion efforts for consistency with other resource management goals of the Plan. Promote the Basin as a total package, and improve coordination among tourism organizations and initiatives in New York, Vermont, and Québec. Encourage collaboration between various organizations, and avoid duplication of efforts by developing a specific framework from which project work may be accomplished in partnership. Develop and implement a tourism strategy that promotes tourist activities that are sustainable over the long term with minimal impact on natural, cultural, historic, and archeological resources. Tourism activities that are either underway or could be initiated include the following:

a) Develop natural and cultural heritage interpretative trails, such as the existing Lake Champlain Historic Landings Heritage Trail, through wayside exhibits and other informative media.

b) Continue to encourage the Lake Champlain Paddlers' Trail, Lake Champlain Birding Trail, Lake Champlain Walkways, Lake Champlain Bikeways, and similar ecotourism around Lake Champlain and the Richelieu River.

c) Seek development of a fishing license agreement between New York and Vermont.

d) Continue to develop the Lake Champlain Underwater Historic Preserve System.

e) Develop a comprehensive guide to all types of public access opportunities on Lake Champlain and its tributaries, including winter access sites.

f) Use existing tourism information centers and marketing organizations to coordinate and disseminate information on opportunities for year-round use of recreational, natural, cultural, and historic resources of the Lake Champlain Basin.

g) In coordination with regional planning, development, and marketing organizations consider scenic byway designation for routes possessing significant scenic, recreational, and/or historic resources in the region, subject to local or county government approval, and encourage actions of the Lake Champlain Byways Corridor Management Plan.

h) Use existing tourism information centers and regional planning initiatives to expand and create interpretive and educational programs about natural, cultural, and historic resources in the Basin to inform tourists and local users about wise use of these resources.

i) Expand facilities and services along the Lake, such as restaurants, lodging, and equipment rentals, in a manner that minimizes impacts on recreational, cultural, and historic resources.

Potential key LCBP partners: Tourism and business organizations, regional marketing organizations, chambers of commerce, state and county tourism departments, state agencies, local and regional planners, private businesses, municipalities, Lake Champlain Byways, Adirondack North Country Association

Cost estimate: \$150,000 per year per activity

Potential funding sources: Local, state, and federal appropriations

Time frame: Ongoing

Benchmark: Development of overall strategies to coordinate various tourism promotional activities

2) Determine, Monitor, and Mitigate the Impact of Increased Recreational Use in Ecologically Sensitive Areas

Identify and monitor ecologically sensitive areas potentially impacted by recreational use, and establish a monitoring program and mitigation strategy to help avoid these impacts.

Potential key LCBP partners: LCRC, VTFWD, VTDEC, VTDFPR, NYSDEC, NYSOPRHP, nonprofit organizations, universities

Cost estimate: \$5,000 to \$30,000 per site depending on level of research

Potential funding sources: Local, state, and federal appropriations

Timeframe: Ongoing

Benchmark: Identification and initial evaluation of 2-4 sites

3) Develop New Public Access Opportunities

At the state level, New York and Vermont will work cooperatively to develop and maintain new public access opportunities along the shores of Lake Champlain, particularly in underserved areas. This will include: locating potential sites (on a willing seller basis) for future access (both boating and non-boating); establishing priority for potential access sites based on results of recreation studies in progress and municipal priorities; exploring options for funding; and considering public-private partnerships to secure new access through cooperative agreements, conservation easements, and land trusts.

Potential key LCBP partners: NYSOPRHP, VTDFPR, VTANR Facilities Division, NYSDEC, VTFWD, nonprofit organizations, municipalities, chambers of commerce, regional marketing organizations, regional planning commissions, county planning departments, businesses

Cost estimate: \$50,000

Potential funding sources: Federal, state, and municipal appropriations

Timeframe: Ongoing

Benchmark: Development of new access sites as recommended by the states of Vermont and New York

PRIORITY ACTIONS

(not listed in priority order)

4) Pursue Funding Alternatives for Public Access Site Enhancement

Improved public access to Lake Champlain would benefit from a dedicated fund to support new access locations and to enhance existing access sites. This should be a lakewide boat-

ACCOMPLISHMENTS

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DEVELOPING LAKE CHAMPLAIN BYWAYS

Through a FHWA Scenic Byway planning grant, New York and Vermont agencies and communities developed a Corridor Management Plan for Lake Champlain. Completed in 2000, the plan focuses on activities to further establish a partnership approach to unify the Lake as a region. A major outcome of the planning project is the proposed *Celebration Champlain!*, a quatracentennial celebration of the arrival of Samuel de Champlain in the basin. Planning for *Celebration Champlain!* will serve as the catalyst in implementing the Corridor Management Plan. A component of the Byways effort is Lake Champlain Walkways, an initiative to establish linked walking paths and trails around the Lake.

PADDLING LAKE CHAMPLAIN

Managed by the nonprofit Lake Champlain Committee, the Paddlers' Trail began in 1993 as a water trail linking camping and access sites for paddlers along the shores of Lake Champlain. To date, the Trail consists of 26 public and private sites ranging from primitive sites to developed campgrounds.

ing facilities program fund to be used exclusively for the enhancement of public access boating sites.

Potential key LCBP partners: NYSOPRHP, NYSDEC, VTDFPR, VTFWD, regional marketing organizations, regional planning commissions, county planning departments
Cost estimate: In-kind participation of agency representatives initially; \$60,000 to \$80,000 per year to administer program

Potential funding source: Dedicated funds to administer program

Timeframe: Ongoing

Benchmark: The securement of funding mechanisms to maintain and improve existing public access sites

5) Continue a Grants Program for Local Governments and Nonprofits Organizations to Develop New Public Access Sites

Continue a grants program to provide funds to government entities and nonprofit organizations on a competitive basis for the development of new boating and non-boating access opportunities.

Potential key LCBP partners: NYSOPRHP, VTDFPR, NYSDEC, VTFWD, regional marketing organizations, regional planning commissions, county planning departments, nonprofit organizations, municipalities

Cost estimate: \$5,000 per year to administer program; \$20,000 to \$75,000 per year for grants

Potential funding sources: State appropriations or dedicated funds

Timeframe: Ongoing

Benchmark: Ongoing annual grants

6) Evaluate the Need for Local Recreation Management Plans in High Use Areas of the Lake

In cooperation with local communities, determine whether the process used as part of the *Malletts Bay Recreation Management Plan* is likely to be an effective process for alleviating congestion and user conflicts occurring in other high use areas of the Lake.

Potential key LCBP partners: NYSOPRHP, NYSDEC, VTDFPR, VTFWD, regional marketing organizations, regional planning commissions, county planning departments, municipalities

Cost estimate: In-kind participation from local and state agency representatives

Potential funding sources: Same as key partners

Timeframe: Ongoing

Benchmark: Evaluation of the *Malletts Bay Recreation Management Plan* and implementation and identification of high-use areas likely to benefit from similar local plans and appropriate implementation actions

7) Assist Communities That Wish to Develop Local Recreation Management Plans

Provide assistance to communities or groups of communities identified through Action 6, above, that desire to develop management plans similar to that recently developed for Malletts Bay.

Potential key LCBP partners: NYSOPRHP, NYSDEC, VTDFPR, VTFWD, regional marketing organizations, regional planning commissions, county planning departments, municipalities

Cost estimate: \$15,000 to \$50,000 per site, depending on the size of the area and complexity of issues to be resolved

Potential funding sources: NPS, state appropriations

Walt Lender



A dock installation in Ticonderoga was funded by a LCBP Public Access grant.

Timeframe: Ongoing

Benchmark: Development of local recreation management plans for communities needing and desiring assistance

OTHER ACTIONS FOR CONSIDERATION

(not listed in priority order)

8) Use Regional Partnerships to Manage Public Access Improvements

Encourage the establishment of regional partnerships of local, state, and federal governments; nonprofit organizations; and private enterprises to manage boating and non-boating public access improvements. The partnerships will establish priorities for improvements and pursue federal, state, and local funding options to accomplish them. Encourage the development of public-private cooperative agreements that describe the responsibilities of various parties to improve and maintain access opportunities.

Potential key LCBP partners: NYSOPRHP, VTDFPR, NYDEC, VTFWD, municipalities, land trusts, APA, USFWS, VTDEC (Public Facilities Division), regional marketing organizations, regional planning commissions, county planning departments, sporting groups, businesses

Cost estimate: In-kind participation of key players; additional costs to be determined on a site by site basis

Potential funding sources: NPS, states of NY and VT (e.g., VT Housing and Conservation Board), USFWS, TEA-21 Program

Timeframe: 2002-2003

Benchmark: Management agreements and funds to improve priority sites

9) Encourage Adopt-an-Access Programs

Encourage Adopt-an-Access programs to help local citizens groups become directly involved in the enhancement of public access sites on Lake Champlain. Local groups would be responsible for guiding access improvements for a given section of the Lake, with overall program coordination at the state level.

Potential key LCBP partners: NYSOPRHP, VTDFPR, NYSDEC, VTFWD, nonprofit organizations, municipalities, regional marketing organizations, regional planning commissions, county planning departments

Cost estimate: \$20,000 per year (\$10,000 per state) to administer program

Potential funding sources: State appropriations, in-kind contributions from nonprofit organizations and volunteers

Timeframe: Ongoing

Benchmark: Establishment of Adopt-an-Access program as described

10) Evaluate and Improve Consistency of Regulations and Enforcement

There are many differences in recreation-related regulations of New York, Vermont, and Québec. Improving consistency does not predetermine that regulations and enforcement will be more or less stringent than they are presently.

a) Evaluate existing boating and non-boating regulations and measures of enforcement. Establish a committee with broad representation (see potential key partners, below) to evaluate existing federal, state, provincial, and munici-



Kelly Dziekan

Marina in Rouses Point, New York.

pal boating and recreational use regulations for their ability to impose and enforce safe boating and recreation on Lake Champlain. Assess the status, limitations, and consistency of federal, state, and provincial boating laws and enforcement, and recommend changes necessary to improve the safety and quality of recreation on Lake Champlain.



Sailboat moored off North Beach, Burlington, VT.

b) Implement (a) with an emphasis on devising ways to make regulation and enforcement more consistent across political boundaries by establishing interstate/provincial agreements for recreation management and law enforcement.

Potential key LCBP partners: NYSOPRH, NYSDEC, VTANR, state, provincial, county and local police departments, US and Canadian Coast Guard, Canadian and US Power Squadrons, boating advisory boards, marine trade associations, state legislatures

Cost estimate: In-kind participation of agency partners

Potential funding sources: Same as key players

Timeframe: Ongoing

Benchmark: Improved consistency of boating and non-boating regulations and law enforcement.

11) Continue to Evaluate Navigational Charts

In coordination with the US and Canadian Coast Guard and NOAA, encourage continued evaluation and updating of navigational aids and charts, identifying areas where safety has increasingly become an issue.

Potential key LCBP partners: US and Canadian Coast Guard, NOAA, state police, NYSOPRHP, NYSDEC

Cost estimate: In-kind participation of agency representatives

Potential funding sources: US Coast Guard, NOAA

Timeframe: 2002-onward

Benchmark: The development of updated navigational aids and charts, as necessary

PROTECTING CULTURAL HERITAGE RESOURCES

GOAL

To identify, preserve, enhance, and protect the irreplaceable cultural heritage resources of the Lake Champlain Basin for the public benefit, now and for generations to come, and to promote an appreciation of their value as a vital aspect of the economic and community life of the Basin.

LCMM



In 1998, an anchor was recovered from Lake Champlain that had been shot off the British ship *Confiance* during the Battle of Plattsburgh, in the War of 1812. Since its restoration, it has been displayed at Plattsburgh City Hall.

The many historic and archeological resources throughout the Lake Champlain Basin tell of a human history spanning more than 10,000 years. These cultural heritage resources link us to our past, and include historic structures and settlements, sites of archeological interest on land and underwater, and traditional cultural properties.

The Basin's cultural heritage resources help us learn about our history and give us a sense of place to pass on to our children and communities. The Abenaki and Iroquois who live here today have long called the Basin home, and many Native American sites are of traditional sacred importance. Some Basin residents can trace their heritage to French and British explorers, or to farmers, industrialists, and merchants who settled here. Many military battles were fought on Lake Champlain, and the submerged historic shipwrecks comprise one of the largest, best-preserved collections in North America. These resources contribute spiritual, recreational, and educational value to our contemporary life. They help make our communities attractive and memorable places in which to live, work, and play, and they also draw thousands of visitors to the region.

ISSUES

Public Awareness and Appreciation

Public awareness, appreciation, and understanding of the Basin's cultural heritage is growing. There is, however, incomplete or cursory documentation as a result of partly varying perceptions of what constitutes cultural heritage resources. Lack of recognition and appreciation results in missed opportunities for stewardship, economic development, recreation, and education.

Protection of Privately Owned Heritage Resources

Private property owners are the primary custodians of the cultural heritage resources in the Basin. There is sometimes a perception by landowners that recognition, including designation of their property as a cultural heritage resource, invariably means restriction on its use. However, most federal and state laws pertaining to heritage resources have little or no impact on private landowners. It is critically

important that the stewardship role and concerns of private landowners be fully acknowledged, and that stewardship programs support the preservation efforts of willing landowners. Programs such as Vermont's Historic Barn Grants, the Federal Investment Tax Credits Program, and the LCBP Cultural Heritage and Recreation Technical Assistance Program should be continued.

Current Management and Protection: Government Issues

Courtesy UVM Special Collections



Bird's eye view of the Burlington waterfront in 1877.

Management of cultural heritage resources within states, and also across international, state, and provincial boundaries, lacks coordination. Protection of resources, even on public lands and under public waters, is far from comprehensive. With numerous players throughout the Basin, reaching a consensus on a system of management and protection and coordinating its application across all jurisdictions and all levels of government continues to be a challenge. Cultural heritage initiatives should be developed in a manner that also addresses environmental concerns.

Coordination of Current Information

Inventories of cultural heritage resources in the Basin have been assembled by numerous organizations, but there is need for further coordination of these inventories. The *Lake Champlain Byways Corridor Management Plan* includes a general inventory of cultural, natural, and recreational resources in New York and

Vermont counties along the Lake. *The Champlain Valley Heritage Corridor Project Report*, produced by the National Park Service, lists national historic landmarks, buildings, sites, and structures on the National Register of Historic Places and National Historic Landmarks. Provincial and state historic preservation offices, regional marketing organizations, and planning commissions have maintained inventories of resources to differing degrees over the years. Comprehensive and coordinated historic resource inventories need to be developed.

Improving Cultural Resource Data, Regional Data Management, and Information Access

Many existing cultural heritage resource inventories do not take advantage of current computer technologies, such as geographic information systems (GIS), and consequently are not well integrated into local and regional land use or economic development plans. Because the actions in this Plan rely on sound, current data that can be interpreted across the entire Basin, immediate action is necessary to make cultural heritage resource data comprehensive and accessible to communities throughout the Basin. Websites on the Internet are a good resource for readily available information. State, provincial, and regional data coordination efforts underway also offer an opportunity for disseminating information better.

Expanding Economic Opportunities of Cultural Heritage Resources

In addition to enhancing our quality of life, the cultural heritage resources in and around Lake Champlain are integral, yet often unrealized, components of the regional economic base. Economic opportunities are linked to the continued commercial use of historic buildings, revitalization of historic downtowns and village centers, history-based tourism, and recreation within historic districts, landscapes, historic sites, museums, and the Lake Champlain Underwater Historic Preserve System. Historic resources have contributed greatly to economic development of the Lake Champlain Basin. We should continue supporting local efforts to improve and market these cultural heritage resources without compromising long-term protection.

HIGH PRIORITY ACTIONS

(not listed in priority order)

1) Develop and Promote Networks and Linkages of Heritage Trails and Programs around the Lake

Heritage resources are often best understood by the public when viewed as a network of sites and places that provide direct, unobtrusive, and economical access to historic communities and resources, whether for walkers, cyclists, motorists, or boaters. For example, Heritage Trails can link publicly owned natural, historic, and/or scenic vistas, historic districts, prehistoric and historic sites, museums, recreational areas, campgrounds, tourist attractions and services (shops, restaurants, lodg-

ing), and lake access in self-directed trails through public and private land (with the permission of willing landowners). These networks can have themes, such as the Revolutionary War, the industrial past, or Native American history. Specific components of such networks should be developed through local planning initiatives. The LCBP fact sheets, *Historic Sites on Lake Champlain* and *Boating to Lake Champlain's State Parks and Historic Villages*, describe the links among sites in New York, Vermont, and Québec. Bicycle theme loops in

communities allow riders to enjoy the view while exploring the history of the area. The Walkways Project of the Lake Champlain Byways planning process links hamlets and villages by foot. Heritage tourism and public appreciation of resources are best served by locally organized and managed resource programs. Ties to related efforts in the Richelieu Valley to the north and the Champlain Canal-Hudson River to the south of the Basin should also be developed.

OBJECTIVES

(not listed in priority order)

- 1) Increase recognition and appreciation of the cultural heritage resources in the Basin.
- 2) Support initiatives that promote the sustainable use of cultural heritage resources and develop strong economic support for cultural heritage preservation and associated economic initiatives by expanding awareness of economic opportunities and identifying new financial resources.
- 3) Protect underwater archeological resources in the Basin, most specifically historic shipwrecks, and expand public access through the Lake Champlain Underwater Historic Preserve System by providing reasonable access to appropriate sites.
- 4) Foster stewardship of cultural heritage resources by private landowners and communities and coordinate a more effective mix of protection strategies (public/private; federal/state/local; regulatory/nonregulatory).
- 5) Increase historical and archeological research (where needed) and accelerate the identification, evaluation, and protection of cultural heritage resources, based upon Basin-specific priorities.
- 6) Better integrate cultural heritage programs with ongoing and future environmental and natural resources protection programs being carried out by federal, state, regional, town, and nonprofit efforts.
- 7) Develop coordinated preservation and management plans for cultural heritage resources in cooperation with governments and organizations at all levels in Vermont, New York, and Québec.

ACCOMPLISHMENTS

SURVEYING UNDERWATER CULTURAL RESOURCES

Since 1996, the LCBP has provided funding to the Lake Champlain Maritime Museum (LCMM) for the Lake Champlain Underwater Survey, resulting in the survey of more than 240 square miles of lake bottom. In 1997, the LCMM found Benedict Arnold's gunboat near Valcour Island in New York. An anchor shot off the British warship *Confiance* during the Battle of Plattsburgh Bay in 1814 is now on display at City Hall in Plattsburgh. It was recovered from the Lake in 1998.

INCREASING UNDERWATER HISTORIC PRESERVES

In 1998, the *Champlain II* in New York and the *O.J. Walker* in Vermont were added to the Lake Champlain Bi-State Underwater Historic Preserve System, increasing the system to seven sites.

INTERPRETING HISTORIC LANDINGS

In 2001, the LCBP opened the Historic Landings Heritage Trail with exhibits installed in Plattsburgh, Whitehall, and Port Kent, New York, and Vergennes, Vermont. The LCBP has identified more than 20 sites to be interpreted with outdoor exhibits.

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Potential key LCBP partners: Landowners, businesses, nonprofits organizations, local and county governments, chambers of commerce, tourism offices, NPS, USEPA, NYS-DEC, VTANR, NYSOPRHP, VTDHP, corresponding agencies in Québec

Cost estimate: \$250,000 per year

Potential funding sources: Federal and state appropriations, NPS, USEPA, NY & VT capital construction budgets, TEA-21, HPF (through states), private sector

Timeframe: 2002-ongoing

Benchmark: Completion of planning for heritage network and development of related maps and brochures

2) Develop and Implement a Management Strategy for Underwater Cultural Heritage Resources in Lake Champlain

Lake Champlain contains one of the best preserved underwater cultural heritage collections in North America. Research and documentation, public interpretation, heritage tourism, and recreation offer unique opportunities to preserve these historic artifacts and their meanings for current and future generations. Advances in marine survey technologies allow many sites not previously located to be found. This has added pressure to develop a management regime around these extraordinary time capsules. One response has been an ambitious Lake Champlain Maritime Museum (LCMM) project to survey and inventory the entire Lake (see Figure 10). This project is an eight-year endeavor and is being funded in part by the LCBP. However, there are new threats to the short-and-long-term stability of this collection, including the arrival of zebra mussels in the Lake in 1993. A new study, the *Impacts of Zebra Mussels on Shipwrecks and the Environment*, was initiated in 1999 by the

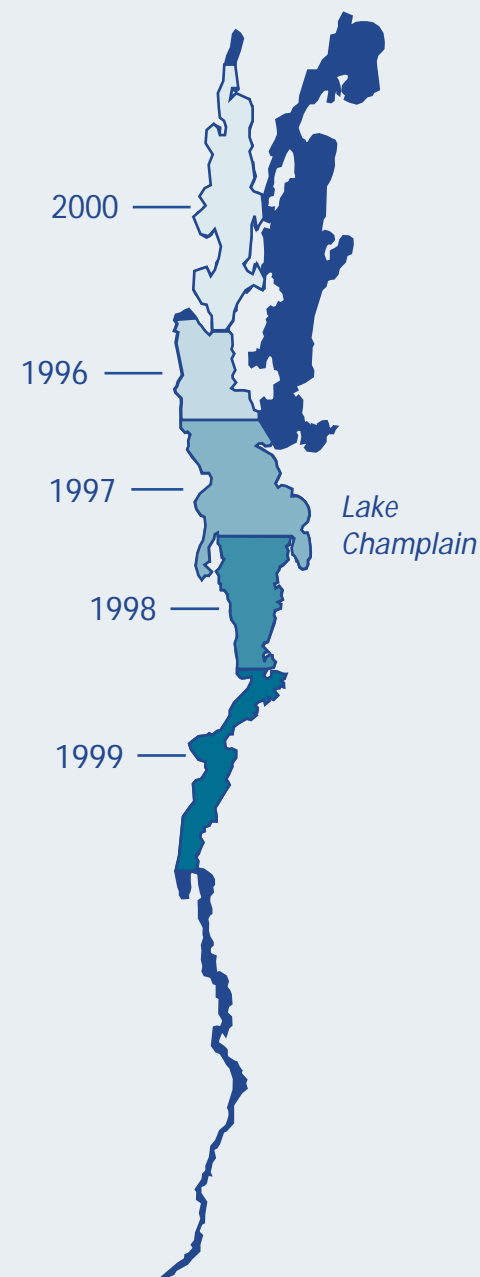


Figure 10. Lake Champlain underwater mapping, 1996-2000.
Source: Lake Champlain Maritime Museum

University of Vermont and LCMM. In addition, LCMM has produced management studies for the states of Vermont and New York focused on the Lake Champlain Underwater Preserve System. These studies have looked at expanding reasonable public access to appropriate underwater sites.

This action recognizes the potential of underwater sites to enrich our understanding of the past and provide extraordinary interpretive opportunities to both divers and non-divers. It supports the development of a bistate, lakewide approach to managing underwater cultural heritage of Lake Champlain and Lake George geology. It supports further survey, documentation, and analysis of the impacts of zebra mussels, and ways in which to provide reasonable public access to appropriate sites. Protection of these sites and related law enforcement is an integral component of this approach. This action also strongly recommends enhanced interpretation of underwater cultural heritage resources for the non-diving public at land-based venues. Developing this strategy would include the following activities:

- a) Continue to survey, document, and evaluate underwater cultural heritage resources.*
- b) Continue to study of the impacts of zebra mussels on shipwrecks.*
- c) Integrate the results of shipwreck work with other resource studies, such as collections of bathymetric, hydrodynamic, and environmental data.*
- d) Make the results of these studies available to the public through a variety of land based exhibits, curriculum, and outdoor signage.*

e) Develop a bistate management approach to the Lake Champlain Underwater Historic Preserve program that includes reasonable public access to appropriate sites as well as enhanced protection.

Potential key LCBP partners: Diver groups, businesses, nonprofit organizations, local and county governments, LCMM, Bateau Below, Lake George Commission, Lake Champlain Byways, NPS, USEPA, NYSDEC, VTANR, NYSOPRHP, VTDHP, Sea Grant, corresponding agencies in Québec

Cost estimate: To be determined

Potential funding sources: NY and VT state capital construction budgets, NY and VT State Historic Sites budgets, HPF, NPS, USEPA, NOAA, Sea Grant, universities, local governments, user fees, federal and state appropriations

Timeframe: 2002-ongoing

Benchmark: Completion of management strategy, including above elements

PRIORITY ACTIONS

(not listed in priority order)

3) Develop a Stewardship Program to Strengthen Nonregulatory Protection of Heritage Resources

Because the majority of heritage resources in the Basin are privately owned, landowners are their most effective stewards. While regulatory mechanisms protect a small percentage of cultural heritage resources, many organizations, groups, and individuals work to protect heritage resources in informal, voluntary ways. A good example of an effective, nonregulatory stewardship program is the LCBP Archeology on the Farm project, which provides a professional archeologist to assist farmers in planning water quality improvement projects. A stewardship program focusing on significant

ACCOMPLISHMENTS

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DESIGNING WAYSIDE EXHIBITS

In 2001, the LCBP designed a template for a unified system of outdoor wayside exhibits in the region. To date, the LCBP has provided technical and design assistance on 62 exhibits that will be posted around the Basin, some of which are bilingual. The LCBP also published the *Lake Champlain Wayside Exhibit Manual* which provides local communities guidelines for planning, designing, and fabricating wayside exhibits.



PROVIDING TECHNICAL ASSISTANCE

Since 1997, the LCBP has provided \$48,000 for more than 70 projects through the Technical Assistance Program. These funds support conditions, archaeological, and engineering assessments; museum mentoring; property interpretation; design; and state and national register nominations.



Reenactments at Mount Independence State Historic Site in Orwell, Vermont.

heritage resources would enhance resource protection through education and technical assistance rather than increased regulation. This program would:

- a) Explore the creation of tax incentives for cultural heritage resource protection.*
- b) Increase landowner awareness of nonregulatory protection tools, such as sale of development rights, tax benefits through donating easements, tax credits, barn grants, and other incentive programs.*
- c) Build the stewardship capabilities of nonprofit groups.*

Potential key LCBP partners:

Landowners, businesses, nonprofit organizations, local and county governments, regional commissions, chambers of commerce,

housing and conservation boards, NPS, USEPA, NYSDEC, VTANR, NYSOPRHP, VTDHP, corresponding agencies in Québec

Cost estimate: \$60,000 per year

Potential funding sources: NPS, USEPA, VHCB, nonprofit organizations, USDA-NRCS, HPF, HUD, National Trust for Historic Preservation, USDA-FMHA

Timeframe: 2002-ongoing

Benchmark: Creation of stewardship program

4) Demonstrate the Links between Cultural Heritage Resources and Economic Development

While tourism at historic sites obviously benefits the area economy, hard data about demographics or economic impact (i.e., employment, sales tax income, purchase of supplies and services from the community, derivative

income from tourism) is lacking. This action proposes a study to detail the contribution of heritage resources to the economic vitality of the Basin. Heritage resources include not only historic sites open to the public, but also historic downtowns, villages and landscapes. This information could be used in future regional economic development plans. Baseline data about cultural heritage tourism should be collected, including: visitor demographics, how visitors heard about sites, what sites they are going to, how much they are spending, how long they are staying, what they want out of the experience, what else they are visiting in the area, and what characteristics of the Basin they value. Analysis of this data would result in appropriate marketing and promotion strategies (see Action 8) and provide objective information about the role of heritage tourism in the economy of the Basin. The *Lake Champlain Cultural Heritage Tourism Survey and Marketing Plan*, based on 2,565 completed surveys, was completed in early 1997 and generated important data on the users of historic sites. An economic analysis of potential income generated by heritage tourism conducted by the National Park Service in 2000 indicated that future heritage resource-related tourism development offers tremendous economic potential in the Lake Champlain Basin. Using this study and additional information about local community interests, this action encourages a coordinated strategy to support heritage tourism development.

Potential key LCBP Partners: Landowners, businesses, diver groups, nonprofit organizations, local and county governments, chambers of commerce, regional commissions, regional marketing organizations, tourism offices, NPS, USEPA, NYSDEC, VTANR, VTACCD, NYSOPRHP, VTDHP, corresponding agencies in Québec

Cost estimate: \$60,000 per year

Potential funding sources: Federal and state appropriations, NPS, EPA, NY and VT capital construction budgets, TEA-21, HPF (through states), private sector

Timeframe: 2001-ongoing

Benchmark: Completion of strategy and use in future economic development planning

5) Link Cultural Heritage to Existing Recreation/Tourism Marketing Programs

A regional approach to marketing the rich heritage resources in the Basin would promote its attractions to a wider audience more efficiently. This would greatly enhance economic development while giving a measure of control over the amount and type of access a site requires. Following the study proposed in Action 7, this action would: 1) establish goals and targets for marketing cultural heritage resources; and 2) build them into existing tourism and recreation marketing plans.

Potential key LCBP partners: Landowners, businesses, diver groups, nonprofit organizations, local and county governments, chambers of commerce, regional commissions, regional marketing organizations, tourism offices, NPS, USEPA, NYSDEC, VTANR, NYSOPRHP, VTDHP, corresponding agencies in Québec

Cost estimate: In-kind participation of key partners

Potential funding sources: Federal and state appropriations, NPS, USEPA, NY and VT capital construction budgets, TEA-21, HPF (through states), private sector

Timeframe: 2002-ongoing

Benchmark: Development of regional marketing goals and their integration into recreation/tourism plans

OTHER ACTIONS FOR CONSIDERATION

(not listed in priority order)

6) Develop and Implement Cultural Heritage Resource Management Plans

Bistate management plans for each major category of cultural heritage resources on the shores and in the waters of Lake Champlain are needed, and should focus first on those resources that are particularly threatened. These management plans would include:

- a) Criteria for selecting priority heritage resources.*
- b) Consistent policies for protecting them.*
- c) Guidelines for county and town protection efforts.*
- d) Recommendations for building staff capacity at state, regional, and local levels and within nonprofit organizations devoted to land and resource protection.*
- e) Mechanisms for providing technical assistance to and building positive relationships with landowners, communities, nonprofit organizations, and other resource protection and economic development agencies.*
- f) Improved levels of compliance with federal and state historic preservation laws.*



Deb Sachs

The public enjoys a wayside exhibit along the Burlington Heritage Trail in Burlington, Vermont.

Potential key LCBP partners: Landowners, businesses, diver groups, nonprofit organizations, local and county governments, regional commissions, chambers of commerce, LCMM, Lake Champlain Byways, NPS, USEPA, NYSDOT, VTrans, NYSDEC, VT ANR, NYSOPRHP, VTDHP, corresponding agencies in Québec

Cost estimate: \$60,000 per year

Potential funding sources: NPS, USEPA, TEA-21, HPF, Community Block Grants (HUD), state coastal zone management programs

Timeframe: 2002-ongoing

Benchmark: Completion of management plans, including above elements

7) Review and Revise Protective Legislation for Cultural Heritage Resources

Protection of heritage resources on state-owned land requires governments to be both vigilant and swift in their response to potential impacts within their jurisdiction. As budgetary shortfalls, staff reductions, physical distances, and general lack of capacity have combined to reduce their effectiveness, new procedures and relationships need to be explored to strengthen existing legislation and ensure enforcement. Because underwater heritage resources are all state-owned, laws and regulations that affect these sites should be evaluated and revised first. Such laws should be consistent and enforceable on the entire Lake. Difficulties with the existing regulatory process are compounded by the lack of public awareness of the importance, goals, and procedures of these laws and regulations. This lack of knowledge and outreach about these processes leads to misunderstanding, loss of trust, possible delays, and, in some cases, loss of resources. Building stronger communication and understanding among regulators, landowners,

farmers, developers, and many others is imperative to accomplish resource protection. Also, the improvement of regulatory processes is necessary to make them clearer and more effective.

Potential key LCBP partners: Landowners, businesses, diver groups, chambers of commerce, developers, LCMM, NPS, USEPA, NYSDEC, VTANR, NYSOPRHP, VTDHP, VTACCD, USFS, USDA-NRCS, other agencies, and corresponding agencies in Québec

Cost estimate: In-kind participation of key partners

Potential funding sources: State and federal agency budgets, NPS, EPA, USFS, NRCS

Time frame: 2002-ongoing

Benchmark: Review of state legislation and recommendation of revision, if needed; development of public outreach tools on existing laws and regulations

8) Encourage Local Efforts to Coordinate Heritage and Economic Development Projects

While a region-wide plan and promotional strategy would greatly contribute to economic development in the Basin, it is crucial that local communities and organizations maintain autonomy in developing their own plans and initiatives. Communities should be assisted in securing funding for innovative projects that demonstrate economic development through heritage resource protection.

Potential key LCBP partners: Businesses, nonprofit organizations, local and county governments, chambers of commerce, regional commissions, regional marketing organizations, NPS, EPA, NYS DEC, VTANR, NYSOPRHP, VTDHP, corresponding agencies in Québec

Cost estimate: \$120,000 per year

Potential funding sources: NPS, USEPA, TEA-21, HPF (through states), HUD, Economic Development Administration

Timeframe: 2002-ongoing

Benchmark: Technical and financial assistance to communities for projects linking cultural heritage resource protection and economic development

9) Create a Basin-wide Cultural Heritage Resource Database

Compile cultural resource survey data from New York, Vermont, and Québec and create a region-wide inventory on a GIS-linked computer database. This database should provide an up-to-date historic record and promote integration in broader planning applications. To achieve this, Vermont, New York, and Québec need to cooperate in developing a uniform cultural resource inventory, evaluation process, and computerized system for all areas of study, analysis, evaluation, designation, protection, interpretation, and promotion. The inventory process should reflect this integration in both its planning and applications. Because the need for a comprehensive inventory is immediate, planning this action within a fixed timetable at the outset of implementing the overall Basin Plan, and listing survey areas according to priority is important.

Potential key LCBP partners: Regional planning commissions, VCGI, NPS, NYSDEC, VTANR, NYSOPRHP, VTDHP, corresponding agencies in Québec

Cost estimate: \$75,000 initial year; \$20,000 per year maintenance

Potential funding sources: NPS, USEPA, state and federal agencies

Timeframe: 2002-ongoing

Benchmark: Completion of database, including public access plan

CHAPTER FIVE

A STRATEGY FOR IMPLEMENTING THE PLAN

Plan implementation steps include coordinating state, federal, and provincial programs for Lake cleanup; assuring that the public is involved in Lake issues; and building local support through nongovernmental organizations and municipalities. Long-term monitoring of the ecosystem's health and measuring the success or weaknesses of the Plan are also important. Implementation must also link Lake issues to legislative bodies and interest groups, and provide financial resources for specific projects and research.

L'implantation du plan

L'implantation du plan comporte plusieurs étapes dont la coordination des programmes de dépollution du Vermont, de l'état de New York, du Québec et du gouvernement fédéral américain, l'engagement du public dans la défense du lac et l'obtention de l'appui local par le biais des organismes non gouvernementaux et des municipalités. La surveillance continue de l'écosystème et la mesure des réussites et des ratés du plan occupent une place tout aussi importante. Finalement, la mise en place du plan doit se faire en collaboration avec les autorités gouvernementales et les groupes d'intérêt et prévoir des ressources suffisantes pour financer des recherches et des projets particuliers.

Numerous cooperating agencies, organizations, and individuals have contributed their time and ideas toward producing a comprehensive pollution prevention, control, and restoration plan for Lake Champlain. The result of these efforts, *Opportunities for Action*, outlines these strategies for protecting and enhancing the environmental, cultural, recreational, and economic activities of or relating to the Lake. The challenge now is to implement these strategies.

Several themes have emerged from the planning process, which should guide agencies, organizations, and individuals as they implement *Opportunities for Action*. These themes include:

- *a partnership approach that relies on existing agencies, organizations, and individuals to implement the Plan, while building capabilities through the formation of innovative partnerships;*
- *an ecosystem approach in which management decisions are based on the complex interrelationships among the physical, biological and chemical components of the Lake Champlain Basin;*
- *a watershed approach in which water quality protection and ecosystem restoration efforts are focused along watershed rather than political boundaries;*

- *the integration of environmental and economic goals in the decision-making process and in selecting the most cost-effective actions to protect and enhance the resources of the Basin;*
- *pollution prevention as a cost-effective means to protect the environment by eliminating pollution before it is generated;*
- *a consensus-based, collaborative approach that strengthens the outcomes of decisions by facilitating a dialogue among multiple interested parties;*
- *flexibility within programs and organizations that enables them to adapt to emerging issues, resources, and technology.*

In developing the first edition of *Opportunities for Action* (1996), the Lake Champlain Management Conference analyzed the capabilities of existing local, regional, state, and federal organizations and determined that these organizations should be responsible, as part of an integrated effort, for implementing the Plan. Informing and involving the public at the local level is an important means through which recommended actions will be successfully carried out. The Management Conference also discussed new approaches to sustained coordination and successful implementation of *Opportunities for Action*. When the first edition of *Opportunities for Action* was approved, the planning task of the Management

Conference was concluded and it ended its existence, passing the tasks of Plan implementation to the Lake Champlain Steering Committee.

The Lake Champlain Steering Committee has followed the guidance of the Management Conference through the first five years of Plan implementation (1996 through 2001). This chapter describes the framework that the Lake Champlain Steering Committee finds most effective for continued implementation of the Plan. The framework described below is based on the established patterns of operations and relies extensively on the partnerships developed in the first five years of implementation.

KEY PARTNERS AND THEIR POTENTIAL ROLES IN PLAN IMPLEMENTATION

The actions presented in Chapters 2, 3, and 4 list a number of potential key partners who can play a pivotal role in carrying out steps contained in the Plan to protect the Lake. Several of these organizations are government agencies already involved in resource protection efforts at the federal, state, regional, and local levels. Existing agencies and organizations should continue their roles in managing resources in the Basin. The Plan does not advocate replacing these agencies and organizations or usurping their authority. However, in some cases, implementing the actions has required that existing programs shift their priorities or form intergovernmental partnerships to maximize scarce human and financial resources. Many of the actions recommend including additional partners in resource man-

agement decisions and supporting public/private partnerships for action. The following section describes the general roles and responsibilities that fall to the various levels of government, the private sector, and the public in meeting the demands to protect the resources of the Lake Champlain Basin.

Local Government

Most of the solutions to problems affecting the Basin, such as nonpoint source pollution from urban and agricultural land uses, failing septic systems, planning for future development, and recreation conflicts are best implemented at the local level. The Plan identifies several actions that local governments can implement to address these matters. Key partners likely to implement such actions are local boards and commissions. Because local governments have primary authority over planning and zoning (in all cases except agriculture in Vermont) and some public health issues, transferring authority to other groups is not envisioned in most situations. Local governments can also incorporate a watershed planning focus into local comprehensive plans.

Regional Government Organizations

Protecting Lake Champlain requires cooperation among the communities within its watershed. Watersheds cross town boundaries, and one town acting alone may not be sufficient to address all issues. Protecting the entire Basin demands a high level of attention from all municipalities in the watershed. Regional organizations—such as the Regional Planning Commissions in Vermont and the County Planning Offices in New York work with a

number of jurisdictions to coordinate efforts that address issues of mutual concern. They will continue to be key partners in focusing implementation efforts through a watershed approach to planning and ensuring that the recommendations of the Plan are carried out equitably.

State and Provincial Agencies

State and provincial agencies in New York, Vermont, and Québec have several key roles in protecting the resources of the Basin. They administer a number of critically important resource management programs, including water quality protection programs, wetlands protection programs, fish and wildlife management programs, and recreation and cultural resource programs, among others. The states and province also provide technical and financial assistance, such as training for wastewater treatment plant operators and funding for local nonpoint source pollution control projects, to ensure that the appropriate people have the expertise to implement their programs.

Although several state and provincial agencies are listed in the Plan, the New York State Department of Environmental Conservation (NYSDEC), the Vermont Agency of Natural Resources (VTANR), and Québec's Minister of Environment (QC MENV) have major roles in implementation. As the leading environmental agencies in each jurisdiction, NYSDEC, VTANR, and QC MENV have critical responsibilities in every major action area in the Plan. Other key state agencies are the Vermont Department of Agriculture, Food, and Markets (for agricultural land use, nonpoint source and pesticide issues) and the New York Department

of Agriculture and Markets (for nonpoint source issues); Vermont Agency of Commerce and Community Development and New York State Department of Economic Development (for economic issues); New York and Vermont Departments of Health (for health advisories); and Vermont Division for Historic Preservation, New York State Office of Parks, Recreation, and Historic Preservation, and New York Department of State (for recreation and cultural resource issues). Other key ministries in Québec include the Ministry of Agriculture, Fisheries, and Food, and the Wildlife and Parks Agency.

Federal Agencies

Many of the activities necessary to implement the Plan need to occur at the local level and, to some degree, at the state level. However, federal agencies have taken a vital role in providing support for Plan implementation in the unique network of partnerships reflected below. Several federal agencies recently signed a *Memorandum of Understanding* to facilitate their cooperation and coordination through the Lake Champlain Basin Program. Representatives of these agencies are active in many of LCBP activities.

- *The USEPA provides financial and technical support to the states for implementing several federal environmental programs. They ensure that all Americans are protected from significant risks to human health and the environment where they live, learn, and work.*
- *The US Department of Agriculture provides financial support and technical information on best management practices for controlling nonpoint source*

pollution, and especially for preventing pollution from agricultural runoff.

- *The US Department of the Interior supports the management plan through three services. The Fish and Wildlife Service cooperates with the states in the management of fish and wildlife resources, operates a National Wildlife Refuge and a National Fish Hatchery in the Basin, and helps ensure that the actions of other federal agencies are consistent with the needs for fish and wildlife conservation. The National Park Service provides financial and technical support for programs concerning cultural heritage and recreational resources associated with the Champlain Valley. The US Geological Survey provides financial and technical support through stream gauge monitoring and watershed research.*
- *The US Army Corps of Engineers provides financial and technical support for management of invasive aquatic species, maintenance of structures within waterways, stream stabilization programs, and nonpoint source pollution control.*
- *The US Department of Commerce, through the National Sea Grant College programs, provides financial and technical support for research, management of fisheries and other aquatic resources, and related watershed programs.*
- *The US Department of Transportation, through the National Scenic Byways Program provides financial and technical support for recreational and economic programs related to the Lake Champlain Byways program.*

Business and Industry

The activities of private businesses and chambers of commerce are a critical component of protecting the resources that support the economic vitality of the Basin. Voluntary efforts to recycle and prevent pollution are examples of how the private sector has been active in implementing elements of the Plan. Educational partnerships with television and other news media have tremendously increased public awareness of the importance of



A scientist from the Québec Ministry of Environment monitors the Missisquoi River.

individual citizen participation and community involvement in good lake stewardship practices. Chambers of commerce have been effective at drawing together business interests to assist in the planning process and will continue to contribute knowledge through the course of Plan implementation.

Academic Institutions and Research Organizations

Academic institutions, research organizations, and cooperative extension programs have served vital roles in studying Lake Champlain and its Basin. They also have been highly effective in educating students, teachers, and other citizens about Lake Champlain issues. Many actions in the Plan call for research concerning lakewide problems and emerging issues. Continued Plan implementation requires continued participation by academic institutions and research organizations, and depends greatly on the soundness of data and information collected by them.

Nongovernmental Organizations

Many actions in the Plan list nonprofit and citizen-based organizations as potential key partners. Watershed associations and environmental groups have long been active in organizing and supporting the activities of individual interests in the Basin. Examples of activities by nonprofit/nongovernmental organizations that implement elements of the Plan include water quality monitoring, research, and conservation of cultural heritage resources found submerged in the Lake. Citizen groups, including watershed organizations, have been especially successful in implementing educational workshops, streambank stabilization, toxic reduction initiatives, aquatic species control, public forums, the restoration of contaminated sites, the encouragement of low impact recreational activities, and continued communication with the Lake Champlain Basin Program about emerging issues and priorities.

Legislative Bodies

Legislative bodies in the Basin are responsible for passing laws and appropriating funds for many programs important to the Lake. Several actions in the Plan call for consistent policies among New York, Vermont, and Québec. This requires extensive cooperation among their legislative bodies. Successful Plan implementation also requires that legislative bodies respond to the will of their constituents and act decisively and creatively to protect and enhance the resources of the Basin in the face of technical, political, and financial obstacles.

Residents and Visitors

The cumulative results of many individual actions make perhaps the greatest difference in the complex issues facing the Lake Champlain Basin. Nearly 600,000 people live, work, and play in the Lake Champlain Basin, which they share with over six million visitors annually. Underlying all of the actions in the Plan is the need for public involvement. Residents of the Basin can be involved in the implementation process in many ways. They can change activities in their own households, maintain septic systems properly, and reduce the use of toxic chemicals in cleaning and lawn care. They can support local initiatives for action, or be prepared to demand action if none is taken. They also can volunteer for local boards, monitor their activities, and participate in citizen groups. Most importantly, residents can inform themselves about caring for their watershed.

Visitors are often involved in the implementation of the Plan through their support of the economic and environmental integrity of the Basin. The inherent beauty of the Basin is a key attraction for visitors, who often bring a heightened sense of appreciation of the quality of the natural environment. They spend numerous dollars in the Basin and can act in environmentally sound ways when they are here.

Coordinating Organizations

The need for state and international communication and cooperation regarding the management of the Lake Champlain Basin has been apparent since the 1940s. There have been numerous successful efforts to bring the two states and countries together since that time, including the International Joint Commission, the Lake Champlain Fish and Wildlife Management Cooperative, the Lake Champlain Research Consortium, and Citizens Advisory Committees. The New England Interstate Water Pollution Control Commission, which coordinates the fiscal affairs of the Lake Champlain Basin Program, is itself a cooperative partnership of the six New England States and New York State.

The coordinating role of the **Lake Champlain Steering Committee**, which operates the LCBP, relies on the cooperation of each of these efforts. Each of these organizations, and others like them, has played a vital role in drawing together key partners to produce coordinated research and consistent policies for the Basin. For specific information on these organizations, see the next section on “Framework for Plan Implementation.”

FRAMEWORK FOR PLAN IMPLEMENTATION

LCBP



Members of the Lake Champlain Steering Committee and the Lake Champlain Basin Program staff.

Through the first five years of Plan implementation, the Lake Champlain Basin Program has provided the institutional framework for coordinating the comprehensive pollution prevention, control, and restoration actions for the future of Lake Champlain Basin. The Lake Champlain Steering Committee has served as the program's primary decision-making body through this period. Continued implementation of the Plan will build upon the success of this established teamwork to coordinate and assist the stewardship efforts of all levels of government, organizations, and citizens.

Existing Frameworks

Several arrangements among agencies and organizations in the Lake Champlain Basin were formed prior to the passage of the Lake Champlain Special Designation Act in 1990 and have thrived through the first five years of plan implementation. The arrangements described below have played important roles in bringing together some of the key partners identified in this Plan, including government agencies, academic institutions, and citizens.

The Boundary Waters Treaty of 1909 created the **International Joint Commission** (IJC) to resolve disputes regarding the use of boundary waters. IJC membership is comprised of six commissioners appointed by the President of the United States and the Prime Minister of Canada. The IJC convened a Champlain-

Richelieu Board to examine regulation of water levels in Lake Champlain during the 1970s.

Created by the *Memorandum of Understanding on Environmental Cooperation on the Management of Lake Champlain* in 1988, the **Lake Champlain Steering Committee** consists of top-level officials representing state and provincial government in New York, Vermont, and Québec; local officials; US funding agencies; and citizen representatives from each jurisdiction. The Steering Committee serves as a forum for information exchange and a mechanism to coordinate state and provincial policies and programs. It is the only formal, international, tri-party, government-based institution currently focused on Lake Champlain.

The **New England Interstate Water Pollution Control Commission** (NEIWPCC) is a non-profit interstate partnership established by Congress in 1947. NEIWPCC's mission is to assist member states (New England states and New York) by providing coordination, public education, training, and leadership in the protection of water quality in the region.

The role of NEIWPCC in the Lake Champlain Basin is to conduct the business and financial affairs of the LCBP, including staffing and administration of grants and contracts.

Citizens Advisory Committees (CACs) in New York, Vermont, and Québec have been created to support the Steering Committee. Consisting of appointed representatives, the CACs make recommendations about the management of Lake Champlain to the Steering Committee and facilitate many aspects of public outreach, including public forums concerning lake issues. During the five-year planning effort which has resulted in this Plan, the CACs also advised the Lake Champlain Management Conference. The New York CAC has fourteen members appointed by the Commissioner of NYSDEC; the Vermont CAC has fourteen members appointed by the Governor and the Legislature; and the Québec CAC has eight to twenty-two members appointed by the Minister of Environment.

The **Lake Champlain Fish and Wildlife Management Cooperative** was created through written agreement in 1973 by the US Fish and Wildlife Service, the New York State Department of Environmental Conservation and the Vermont Fish and Wildlife Department. The Cooperative Agreement, which was updated in 1995, created a Policy Committee consisting of program directors from the three agencies, and Management and Technical Committees of agency staff. Organizations in Québec are not formal partners with the Cooperative but coordinate and communicate with it.

The **Lake Champlain Ecosystem Team** is an association of organizations involved in the conservation of plants, animals, and their habitats in the Lake Champlain watershed. The Lake Champlain Ecosystem Team maintains and enhances ecological integrity throughout the Basin. Their efforts include enhancing interdisciplinary cooperation and partnerships among federal, state, and private conservation organizations and academic institutions; facilitating and coordinating biological resource conservation activities; and exchanging information.

Several academic institutions have established a multidisciplinary research and education program for Lake Champlain called the **Lake Champlain Research Consortium**. Membership in the Consortium currently consists of selected academic institutions conducting research within the Basin boundaries. The Lake Champlain Research Consortium periodically prepares a list of research needs and priorities related to the management issues in the Plan.

All of these organizations have been involved in important research and management activities for the Lake Champlain Basin. Continued coordination of these programs and activities is of paramount importance to successful Plan implementation.

The Lake Champlain Basin and Adirondack region have been designated as one of the United Nations Education, Scientific, and Cultural Organization's (UNESCO) international biosphere reserves. This designation is strictly honorary and carries with it no restrictions, regulations, or funding.

ECHO



In 1999, the Rubenstein Ecosystem Science Laboratory, a new state-of-the-art lake research facility, opened on the Burlington waterfront as an extension of the University of Vermont, in partnership with St. Michael's College and ECHO at the Leahy Center for Lake Champlain.

KEY FUNCTIONS FOR PLAN IMPLEMENTATION

LCBP



Each year the LCBP and Citizens Advisory Committees hold public meetings to hear comments on the implementation of *Opportunities for Action*.

The Lake Champlain Steering Committee has identified a list of functions that must be accomplished to continue successfully implementation the Plan. These functions include the following:

Coordinate Programs and Implementation Activities

Coordination among government agencies, regional and local governments, the public and private sectors, nongovernmental/non-profit organizations, and residents and visitors is critical to successful implementation of the Plan. Coordination involves facilitating data management and information exchange, data sharing, and improving efficiency among key partners while not duplicating programs or creating new layers of bureaucracy.

Inform and Involve the Public

Public information and involvement efforts are required for successful implementation of the Plan. A public that understands water quality and resource management issues of the Basin can make informed choices about the long-term protection and restoration of the Lake. A commitment to lifelong education about Basin resources is needed to facilitate this process. Furthermore, involving the public in planning and implementation increases both the sphere of responsibility for action

and support for recommended actions. Refer to “Informing and Involving the Public” (p. 91) for actions dedicated to accomplishing this function.

Build Local-level Implementation

Participation at the local-level is the cornerstone of successful Plan implementation. Addressing pollution problems at the local level is important because those most affected by an issue are often best able to address that issue. Many communities have existing resources and organizations to help implement programs, but may lack technical expertise, adequate funding, or access to additional human and financial resources. Building local capacity for Plan implementation requires a strengthening of technical assistance to community groups, and may require additional financial support for local programs. Refer to “Building Local-Level Implementation” (p. 95) for actions dedicated to accomplishing this function.

Measure and Monitor Success Against Plan Benchmarks

A critical component of watershed planning is monitoring. Monitoring must accomplish two roles. First, it must be a source of information regarding the health of the Lake and Basin. Management capacity hinges on the availabili-

ty and reliability of comprehensive monitoring of key ecosystem indicators. Second, monitoring must measure the degree of success of management programs and ensure accountability to the public. Monitoring can help determine progress toward goals and whether or not priorities need to be adjusted. Refer to “Measuring and Monitoring Success” (p. 99) for actions dedicated to accomplishing this function.

Create Links with Legislative Bodies

Successful Plan implementation depends greatly on the ability to gain political support for recommended actions. A framework is needed to communicate needs and recommend actions concerning the Lake to legislative bodies who formulate federal, state, and local laws and appropriate funds to various programs.

Create Links with Interest Groups

Implementation of the recommended actions in the Plan depends greatly on continued support from numerous individuals and groups. Decisions concerning the management of the resources in the Lake Champlain Basin must be made through a consensus-based, collaborative process that encourages the expression and understanding of diverse viewpoints. This process helps integrate economic and environmental goals into Plan implementation and ensures that a focus on implementation at the local level is maintained.

Conduct Research

The Plan identifies several areas in which research is needed. Research has been an important component of preparing the Plan and will continue to provide critical information as implementation evolves. Improved knowledge of the physical, chemical, biological, and social characteristics of the Lake and Basin will help resource managers make effective policy and management decisions in the future.

Secure and Direct Funding

The cost of implementing the Plan is high, but not as high as the potential costs of failing to act. The ability to implement watershed programs rests heavily on the availability of and access to funding sources. A mechanism must be in place to seek public and private funding for program implementation and to allocate resources to appropriate entities based upon recommended priorities. Refer to “Strategies for Funding Implementation” (p. 103) for a discussion of funding implementation efforts.

Update Plan Recommendations

Because environmental conditions in the Basin will change over time and new technologies will be discovered, priorities for action in the Plan may change. Some management programs may become more important, others less. The Plan should be reviewed and updated periodically to reflect these changing conditions.

Advise and Encourage Agencies Responsible for Implementation

As the Plan evolves, various agencies will fulfill their responsibilities for implementing certain actions. Listed benchmarks provide gauges for monitoring success. A mechanism is needed that encourages those responsible for implementing actions to follow through with their commitments and reach these benchmarks.



OC MEN V

In May 2002, the annual Lake Champlain Research Consortium Symposium was held in Saint-Jean-sur-Richelieu, Québec.

A FRAMEWORK FOR CARRYING OUT KEY FUNCTIONS

The guiding principle for all Steering Committee actions and policies is to ensure that the Lake gets better.



The Lake Champlain Basin Program signed onto the US EPA's voluntary Clean Marine Engine initiative for Lake Champlain during July 2002. Left to right: Jane M. Kenny, EPA Region 2 Regional Administrator, Bill Howland, LCBP Program Manager, and Robert Varney, EPA New England Regional Administrator.

The following section provides recommendation for continued operations of the Lake Champlain Basin Program to ensure the successful implementation of the Plan. A partnership approach involving numerous partners is recommended to respond to the functions described below.

RECOMMENDATIONS

1) Continue the Present Steering Committee and Maintain the Breadth of Representation and Perspectives for Decision-making

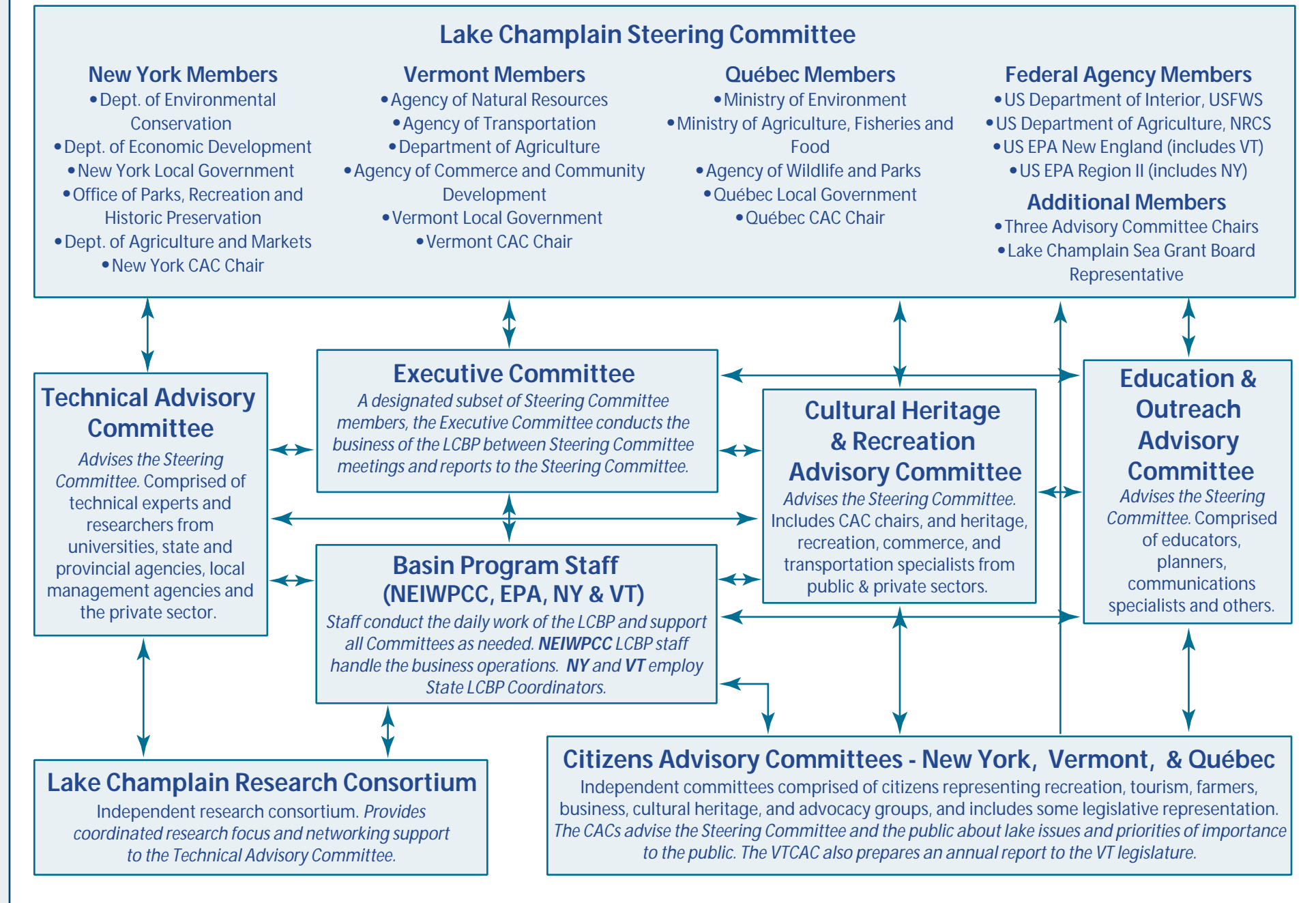
The Steering Committee should continue to function in its present role as a participatory forum in which key state, provincial, and local leaders from New York, Vermont, and Québec can discuss issues of Lake Champlain and its watershed, and coordinate policies and programs. Each jurisdiction has identified its chief delegate, who hosts and chairs Steering Committee meetings in rotation. This pattern contributes to teamwork.

The states of New York and Vermont and the province of Québec should consider maintaining the following partners on the Steering Committee to ensure a diversity of perspectives:

Four New York State agency representatives appointed by the Governor: New York should consider NYSDEC; NYS Department of Economic Development; NYS Department of Agriculture and Markets; and NYS Office of Parks, Recreation, and Historic Preservation to be selected by the State;

Four Vermont State agency representatives appointed by the Governor: Vermont should consider VTANR; VT Department of Agriculture, Food, and Markets; the VT Agency of Commerce and Community Development; and the VT Agency of Transportation, to be selected by the State;

Four Québec representatives appointed by the Premier: Québec should consider three provincial representatives from the Ministry of Environment; the Ministry of Agriculture, Fisheries, and Food; and Wildlife and Parks, and a fourth representative to be selected by the Province from provincial agencies;

Figure 11. Lake Champlain Basin Program Operating Structure

Three local government representatives, one each from New York, Vermont, and Québec. Local governments should nominate representatives and the governors/premier select from that list.

Three CAC chairs or designees (see below).

One chair or designee from each of the Advisory Committees: TAC, CHRAC and E&O (see below).

One Sea Grant Board representative.

Three US federal agency representatives.

The US Department of Agriculture, the US Environmental Protection Agency New England Region and Region II, and the US Department of the Interior should be represented in these positions.

Modifying the membership of the present Steering Committee to include additional key players as needed will help to ensure that decisions concerning the management of Lake Champlain Basin resources are made through a consensus-based, collaborative process.

Steering Committee Charge

The charge of the Steering Committee includes:

a) Facilitate communication and coordination among key partners working to implement the Plan.

b) Monitor and evaluate progress against Plan benchmarks and communicate that information by periodically producing an annual implementation status report, and other education and outreach tools.

c) Secure and direct Lake Champlain Basin Program funding.

d) Charge the Executive and Advisory Committees with tasks as needed.

e) Reassess and update Plan recommendations every five years based on changing environmental conditions, management programs, and public input.

f) Develop an annual budget to ensure Plan implementation.

g) Negotiate partnerships and commitments among agencies and groups.

h) Seek consistency in regulatory programs and standards, such as those concerning wetlands and toxic substances (consistency does not predetermine that standards will be more restrictive or less restrictive than present standards); and develop reciprocal information programs such as the emergency spill response joint procedure between New York, Vermont, and Québec.

i) Provide technical and financial assistance to local communities and organizations.

j) Assist with the coordination of cultural heritage and recreational resource enhancement programs associated with the Lake and the Basin.

k) Make adjustments in the composition of the Steering Committee as needed to achieve the goals of the Plan.



Members of the Missisquoi Bay Corporation, compliments the Lake Champlain Steering Committee, tour a water quality project on Wallbridge Stream with the Regional Director of Monteregie.

To increase its effectiveness, the Steering Committee has assigned eleven of its members to comprise an **Executive Committee** to meet six to eight times per year between Steering Committee meetings. The Executive Committee is comprised of Steering Committee representatives of the NYSDEC, VTANR, QC MENV, USEPA New England, USEPA Region II, and the chairs of the six advisory committees (VTCAC, NYCAC, Québec CAC, TAC, CHRAC, and E&O). These eleven members comprise the voting membership of the Executive Committee. The Executive Committee chair rotates biannually among three key implementing agencies: VTANR, NYSDEC, and the USEPA. Because it meets more frequently than the Steering Committee, the Executive Committee provides leadership continuity through the year by representing the Steering Committee between meetings and interpreting the intent of the Steering Committee to the staff. The Executive Committee chair reports back to the Steering Committee at regular Steering Committee meetings.

Cost estimate: To be determined through an annual budget development process

Potential funding sources: State and federal appropriations, in-kind participation, public/private partnerships, grants from other funding sources, such as Sea Grant

Timeframe: Ongoing

Benchmarks: Financial and implementation commitments from LCBP partners identified for priority actions; production of annual progress report; preparation of annual budget; achievement of coordinated and consistent policies and programs; six to twelve Steering Committee or Executive Committee meetings per year at times convenient for members

2) Continue the Present Citizens Advisory Committees (CACs) and Ensure that Various Stakeholders Are Represented

The New York, Vermont, and Québec CACs should continue in their present roles as liaisons to the public. As positions become available on the CACs, the states and Québec should strive to ensure that representatives from environmental groups, agriculture, business/industry, sports and recreation, and local government be included. Stakeholder groups should nominate representatives, and the persons/agencies in each state and Québec who have the authority to appoint CAC representatives should select from that list. All members of the CACs should serve two-to- three year appointments. The CACs should elect their chair, who will serve as a voting member of the Steering and Executive Committees. The role of the CACs include:

a) Advise the Steering Committee about public concerns.

b) Inform and involve the public in issues concerning the Lake and the Basin.

c) Link the Steering Committee to state legislative bodies and groups implementing the Plan at the local level.

d) Provide a regular forum for interest groups and local governments to discuss the issues facing the Lake and the Basin.

e) Provide recommendations to the Steering Committee about the reassessment of Plan recommendations.

f) Advise and encourage agencies that accept responsibility for implementing Plan recommendations to follow through with their commitments, for example, by presenting an annual report of recommendations to the legislature.

g) Participate in review panels for LCBP grant programs.

h) Host public meetings for information exchange regarding plan implementation.

Cost estimate: To be determined through an annual budget development process

Potential funding sources: State and federal appropriations, in-kind participation, public/private partnerships

Timeframe: Ongoing

Benchmarks: Assistance to the Steering Committee in production of annual report; provision of annual recommendations concerning the Lake to the Steering Committee and legislative bodies; inclusion of representatives from environmental groups, agriculture, business/industry, sports and recreation, local governments on the CACs; meetings of joint Citizens Advisory Committees each year

3) Continue the Technical Advisory Committee

The Steering Committee should appoint and retain a Technical Advisory Committee (TAC) comprised of professionals from academia, natural resource management agencies, and other appropriate sectors as it deems appropriate. The TAC members serve at the discretion of the Steering Committee. The chair of the TAC, appointed by the Steering Committee, serves as a voting member of the Steering and Executive Committees. The role of the TAC includes the following:

a) Present the Steering Committee with technically sound information to be used in the decision-making process.

b) Advise the Steering Committee about emerging issues with management implications, the necessary research or actions to address those issues, and related technical funding priorities.

c) Determine the technical merits of LCBP-funded scientific studies and projects.

d) Facilitate project implementation and evaluate final products and reports of those projects as needed.

e) Interpret the results of monitoring programs and other technical information to help determine success or redirection of projects.

Organizations and partnerships established independently of the LCBP to address technical issues in the Basin will continue to function in their own right, but may also provide input to the TAC. These organizations include the Lake Champlain Fish and Wildlife Management Cooperative, the Lake Champlain Research Consortium, Sea Grant, and several taskforces and workgroups.

Cost estimate: To be determined through an annual budget development process

Potential funding sources: State and federal appropriations, in-kind participation, public/private partnerships

Timeframe: 2002-ongoing

Benchmarks: Assistance to the Steering Committee in production of annual status report; development of recommendations to the Steering Committee on annual workplan for research, monitoring, and technical assistance to implementation projects; monthly meetings of TAC as needed

4) Continue the Cultural Heritage and Recreation Advisory Committee

The Steering Committee should appoint and retain a Cultural Heritage and Recreation Advisory Committee (CHRAC) composed of professionals from local government, management agencies, and other appropriate sectors. The CHRAC members serve at the discretion of the Steering Committee. The chair of the CHRAC, appointed by the Steering Committee, serves as a voting member of the Steering and Executive Committees. The role of the CHRAC includes the following:

a) Present the Steering Committee with sound information concerning cultural heritage and recreational initiatives to be used in the decision-making process.

b) Advise the Steering Committee about emerging issues with management implications and the necessary research or actions to address those issues.

c) Advise the Steering Committee regarding opportunities for transboundary partnerships and cooperative projects both within the Basin and adjacent areas.

d) Determine technical merit of LCBP-funded cultural heritage and recreation studies and projects.

e) Interpret the results of cultural heritage and recreation programs to help determine success or redirection of projects.

Organizations and partnerships established independently of the LCBP to address cultural heritage and recreational issues in the Basin will continue to function in their own right, but may also provide input to the CHRAC. These organizations include the regional marketing organizations and chambers of commerce, scenic byways programs, cultural heritage tourism initiatives, and councils on the arts in both states.

Cost estimate: To be determined through an annual budget development process

Potential funding sources: State and federal appropriations, in-kind participation, public/private partnerships

Timeframe: 2002-ongoing

Benchmarks: Assistance to the Steering Committee in production of periodic status reports; recommendations to the Steering Committee on annual workplan for cultural heritage and recreational resource programs

5) Continue the Education and Outreach Advisory Committee

The Steering Committee should appoint and retain an E&O Advisory Committee comprised of professionals from educational institutions in the Basin and with representation from the CACs and other appropriate sectors. The E&O members serve at the discretion of the Steering Committee. The chair of the E&O Committee, appointed by the Steering Committee, serves as a voting member of the Steering and Executive Committees. The role of the E&O Committee includes the following:

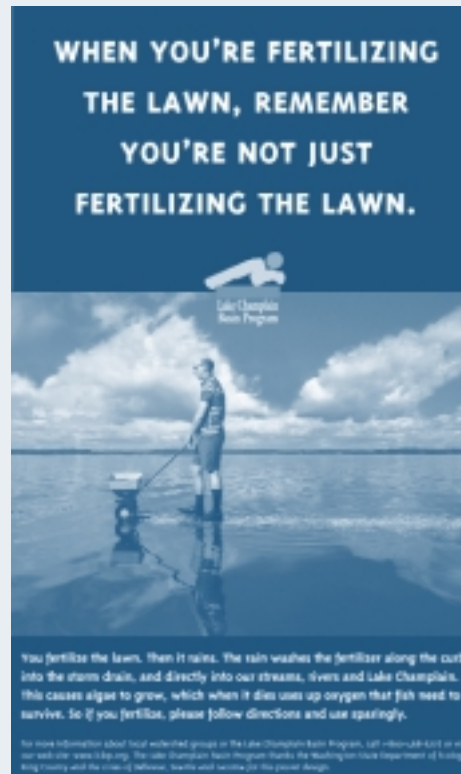
- a) Present the Steering Committee with sound education and outreach information to be used in the decision-making process.*
- b) Advise the Steering Committee about potential outreach methods to achieve needed communication with stakeholders regarding emerging public information issues and recommend actions to address those issues.*
- c) Guide and facilitate aspects of implementation projects to inform and involve the public.*
- d) Interpret the results of information and outreach programs to help determine success or redirection of projects.*

Cost estimate: To be determined through an annual budget development process

Potential funding sources: State and federal appropriations, in-kind participation, public/private partnerships

Timeframe: 2001-ongoing

Benchmark: Assistance to the Steering Committee in production of periodic status reports; recommendations to the Steering Committee on annual workplan for education and outreach programs



Outreach tools, such as this poster, inform the public about nonpoint sources of phosphorus from urban/suburban development.

INFORMING AND INVOLVING THE PUBLIC

GOAL

To promote a better understanding and appreciation of the Lake Champlain Basin and its resources in order to encourage greater public participation, individual responsibility, and action for protecting these resources.



Children learn about water pollution with the LCBP's watershed model at a Boy Scout field day.

The future of the Lake Champlain Basin rests in the hands of its citizens and leaders. Public information and involvement efforts must continue and expand to involve people actively in protecting and appreciating the resources of the entire Basin. Ultimately, a public that understands the water quality and related resource management problems of the Basin, as well as possible solutions to those problems, can make informed choices about its long-term protection and restoration.

Informing the public and direct citizen involvement can achieve many of the priority actions discussed in this Plan. Each priority action in this Plan recognizes the need for strong public support and individual action. For example, an effective way to help reduce the spread of zebra mussels is to inform boaters to inspect and clean their boats if they have been in infested waters. This can be achieved through interpretive signs or displays, literature, presentations, and/or citizen taskforces. This has been accomplished successfully in Minnesota, where boater survey results indicate that boater education programs have been effective in changing boater behavior and reducing the spread of harmful exotic species.

The cumulative results of many individual actions make a difference in the complex issues facing the Lake Champlain Basin. Individual responsibility in protecting a shared resource is very important; people must become aware of how they contribute to pollution before they can take responsible actions to reduce and prevent it. When people are given the opportunity to develop awareness, knowledge, skills, and commitment towards a Basin issue, they can make informed decisions and take constructive actions. When people know how they can make a difference, they will.

ISSUES

The Need for Increased Public Awareness and Understanding of Basin Issues

Public awareness and understanding of Lake Champlain Basin issues and the priority actions needed to address them is limited. This is especially true of communities located further from the Lake whose residents may be unaware that they are within the Lake Champlain drainage basin and therefore connected to the quality of Lake resources. People need to become aware of a problem before they can understand how they contribute to it and assume responsibility for solving it.

The Need for Local Community Involvement

The real power in public involvement comes from the local or community level. Programs that bring together students, professionals, and community members are powerful and cost-effective tools. Community involvement is especially important for addressing issues that occur in only specific areas of the Basin. People most affected by an issue are best able to address that issue. At a community or watershed level, partnerships can be created and local action taken.

The Need for More Individual Action

Public awareness of the problems within the Basin is growing, but there is a definite lack of information about how each of us can help to solve these issues. People must understand their responsibility as stewards of the Basin, and must speak out for its protection. Using the public's skills, energy, and enthusiasm is important when addressing priority Basin issues. Additional opportunities that allow individuals to become involved and take action need to be created. Programs that emphasize how each person can make a difference need to be implemented.



Launching the *Red Wing*, a long boat built by Addison County students at the Lake Champlain Maritime Museum.

OBJECTIVES

(not listed in priority order)

- 1) Promote public and governmental awareness and understanding of issues in the Lake Champlain Basin and the priority actions needed to address them.
- 2) Facilitate public participation in the development of public policy for the Lake Champlain Basin and in activities relating to its cleanup and protection.
- 3) Build community awareness and stewardship of the Lake Champlain Basin ecosystem and its value to the region.
- 4) Increase individual responsibility for Basin issues by developing programs that allow individuals to become involved and take action.
- 5) Increase communication and cooperation among the diverse groups involved in Lake Champlain Basin education and outreach.
- 6) Develop a flexible, sustainable, community-based organizational framework supported by public and private funds for public involvement and education in all aspects of Basin management.
- 7) Develop long-term environmental stewardship and understanding of the Lake Champlain Basin by enhancing educational opportunities at all educational levels.

ACTIONS

(not listed in priority order)

1) Build Awareness and Understanding of Basin Resources

Work with the general public, interest groups, and decision makers to build awareness and understanding of the key natural resource issues in the Basin and the priority actions needed to address them. This should include information on how these priority issues and actions contribute to and interact with social and economic values. Specific components of this action include:

a) Develop printed and other educational materials such as citizen action guides, slide shows, internet materials, videos, public service announcements, press releases, mobile displays, and computer models for specific audiences.

b) Conduct presentations to special interest groups, communities, and local government decision makers.

c) Display exhibits at conferences, fairs, and expositions.

d) Hold public forums and field trips on priority Basin issues and actions, and serve as a vehicle for translating local Basin issues and priority actions.

e) Hold a State of the Lake conference periodically to bring together those interested in the Basin and to share progress, address challenges, and provide public education and involvement.

f) Develop a speakers' bureau on priority Basin issues.

g) Provide comprehensive Resource Rooms where individuals can obtain historic and current information on the Basin.

h) Help coordinate communication between existing education and outreach organizations, and develop partnerships.

i) Evaluate the effectiveness of education and outreach activities to determine their impact on local citizens, municipalities, and non-governmental organizations.

j) Foster partnerships with local media, including television, radio, and print media to cover Basin issues regularly.

k) Maintain the volunteer Education Advisory Committee to help coordinate Basin-wide educational efforts.

Potential key LCBP partners: Federal agencies, state agencies, provincial agencies, municipalities, schools, universities/colleges, and private/nonprofit organizations

Cost estimate: \$175,000 per year

Potential funding sources: Federal grants, state funds, in-kind matches (private and nonprofit)

Timeframe: Annually

Benchmarks: Development and distribution of products listed in a, d, and e; completion of b, c, and f through k

2) Produce Coordinated Education Programs for Students

Work with state and local educators to organize educational materials about the Basin and produce coordinated education programs for students based on priority issues and actions.

ACCOMPLISHMENTS

Local connections and lake stewardship are fostered through many LCBP-supported information and outreach programs. Ongoing programs include community education grants, citizen involvement opportunities, and providing about 100 school and community outreach programs annually. Some highlights include:

CHAMPLAIN BASIN EDUCATION INITIATIVE

Through CBEI, the LCBP partners with six local education organizations, including the Adirondack Visitor Interpretive Center and Shelburne Farms, to help educators teach about the Lake. Since 1992, 474 educators have participated.

SPECIAL MEDIA PROJECTS

The LCBP issues news releases about the Lake and progress towards implementing *Opportunities for Action*. In May 1999, the LCBP began a new partnership with WPTZ News Channel 5 and KeyBank, called *Champlain 2000*, which highlights Lake issues. More than 100 topics, such as pulling water chestnuts, "adopt-a-salmon," and reducing pesticides have aired. The series has won several environmental and media awards. The LCBP has also participated in a news series on Vermont Public Radio and has been a guest on local call-in programs.

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ACCOMPLISHMENTS

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WEBSITES & PUBLICATIONS

In 1999, the LCBP significantly upgraded its website, www.lcbp.org, which provides online access to *Opportunities for Action*, the *Casin' the Basin* newsletter, the *Lake Champlain Basin Atlas*, fact sheets, volunteer opportunities, and webpages for local watershed groups. LCBP-supported publications include the curriculum guide, *This Lake Alive!*, and the *Lake Champlain Basin Atlas*.

THE LEAHY CENTER FOR LAKE CHAMPLAIN

Since 1995, the LCBP has supported the Center's student and family educational programs, hands-on learning, and resource room. The LCBP will continue its support during the development of their new multimillion dollar facility and when the facility opens in 2003.

Ensure coordination with existing education and outreach organizations. Components of this approach include:

- a) Conduct teacher training workshops.*
- b) Complete comprehensive teacher training institutes.*

c) Develop a comprehensive Basin Resource Guide for educators to use in developing units on Lake Champlain (the Resource Guide should be based on protecting and enhancing the environmental integrity of the Lake Champlain Basin, taking into consideration social and economic benefits).

d) Work with state education departments to integrate Basin education into classrooms.

e) Provide opportunities for teachers and students to participate in Basin-related field trips and restoration projects.

f) Provide Basin-related presentations to schools.

g) Evaluate the success of education initiatives.

h) Use the Internet and other media to share Lake Champlain data with students and teachers.

Potential key LCBP partners: Federal agencies, state agencies, provincial agencies, municipalities, schools, universities/colleges, and private/nonprofit organizations

Cost estimate: \$100,000 per year

Potential funding sources: Federal grants, in-kind matches (private and no-profit)

Timeframe: Annually

Benchmark: Completion of components a through h above, including the distribution of Lake Champlain Resource Guide to Basin educators

3) Provide Opportunities for Hands-on Citizen Action and Implementation of the Plan

Provide and encourage opportunities for citizen involvement in Basin issues and priority actions to aid in the implementation of the

Plan. Examples of possible programs include:

a) Increase opportunities to prevent pollution, such as toxic reduction programs, recycling programs, and citizen action guides.

b) Coordinate nutrient management and toxics reduction outreach to farmers.

c) Develop opportunities for citizens to become more aware of and help monitor the spread of nuisance nonnative aquatic species.

d) Organize river and lake cleanups.

e) Coordinate and support partnership opportunities through local implementation and education grants to increase public involvement.

f) Develop and organize a Lake Champlain Basin Conservation Corps using existing programs, such as the Vermont Youth Conservation Corps (VYCC).

g) Strengthen the links among the public, local groups, and volunteers.

Potential key LCBP partners: Federal agencies, state agencies, municipalities, schools, universities/colleges, and private and nonprofit organizations

Cost estimate: \$125,000 per year

Potential funding sources: Federal grants, state funding, in-kind matches (private and nonprofit)

Timeframe: Annually

Benchmark: Development and implementation of hands-on activities, such as river and lake cleanups

BUILDING LOCAL-LEVEL IMPLEMENTATION

GOAL

Support and enhance cooperative watershed planning efforts to protect and improve water quality.

Village of Champlain



The Village of Champlain, New York received \$13,000 from an LCBP grant to relocate a phosphorus injection point, which will result in less phosphorus in the plant's discharge.

Chapters 2 through 4 identify specific actions for reducing various pollutants and enhancing cultural and recreational resources within the Basin. This section addresses the processes at the regional, municipal, and grassroots levels necessary to achieve many of these management goals. It focuses on watershed planning at the local scale, as this is the level at which most planning occurs in the Basin.

River and lake associations play a key role in organizing watershed protection efforts. These associations accomplish a great deal through education and outreach programs, democratic participation in the development review process, and participation in citizen monitoring activities. Watershed associations also act as catalysts for developing nonregulatory protection programs, and can effectively advocate for improved conservation-oriented land use practices. River and lake associations can encompass several local jurisdictions. Regional examples include the Boquet River and AuSable River Associations in New York; the Lewis Creek Association and the Friends of the Mad River in Vermont; and the Poughkeepsie-Mettowee Watershed Partnership in New York and Vermont. Watershed associations work closely with local government and respect a wide variety of interests, including property rights, environmental protection, and economic development.

Most land use planning in the Basin occurs at the municipal level. When watershed boundaries are contained within municipal boundaries, municipal watershed planning can be very effective. Municipalities may develop watershed districts that have special review criteria for new development based on a long-term water quality protection strategy. The designation of local riparian “buffer” zones along streams, lakes, and wetlands can be important water resources protection tools. Local capabilities for watershed planning vary greatly throughout the Basin in both New York and Vermont. In some areas (often near urban centers), municipalities have already developed watershed plans and instituted aggressive water quality protection measures—Lake George, New York provides a good example. Municipalities in these areas typically benefit from ongoing technical support from local staff, watershed associations, regional planning commissions, county planning offices, or conservation districts. In other parts of the Basin, municipalities have very limited local capacity for any type of planning or land use regulation. Working in partnership with willing landowners is especially productive as most land in the Basin is privately owned.

ISSUES

Insufficient Technical and Financial Assistance

One of the major impediments to developing and implementing watershed protection plans at the local and regional level is insufficient financial and technical support. Watershed groups may develop the necessary awareness and enthusiasm for a project, but may need technical and organizational assistance. Some assistance is currently provided to watershed associations in Vermont through the VTANR, and in New York through the NYSDEC, the Cornell Cooperative Extension, and county and regional planning commissions. However, municipalities need additional technical and financial assistance, and watershed associations need the resources to hire their own paid staff. Developing a local capacity grant program for watershed associations may be one effective way to address this shortage.

The Need for Better Communication

Often communication about watershed planning among communities and regions within the Basin is insufficient. An effective process for disseminating information on successful watershed planning approaches is needed. Likewise, the difficulties and problems encountered in less successful watershed planning efforts need to be documented and communicated to help others avoid these problems.

The Need for Innovative Partnerships

Experience in a number of communities and regions has pointed to the value of innovative partnerships in developing and implementing effective watershed plans. For example, the Mad River Valley Planning District in Vermont has developed a strong watershed planning capability through the formation of a three-way partnership among district towns, a private nonprofit environmental organization, and the state of Vermont. This arrangement provides for a funding base, extensive grass-roots involvement, strong local political support through the district board membership, and technical assistance from the state. There often may be a role for state and federal governments, as well as county and regional planning commissions, in this process (e.g., funding and technical assistance).

OBJECTIVES

(not listed in priority order)

- 1) Support formal and informal local and regional partnerships to pursue watershed protection efforts.
- 2) Increase public participation in watershed protection efforts.
- 3) Encourage citizens, state and local governments, and formal and informal local and regional partnerships to adopt a proactive approach to watershed protection that considers the cumulative impacts on water resources.
- 4) Demonstrate new and emerging models for watershed planning within the Basin, especially those based on local and regional initiatives.
- 5) Ensure that nutrient and nonpoint source management efforts are coordinated with local and regional watershed planning initiatives throughout sub-basins.
- 6) Promote public education and informed discussion about regional land use patterns in the Basin.
- 7) Preserve the economic vitality of the region by capitalizing on the unique qualities of the Basin.

ACTIONS

(not listed in priority order)

1) Expand Technical and Financial Assistance for Watershed Planning at the Local Level

Elements of this action include:

a) Provide technical assistance to communities for addressing issues such as shoreline protection, soil erosion, sediment control, wetland conservation, and on-site septic system troubleshooting; emphasize nonregulatory approaches and make available model standards appropriate for adoption by local communities.

b) Provide state and federal financial support to watershed associations to enable them to hire staff and pursue specific identified needs in each watershed. Both start-up and ongoing support funds are needed.

c) Assist local and regional planning commissions in evaluating and responding to development trends and estimating future impacts of these trends on water quality.

d) Provide technical assistance via data sharing, Internet use, and public relations.

Potential key LCBP partners: USDA-NRCS, NYSDEC, VTDEC, USFWS, county and regional planning commissions, NRCDS, SWCDs, nonprofit/private organizations, municipalities, businesses

Cost estimate: \$350,000 per year

Potential funding sources: Federal and state appropriations

Timeframe: Ongoing

Benchmark: Improved technical and financial assistance to communities as described

2) Develop a Program to Facilitate Information Exchange among Local Watershed Associations

This action would develop a program to continue the type of information exchange initiated by the successful LCBP Mad River Watershed Planning Demonstration Project. The Mad River Project included a series of meetings to share lessons learned from watershed planning efforts throughout the Basin. Existing and emerging local watershed organizations were invited in the hope that the insights of older, experienced organizations could aid newer organizations in their development. Based on the success of these meetings, this action is to establish a program to continue this information exchange.

a) Initiate forums for river and lake associations to share experiences and information.

b) Use newsletters, the Internet, and list-serves to help groups share information.

Potential key LCBP partners: Watershed associations, NYSDEC, VTDEC, regional planning commissions, county planning offices

Cost estimate: \$25,000 per year

Potential funding sources: Federal and state appropriations

Timeframe: Ongoing

Benchmark: Establishment of a forum for information exchange among watershed organizations

ACCOMPLISHMENTS

LOCAL WATERSHED GROUPS

The LCBP has begun providing additional technical and financial assistance for local watershed groups. The LCBP assists these groups via grants, training programs, professional development funds, and assistance with public relations and website development. Twice per year, the groups gather to exchange information. As local watershed groups expand, volunteers from local communities will have a stronger voice in protecting the water resources throughout the Basin. Since 1992, more than \$736,000 of LCBP funds has been provided to local watershed projects.



The Vermont Youth Conservation Corps helps many local watershed groups stabilize streambanks.

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ACCOMPLISHMENTS

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LOCAL TECHNICAL ASSISTANCE

Many groups within the Basin are providing local technical assistance to municipalities on planning, zoning, and land conservation efforts. For example, the town of Essex, NY, received financial assistance from the LCBP for shoreline planning. Lake Champlain Sea Grant also provided technical assistance. In another example, Highgate, VT, is working with LCBP and the Northwest Regional Planning Commission to develop a lakeshore erosion guide for municipalities. The Vermont Better Backroads Program, Cooperative Extension, and Soil and Water Conservation Districts also provide technical assistance to Basin communities.



MRBA

Education programs and river cleanups exemplify the type of work accomplished by local watershed groups.

3) Conduct Watershed Planning Demonstration Projects

Undertake demonstration projects to illustrate local/regional watershed approaches to planning and water quality protection, restoration, and improvement. These demonstration projects should identify the full range of local water quality concerns along with recommended solutions. Additionally, local watershed projects should contribute to the attainment of water quality goals in downstream waters such as Lake Champlain.

Potential key LCBP partners: USDA-NRCS, NYSDEC, VTDEC, watershed associations, universities, extension service, municipalities and nonprofit/private organizations, landowners

Cost estimate: \$50,000-\$100,000 per year

Potential funding source: State and federal appropriations

Time frame: Ongoing

Benchmark: Completion of one or more watershed planning demonstration projects per year

MEASURING AND MONITORING SUCCESS

GOAL

Document progress and achievements resulting from implementation of the Plan.

Lamoille County NRCD



Students from Lamoille County learn to monitor streams for macroinvertebrates.

Monitoring environmental conditions in the Lake and Basin is an essential part of Plan implementation and is an integral component of measuring the success of lake and watershed management efforts. The data produced from monitoring activities provide information on natural processes occurring in the Lake, basic characteristics of the ecosystem, and water quality trends. This information aids in understanding how human activities and management actions are affecting the Lake. Managing this data and making it available to policymakers, managers, researchers, community groups, and the public maximizes the success of management efforts.

Monitoring projects in the Basin have been designed for a variety of purposes and cover a wide range of topics from forest health and biodiversity to atmospheric and surface water quality. Recent monitoring programs include the Lake Champlain Long-Term Water Quality and Biological Monitoring Program (VTDEC, et al.; 2001); the Lake Champlain Diagnostic-Feasibility Study (VTDEC and NYSDEC, 1994); the Lake Champlain Zebra Mussel Monitoring Program (VTDEC, 2000); and the Vermont Lay Monitoring Program, which has provided lakewide monitoring of eutrophication-related parameters during the summer season using citizen volunteers and a consistent EPA-approved methodology every year since 1979 (Picotte, 2000). The Lake Champlain Sediment Toxics Assessment Program (Diamond, et al.; 1999) provides a current database on concentrations of organic and inorganic toxic substances in the sediments in many areas of the Lake. The Vermont Lay Monitoring Program and the Lake Champlain Long-Term Water Quality and Biological Monitoring Program are intended to be ongoing.

ISSUES

Continuing the Lake Champlain Long-Term Water Quality and Biological Monitoring Program

During 1999-2000, the LCBP convened several workgroup sessions to design, assess, re-eval-

uate, and adjust the scope of the Lake Champlain Long-Term Water Quality and Biological Monitoring Program. Participants affirmed that this program should continue and should serve as a primary means for monitoring key indicators of environmental quality throughout the Basin, detecting environmental trends, predicting the effects of management actions, and guiding management actions over time.

Workgroup participants also concluded that the scope of the program should expand to support new and ongoing monitoring activities and special projects where feasible. Such activities may include monitoring toxic substances in the water, sediment, air, and biota; biological indicator organisms, including selected species of fish or other higher level organisms; exotic species; and meteorological data. The LCBP's current ecosystem indicators project may lend insight into how to best integrate this additional monitoring into the long-term monitoring program. Improved integration of these monitoring activities will make more efficient use of available resources and strengthen monitoring efforts. Statistically sound information about water quality, living resources, and habitats of the Lake Champlain Basin, and GIS applications of these data are necessary to assess progress toward achieving the goals in this Plan.

OBJECTIVES

(not listed in priority order)

- 1) Monitor key indicators of environmental quality in the Lake Champlain Basin.
- 2) Track land use changes that impact environmental quality in the Lake Champlain Basin.
- 3) Coordinate management and accessibility of Lake Champlain Basin data.
- 4) Use the data assembled to assess ecosystem conditions and environmental quality; document environmental trends; predict the effects of management actions on the Lake Champlain ecosystem; and guide changes to management actions over time.

Monitoring Land Use Changes

As noted in chapter 2, increased phosphorus loads generated by land use changes appear to be offsetting some of the gains achieved by point and agricultural nonpoint source reduction efforts. As the population within the Basin increases, particularly on the Vermont side of the Lake, more land will become developed. A reliable way of monitoring land use changes over time is needed to estimate the impacts of these changes on phosphorus loadings to the Lake (LCBP, 2000).

Improving Coordination and Data Sharing

Recent enhancements to data sharing and dissemination include long-term water quality monitoring data that are available in electronic format upon request and a summary on the LCBP and VTDEC websites, and the work of the Missisquoi Bay Task Force that resulted in increased monitoring and stream gaging of Missisquoi Bay. Improved coordination among managers responsible for water quality, fish and wildlife, aquatic nuisance species, and human health needs to be expanded Basin-wide. A formal process to facilitate data sharing and interpretation is essential to Plan implementation. Equally important is the regular production of summary reports for the general public. The

Basin has also experienced an encouraging rise in the number of volunteer citizen monitoring groups. Improved coordination and data-sharing may be expanded to incorporate work of these groups, many of which are affiliated with the states for data quality assurance purposes.

ACTIONS

(not listed in priority order)

1) Continue to Monitor Key Baseline Parameters in the Lake Champlain Basin

- a) Continue the bistate Lake Champlain Long-Term Water Quality and Biological Monitoring Program and related monitoring in Québec.*
- b) Continue the USGS stream gauging network.*
- c) Continue basic meteorologic monitoring.*
- d) Develop annual data reports, annual load estimates, and periodic trends analyses.*

Potential key LCBP partners: NYSDEC, VTDEC, NYS Biological Survey, USFWS, USGS, QC MENV, LCRC, USEPA, other relevant state, provincial, and federal agencies

Cost estimate: \$600,000 per year

Potential funding sources: Federal and state appropriations, and in-kind participation of other federal and state agencies

Timeframe: Ongoing

Benchmark: Continuation of programs listed above, documentation of trends, direction and assessment of management efforts

2) Continue and Expand Companion Monitoring Programs Essential for Particular Management Concerns

a) Provide a statistically sound data set on toxic substances in fish and wildlife tissue for coordinated management use by both human health officials and fish and wildlife managers.

b) Document the introduction, spread, economic impact, and management of aquatic nuisance species.

c) Periodically measure toxic substances, including contaminants of concern and new generation chemicals in the water column and lakebottom sediments.

d) Monitor point source wastewater discharges, as necessary, to help measure success towards phosphorus and other point source reduction goals.

e) Expand monitoring at tributary mouths to obtain data sufficient to calculate annual loadings, and to measure success towards phosphorus reduction goals more accurately.

f) Periodically update information on land use, agricultural practices, and extent of natural habitats in the Lake Champlain Basin.

g) Expand monitoring in targeted watersheds to evaluate effectiveness of BMP implementation for control of nonpoint source pollution.

h) Periodically collect quality assurance samples from wastewater treatment facilities to ensure accurate estimates of point source phosphorus loads.

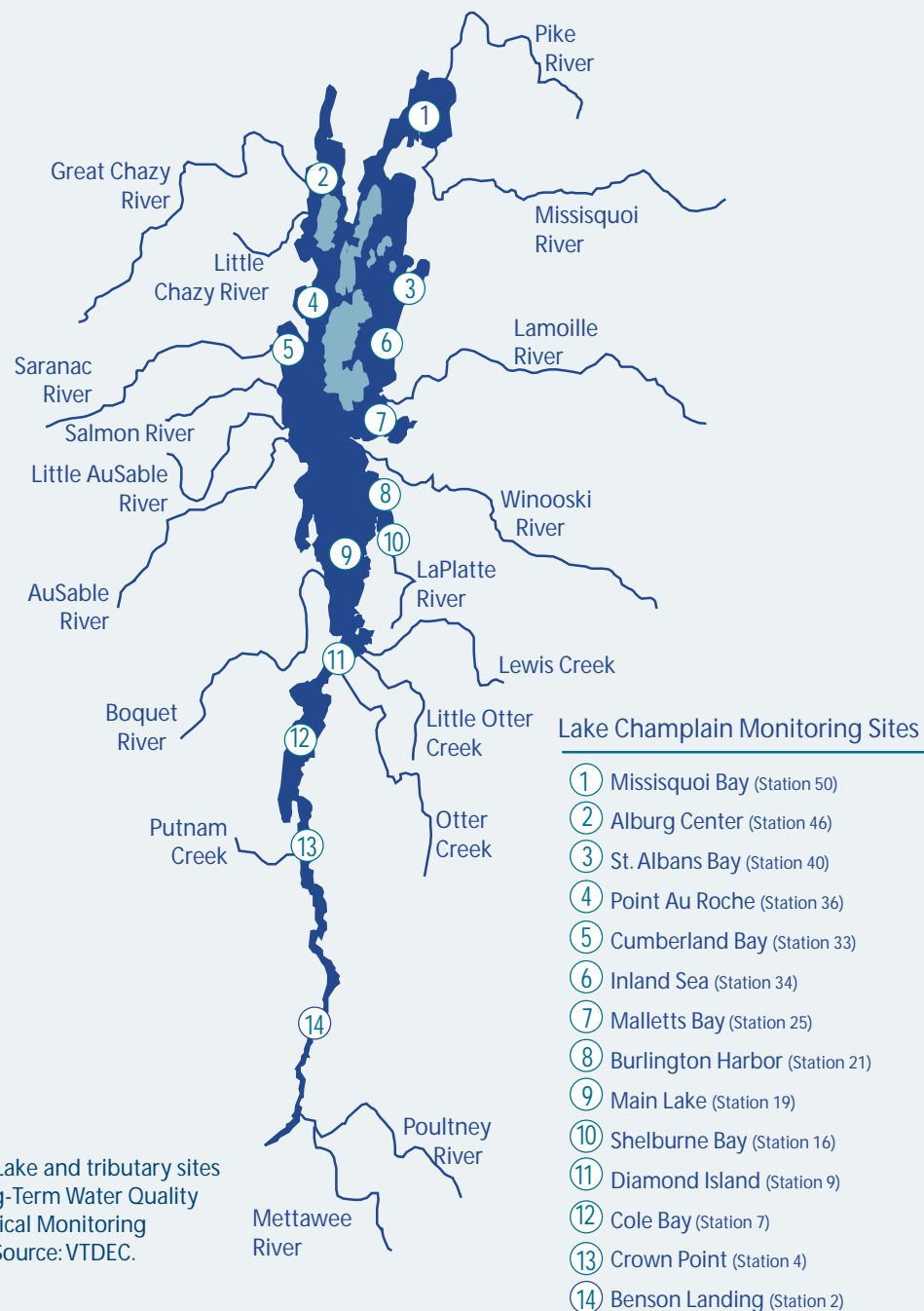


Figure 12: Lake and tributary sites in the Long-Term Water Quality and Biological Monitoring Program. Source: VTDEC.

ACCOMPLISHMENTS

WATER QUALITY MONITORING SHIFTS TO TREND DETECTION

After 10 years of building a comprehensive database of Lake Champlain water quality and biological information, the lake monitoring program is shifting from data collection to overall trend detection. Trends will determine whether water quality improvement targets are being met. All the data is readily accessible in electronic and paper formats.

EFFECTIVENESS OF BEST MANAGEMENT PRACTICES (BMP) IS BEING DECIPHERED

Two long-term projects are evaluating the effectiveness of BMPs to reduce nonpoint source water pollution. The projects focus on urban and agricultural sources of nonpoint source water pollution. These projects contribute to solutions for hard-to-solve phosphorus reduction challenges.



A "Real-time" stream gauge monitors results.

i) Measure land use changes to assess their impacts on nonpoint source loads.

j) Improve understanding of Lake Champlain hydrodynamics and its effects on in-lake phosphorus concentrations, toxic substances, and pollutant transport to drinking water intakes. Potential monitoring parameters could include water level, temperature, and water current.

Potential key LCBP partners: Federal, state, provincial, and local agencies (including USGS, NOAA, USFWS, state and federal agricultural agencies); LCRC; lay monitoring programs, watershed associations; QC MENV; USEPA

Cost estimate: \$250,000 per year

Potential funding sources: Federal appropriations and in-kind participation of other federal and state agencies; USEPA EMAP, Clean Lakes program, federal and state appropriations

Timeframe: Ongoing

Benchmark: Periodic monitoring reports incorporating these activities into the long-term monitoring program (in Action 1) where appropriate

3) Develop and Use Indicators of Environmental Quality

a) Identify environmental indicators through the current ecosystem indicators project.

b) Identify appropriate additional monitoring sites and parameters throughout the Basin to support the use of these indicators.

c) Ensure that major habitats and management concerns are addressed.

Potential key LCBP partners: LCRC, USFWS, NYSDEC, VTANR, VTDOH, NYSDOH, LCFWMC, USEPA, universities, QC MENV

Cost estimate: \$150,000 per year and in-kind participation of agency representatives

Potential funding sources: State and federal appropriations

Timeframe: Ongoing

Benchmark: Identification of indicators and monitoring sites

4) Create a Unified Data Access System for Coordination and Data-Sharing among Stakeholders in the Basin, and Produce Timely and Accessible Summary Reports for the General Public

a) Establish an online information center with searchable data sets and links to repositories.

b) Identify and locate existing data sets, including historical data where appropriate.

c) Update existing data repositories and establish new ones where important gaps in data exist.

d) Identify protocols for data input, data summaries, and accessibility, and ensure that new data collected follow these protocols.

Potential key LCBP partners: Federal, state, and local agencies (including USFWS, USGS), USEPA, LCRC, universities, lay monitoring programs, watershed associations, the Province of Québec.

Cost estimate: \$25,000 to \$50,000 per year

Potential funding sources: State and federal appropriations, in-kind contributions

Timeframe: Ongoing

Benchmark: Expand the process for data-sharing; publication of status and trends report for the public

STRATEGIES FOR FUNDING IMPLEMENTATION

LCBP



Many diverse funding sources help implement Plan actions. For example, funding from the North American Wetlands Conservation Act helped implement the Lake Champlain Wetlands Acquisition Strategy.

Each action in *Opportunities for Action* has an estimated cost and potential funding sources associated with it. The identified potential funding sources reflect the most probable sources of funding for the action, but do not indicate a monetary commitment from any organization. As various groups take responsibility for implementing actions, the funding sources available to these organizations and the actual costs of the actions will become more clear. For many actions, the cost of implementation changes, such that new estimates will be necessary from time to time.

In several instances in the Plan, specific funding sources are identified for actions. For example, in the section on “Protecting Wetlands,” Action 1, “Continue to Secure Funding and Implement the Lake Champlain Wetlands Acquisition Strategy,” lists the USFWS North American Wetlands Conservation Act funding as a potential source of funding for the action. This source was identified because it has been used effectively for the first two phases of funding for wetland acquisition in the Lake Champlain Basin. However, in addition to such specific funding sources, the action also lists general funding sources, such as state and private funds. By listing these general funding sources, the Plan recognizes the need for innovation wherever possible and does not limit itself to seeking funding from traditional, earmarked sources.

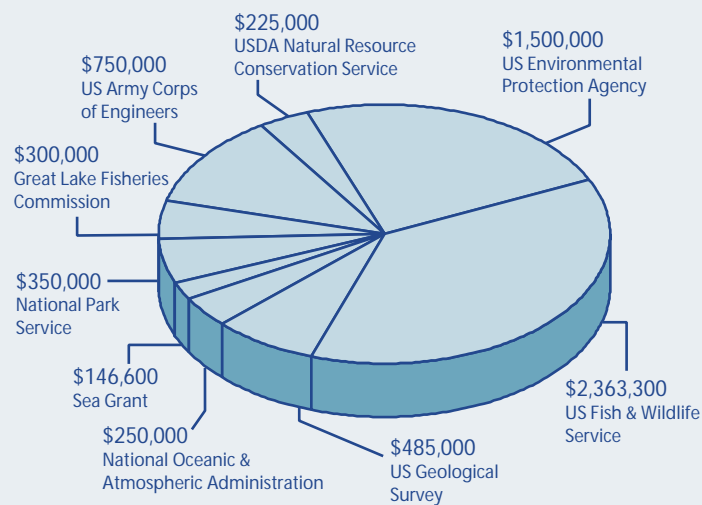
The Institutional Arrangements report (Yellow Wood Associates, 1995) suggested four principles to guide successful funding of watershed programs: 1) the sources and products of funding should be clearly understood by the public; 2) funding should be flexible and not solely tied to political sources; 3) funding sources should be diversified to reduce dependence on specific organizations; and 4) funding must be adequate to fully carry out the intended purpose of the action.

Opportunities for Action provides benchmarks under each action which are indications of what will be accomplished when the action is implemented. The public can refer to these benchmarks to understand how the funding for each action will be used. For several actions, the cost-estimate also outlines what the funding will provide (e.g., \$50,000 to hire a wetland biologist and coordinator of state programs). Each action also lists an expected timeframe for implementation.

Opportunities for Action seeks diverse funding sources and does not limit itself to money allocated by traditional federal and state programs, local costshare contributions, foundation grants, and costs borne directly by the private sector. Several actions in the Plan call for the formation of public/private partnerships as a key means to reducing dependence on one source of funding. For example, private entities could help maintain or improve public

parks or Lake accesses in exchange for publicity and other incentives (see section on “Managing Recreation,” Actions 1, 8).

Because of its evolving nature, *Opportunities for Action* is intended to be updated and evaluated every five years, at which time new priority actions and sources of funding may emerge and be incorporated. Actions have built in flexibility with a range of potential key partners and funding sources identified. If funding from one source diminishes, other sources will be tapped. Also, because the Plan covers a wide range of issues which have different funding sources, many of the actions will not compete with each other for scarce financial resources. Financing options can be mixed and matched to fund the priority actions in the Plan successfully.



Note: Additional funding includes \$1,000,000 through the USEPA for the Montgomery Wastewater Treatment Plant upgrade. The Lake Champlain Basin Science Center received \$500,000 through the US EPA and \$500,000 through the Institute for Museum and Library Sciences. Missisquoi National Wildlife Refuge received \$2,000,000 for a new headquarters and visitor center through the USFWS.

Figure 13. Fiscal year 2001 federal Lake Champlain appropriations.

CHAPTER SIX

ECONOMICS IN THE LAKE CHAMPLAIN BASIN

Economic data demonstrate that good water quality has a strong, positive impact with the Lake Champlain Basin, especially for local economies that depend on seasonal tourist expenditures for their revenue.

Updated economic data and analysis are important as Basin partners facilitate efficient and equitable distribution of the costs and benefits throughout the plan implementation process.

Les aspects économiques

Les données économiques actuelles montrent qu'une bonne qualité de l'eau a un effet très positif l'ensemble du bassin du lac Champlain. Les communautés locales, dont les revenus sont tributaires des retombées économiques du tourisme saisonnier, en bénéficient particulièrement. Des données et des analyses économiques à jour sont importantes pour les partenaires. Ces informations leur permettront de répartir efficacement et équitablement les coûts et les bénéfices tout au long de la mise en place du plan.

GOAL

Promote healthy and diverse economic activity, and sustainable development principles within the Lake Champlain Basin while improving water quality and conserving the natural and cultural heritage resources on which the regional economy is based.

An important goal of *Opportunities for Action* is to promote water quality objectives in ways that are compatible with economic vitality, and to tailor pollution prevention and control programs to be both economically appropriate and environmentally effective. The summary information presented in this chapter is drawn largely from the economic analyses prepared for the LCBP in 1996 (Holmes & Associates and Artuso, 1993; 1996), and has been augmented with additional economic and population data for the Lake Champlain Basin that has more recently become available.

Sustainable development is an economic development concept that gives full consideration to the social, economic, quality of life, and environmental aspects of development decisions. To promote sustainable development, it is essential to work closely with economic development agencies, chambers of commerce, business and industry groups, real estate development interests, local governments, and environmental organizations to identify actions and programs that can lead to sustained economic activity, good wages, long-term employment, affordable housing and a cleaner environment. For a number of years, the Province of Québec has been incorporating sustainable development principles into all government programs. The LCBP has provided funding for projects—such as alternative manure management and composting demonstration projects—that promote new technologies, improve environmental conditions, and generate revenues within the local economy. The Plattsburgh Air Force Base redevelopment is a recent example of the close integration of environmental cleanup and long-term development activity. The Triangle of Excellence Program is a good example of regional cooperation. The program is a joint effort organized by the mayors of Burlington, Plattsburgh, and St. Jean-sur-Richelieu to promote regional cooperation and economic development. The Plattsburgh Chamber of Commerce is also working on regional cooperative efforts to link economic activity among Québec, northern New York, and the Hudson River area.

The LCBP has helped fund numerous recreational and historic preservation projects which help to stimulate the local economy, such as Lake Champlain Bikeways, the Birding Trail, and the Historic Landings Heritage Trail. The NYSDEC and VTDEC regularly schedule pollution prevention workshops to help businesses reduce costs while ensuring compliance with environmental regulations.

Many state and federal environmental issues, such as stormwater management, and TMDL requirements require careful efforts so that protection of water bodies from pollution is successful, and economic vitality and well-planned development may occur. The role of the LCBP in these efforts will be to promote environmentally sound decision-making, encourage interagency and regional cooperation, support alternative and innovative technology, and promote economic vitality, particularly in tourism and recreation, based on the appropriate use of the natural resources of the Basin.

THE ECONOMIC IMPORTANCE OF LAKE CHAMPLAIN

Recreation and Tourism

The Lake Champlain region has rapidly evolved towards a service-oriented economy, with one-third of total employment in the service industries in 1990. Recreation and tourism constitute a major portion of that service economy. A recent comprehensive study of tourism showed that tourists in

Vermont spent \$4 billion in 1998-99 (April 98 to March 99), 15% of the total state economy. Tourism also contributed 23% of the jobs in Vermont and 23% of total state personal income. Based on earlier socioeconomic research, about 68% of this sector of the Vermont economy occurs in the Lake Champlain Basin (Holmes & Associates 1993: 4-10). Accordingly, the Lake Champlain Basin portion of the Vermont tourism economy can be valued at about \$2.7 billion. Approximately 71% of the Lake Champlain Basin's economy occurs in Vermont, while 29% occurs in New York (Holmes & Associates and Artuso 1993: 4-13). It follows that the tourism economy of the Basin in New York equals approximately \$1.1 billion, and the total Basin-wide tourism economy reached about of \$3.8 billion in expenditures in 1998-99.

Two other statistics developed in earlier socioeconomic research on Lake Champlain allow us to approximate the economic impact of tourism in the Basin. One is that approximately 40% of tourism in the Basin occurs in the shoreland towns bordering Lake Champlain (Holmes & Associates and Artuso 1993: 4-14). The other is that Lake Champlain directly influences at least 15% of the tourism occurring in those shoreland towns (Holmes & Associates and Artuso 1996; Yellow Wood Associates 1995). Using the 1998-99 Vermont tourism data, it can be projected that \$1.5 billion of tourism expenditures are occurring in shoreland towns, and that \$228 million of those expenditures are being spent on Lake Champlain, related activities (e.g., boating, camping, fishing, motels, etc.). Those are tourism-related expenditures by visitors to the area. Local residents also use Lake Champlain

for recreation. A survey investigating the economic impact of the sea lamprey control program found that residents within thirty-five miles of Lake Champlain spent \$118 million in 1997 on water-based recreational activities on Lake Champlain. These dollars spent at local businesses by local residents are in addition to \$228 million in Lake Champlain-related expenditures made by visitors from outside the area. An additional component of the Lake Champlain-related tourism economy is the seasonal homeowners around the Lake. Seasonal residents around the Lake spent \$16 million on nondurable goods in 1995 (EFCA, 1995; Holmes & Associates and Artuso 1996: 80).

The international feel of Lake Champlain and the cooperative tourism efforts already underway, especially within the US-Canadian corridor along Missisquoi Bay and the Richelieu River, makes the Basin one of the more appealing tourist destinations in the Northeastern US. The Richelieu Valley region of Québec has been working to stimulate tourism interregionally by promoting outdoor activities, cultural heritage, and eco-tourism activities provided by the natural, historical, and cultural attractions around Lake Champlain and the Richelieu River Basin.

The natural and cultural resources of the Lake Champlain Basin provide a foundation that supports other components of the regional economy. Abundant and diverse natural resources are a major reason many Basin residents choose to live where they do. Sport fishing and hunting, as well as nonconsumptive uses such as boating, hiking, and cross-country skiing, all are made more attractive to local residents by excellent water quality, abundant

wildlife, and wildlife habitat. Whereas only a generation ago, railroads, airports, and highways were the key determinants for locating a new factory, economists are now finding that recreational opportunities, quality of life, good schools, and healthcare are key factors guiding the location of new industries.

While many types of recreation are available within the Basin, water-based recreation provides the primary attraction for visitors. Bike paths, scores of municipal and state parks, beaches, ski trails, boat launches, boat tours on the Lake, and portions of the Green Mountain National Forest and the Adirondack Park all are located in the Basin. Protection and enhancement of the environmental, cultural, and historic resources are clearly important to many recreational users, as these resources are the main focus of the recreational experience. Much of the challenge in recreation management lies in providing additional recreation opportunities in ways that do not significantly worsen water quality.

In 1988, the average expenditure by New York anglers on nondurable goods at Lake Champlain was \$19.61 per angler day, for a total of \$9.5 million in local expenditures. They spent an additional \$4.7 million *en route*. Holmes & Associates (1993) extrapolated the New York findings to Vermont and concluded that angler expenditures on nondurable goods at Lake Champlain approximated \$32 million annually. A more recent survey of fishing license holders in New York and Vermont estimated that Lake Champlain anglers spent \$100 million on nondurable goods (e.g., tackle, bait, refreshments) and \$105 million on durable goods (e.g., fishing rods, fishing boats) in 1997 (Gilbert 2000). Gilbert's data

indicates that during the open water season, more than one-third (42%) of 1997 open water fishing expenditures were associated with fishing for lake trout, 27% with fishing for land-locked salmon, 11% with bass, and 8% were associated with walleye fishing.

There are 98 fishing and fishing-related businesses within ten miles of Lake Champlain. In 1997, the owners of those businesses estimated that 78% (\$5.6 million) of their \$7.2 million in gross fishing based income was derived from anglers fishing Lake Champlain or its tributaries.

The plan recommends investigating the development of a joint New York and Vermont Lake Champlain fishing license agreement. An in-depth benefit-cost analysis of that proposal, which has not yet been undertaken, would be a positive development for anglers and the fishing economy around the Lake. Vermont and New York management agencies are continuing to discuss options for a reciprocal agreement and to study the potential impacts of various alternatives on vital fish and wildlife program revenues.

Economic Aspects of Clean Water

Approximately 200,000 people use Lake Champlain as a source of drinking water, including an estimated 4,149 households with private water systems drawing from the Lake. Human health concerns related to Lake Champlain have been elevated to a Highest Priority in this revised version of Opportunities for Action. 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 or toxins from bacteria.

There are 99 public water systems that draw water from Lake Champlain, comprised of 35 residential suppliers and 64 non-residential suppliers, such as motels, schools, businesses, campgrounds, restaurants, gas stations, etc., serving approximately 188,000 people (35% of the US population of the Basin).

Approximately 137,803 Vermont residents are served by 25 municipal and 6 commercial drinking water supply systems that draw their source water from Lake Champlain, indicating that almost one quarter (24%) of Vermont's population relies on Lake Champlain for drinking water. Although the vast majority use public water systems that are monitored and regulated, approximately 4,000 people draw their own water directly from the Lake. However, it is not recommended for drinking without treatment.

The Champlain Water District pumps approximately 11 million gallons of water per day from Lake Champlain. At a wholesale rate of \$1.11 per 1,000 gallons in 2001, Lake Champlain drinking water could be partially valued at \$12 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 two thirds (62%) of Lake Champlain drinking water users, the total wholesale use value of Lake Champlain drinking water would be approximately \$36 million in 2001.

OBJECTIVES

(not listed in priority order)

- 1) Gather economic data to increase understanding of the relationship between the economy and the environment.
- 2) Encourage cost-benefit analyses to determine the most cost effective means of pollution prevention.
- 3) Encourage the use of federal, state, local, and private funding for brownfield redevelopment and other activities that return previously contaminated land to viable economic use.
- 4) Improve capacity for regional cooperation on cultural heritage-based economic initiatives.
- 5) Encourage natural resource agencies to work cooperatively on appropriate marketing of Lake Champlain's natural resources including fishing, hunting, hiking, camping, and paddling.
- 6) Fund projects to reduce the impact of sprawl on the water quality of the Lake and its tributaries.
- 7) Encourage the sustainable use of the Basin's natural, cultural, and historic resources.
- 8) Work to reduce the negative economic impacts of aquatic nuisance species in the Basin.

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 are now below national averages, there would be direct adverse economic impacts in terms of increased drinking water filtration and treatment costs if Lake Champlain nutrient levels were to increase or if federal or state drinking water standards were to become more strict.

Swimmable Waters

While the actual number of swimmers is unknown, an estimated 968,000 visits to public and private commercial beaches on Lake Champlain occurred in 1993. Swimming and wading were the most popular recreational activities on Lake Champlain, accounting for 1.2 million user days and 38% of all Lake-related recreational activity for residents living within 35 miles of the Lake. In addition, swimming is an important recreation activity at more than 9,000 seasonal homes and other year-round homes lakeshore towns. Periodic high levels of fecal coliform have caused public beach closings in some areas of the Lake, curtailing swimming activities and resulting in adverse economic impact on the local economy.

There are 54 public and commercial beaches and 10 private beaches on Lake Champlain. Recent beach closings, primarily in Vermont, have been triggered by excessive coliform bacteria counts. These problems appear to be site specific, and the source of contamination is

typically in the vicinity of the beach or upstream in the watershed. There has been significant progress on eliminating combined sewer overflows, but work remains. In addition, controlling urban runoff, agricultural and natural sources, and animal wastes will contribute to success.

Beach users have many options when arriving at a closed beach. They can look for another beach on Lake Champlain, travel to another lake or cancel their beach trip. In the first case, the economic benefit of their beach trip-related expenditures is transferred to the other beach location. In other scenarios, the recreational expenditures are lost to Lake Champlain area businesses. As an example, one Vermont beach was closed for most of 1995 because of pathogens possibly related to a malfunctioning septic system. The beach had 500 to 2,000 users per day in 1993. Using a Vermont State Park day use expenditure estimate of \$26.82 per group, lost expenditures amounted to \$3,800 to \$15,340 per day. During the swimming season, local businesses may have lost about \$200,000 to \$350,000.

OVERVIEW OF THE LAKE CHAMPLAIN BASIN ECONOMY

Employment and Income

The diverse economy of the Lake Champlain Basin has helped it weather recessions between 1980 and 2000. In addition to tourism, major sectors of the Basin economy

include manufacturing, agriculture, retail and wholesale trade, healthcare, universities, prisons, and state government. Research for the LCBP in the 1990s found that employment in the service sector comprises 35% of Basin employment by industry, followed by trade (22%), and manufacturing (15%). The trend in the last twenty years has been towards an increase in the service and trade sectors and a decrease in the manufacturing sector. The most recent Economic Census for Vermont (US Census Bureau 1997) indicates that sales and receipts for all Vermont establishments totaled more than \$29 billion in 1997, and that manufacturing accounted for 27% of that total; retail trade, 20%; wholesale trade, 16%; and services, 13%.

Income from wages, especially in the rural portions of the Basin, lags behind the national average. In the Adirondack Park portion of the Lake Champlain Basin, average annual wages in 1992 were \$20,621, in contrast to \$32,411 for the State of New York and \$25,903 for the nation. In Vermont, nonmetropolitan earnings per job were \$24,774 in 1999, while metropolitan earnings were \$28,039. Nationally, the averages for nonmetropolitan earnings were \$24,408 and for metropolitan earnings were \$36,526.

Economic Dependence on Natural Resources

The more traditional rural industries of natural resource harvesting, resource extraction, and farming continue to make significant contributions to local economies. The 1990 US census data for Vermont indicated that 4.2% of employment was in the agriculture, forestry, and

fishing industry, totaling 12,000 people, while nationally the sector accounted for 2.7% of all employment (US Department of Commerce). In several locations around the Basin, primary businesses related to agriculture, mining, and forestry are the major employers. For example, the “agriculture, forestry, and fisheries” industry grouping accounts for more than 25% of all employment in the Vermont towns of Bridport, Shoreham, and Addison. The town of Willsboro, New York has approximately 11% of its employment in agriculture, forestry, and mining activities (US Department of Commerce 1990 Census; Holmes & Associates and Artuso 1996: 50-52). The term “primary employment” distinguishes direct harvesting and preliminary processing of natural resource commodities from “secondary employment,” which involves the subsequent transportation, processing, packaging, and marketing of the natural resource. While secondary employment is difficult to quantify, secondary agriculture-related employment is thought to comprise an additional 10% to 15% of total local employment.



Proctor Maple Research Center

The Lake Champlain Basin produces approximately one-third of the maple syrup in the United States.

Agriculture

In the ten counties of New York and Vermont that are predominately in the Basin, there were approximately 4,840 farms in 1987, with the distribution roughly being one-third in New York and two-thirds in Vermont. According to the 1997 Census of Agriculture, the number of acres of farmland in Vermont decreased by one percent from 1992 to 1997, to 1.3 million acres, while the number of full-time farms decreased six percent to 3,300.

The total value of agricultural products sold from farms in the Basin in 1990 was \$415.5 million, with 58% of the total attributable to Vermont farms. Sales from farms in the Vermont sector of the Basin accounted for approximately 64% of all Vermont farm sales. By 1997, sales from Vermont farms totaled \$476 million and the sales per farm averaged \$82,000, indicating that the total value of Lake Champlain Basin agricultural products had risen to \$526 million. In New York,

Washington County accounts for 51% of the New York Basin farm acreage, while in Vermont, Addison and Franklin Counties account for 53% of the farm acreage.

Dairy products account for the majority of farm sales in both New York and Vermont Basin areas. Data for 1989 indicate that dairy products accounted for 72% of Vermont farm cash receipts, followed by beef and veal (13%), horses (6%), hay (3%), and maple syrup (3%). In 1990, dairy product sales in

the three New York Basin counties accounted for about 60% of total farm sales, while statewide, dairy product sales accounted for 53% of New York farm cash receipts.

According to the New York Soil and Water Conservation Committee, there are now 1,080 farms in the New York portion of the Basin. Of those, approximately 600 are considered to be commercial farms. At least 55 of those farms are classified as concentrated animal feeding operations (CAFOs) with 300 or more animal units or approximately 215 mature dairy cows. These CAFOs must develop and implement comprehensive nutrient management plans within five years. Over the past five years, New York has committed \$3 million in cost-share funds for agricultural environmental management in the New York portion of the Basin, with farm operators committing nearly \$1 million in matching funds. The costs of constructing manure storage structures continues to rise and now can exceed \$250,000.

Forest Products

Forest products include a wide diversity of commodities and manufactured items such as building materials, paper, maple syrup, and furniture. The importance of specific forest products-related industries to local economies varies from one part of the Basin to another. Maple syrup contributes significantly to local rural economies in the Basin. In 1999, Vermont remained the largest producing state in the nation, accounting for 31% of the total US maple production. Vermont's maple syrup production was valued at \$10.5 million in 1999, while production in New York portion of the Lake Champlain Basin was valued at

Don Meals



Dairy products account for the majority of farm sales in both New York and Vermont.

\$1 million. Maple candy and other maple items are value-added products that increase the economic impact of the maple syrup industry in local economies. Manufacturing of paper and paper products makes a significant economic impact on rural economies as well. For example, in 2000, International Paper's Ticonderoga Mill employed 690 people and had a payroll of \$36 million. Approximately 90% of all employees live in the New York towns in the vicinity of Ticonderoga. In 2000, the mill purchased more than \$30 million in goods and services in the Ticonderoga area of New York State. The mill also purchased \$20 million of fiber, wood chips, and bark from the Adirondack region, and 285 private truckers were involved in bringing wood to the mill. International Paper is the largest private landowner in New York State, owning and managing nearly 300,000 acres of forestland, most of it located within the Adirondack Park.

In Vermont, three counties each account for 14% of the volume of sawlogs: Caledonia, Orleans, and Windsor. Of those, only Orleans is considered a Basin county, and only about one-half of the county lies within the Basin. In the New York sector of the Basin, a significant amount of the land area is classified as commercial forestland: Clinton County (69%), Franklin County (61%), Essex County (48%), Warren County (59%), and Washington County (48%). According to recent research on the forest-based economy of the northern forest region of New York, Vermont, New Hampshire, and Maine, jobs in lumber, wood, and paper products have declined from 1987 to 1997. There is local evidence of that decline in the closing of several sawmills and plywood mills during 2000-2001 in the New York portion of the Basin, and related reductions in the

workforce in paper mills in the region. However, wood manufacturing of value-added products, such as furniture, is a growing and strong economic sector.

POPULATION CHANGE AND LAND USE

Population change can be an indicator of economic activity—or lack of economic opportunity—and can indicate high growth areas where land use planning is needed to protect water quality. Table 3 presents the total population in each of nine major watersheds around the Lake Champlain Basin.

The preliminary 2000 Census data indicates that the US population in the Basin numbers about 541,000 people. An estimated 30,000 people live in the Québec portion of the Lake Champlain Basin. About 63% of the 609,000 residents in Vermont live in the Lake Champlain Basin. Seventy-two percent of the population in the US portion of the Basin resides

in Vermont, and 28% reside in New York. Approximately 45% of the Lake Champlain Basin residents live in towns bordering the shore of Lake Champlain.

The Vermont portion of the Main Lake area, which includes the Winooski River Basin and contains the cities of Burlington and Montpelier, comprises almost one-half of the population in the Basin (47%). The other main population center is the Plattsburgh area of New York which includes the Saranac and Chazy River basins. Here, 15% of the population resides. Another population center is the Mallets Bay area north of Burlington, representing a portion of the Lamoille River Basin, with 12% of the population. The six percent increase in population between 1990 and 2000 was the lowest rate of increase of any of the past five decades (Table 4). The higher growth areas were Mallets Bay, Lake George, Missisquoi Bay, and the Inland Sea watershed areas. The watershed area including Plattsburgh experienced a 6% decline in population

Lake Champlain Basin Watershed/Lake Segment	Total Population						Percent (%) of 2000 Population
	1950	1960	1970	1980	1990	2000	
Missisquoi Bay	20,752	19,427	20,050	22,786	25,228	28,104	5
Inland Sea	11,922	12,516	13,427	14,123	16,200	17,921	3
Mallets Bay	23,534	23,833	34,135	46,832	56,237	65,295	12
Broad Lake, VT	151,393	163,893	194,040	216,256	236,698	254,228	47
South Lake, VT	14,290	16,152	16,123	18,012	19,925	21,228	4
South Lake, NY	23,219	22,641	24,572	25,057	27,607	28,666	5
Lake George	3,566	4,617	5,305	5,953	5,765	6,549	1
Broad Lake South, NY	29,568	31,851	31,175	34,241	36,113	37,987	7
Broad Lake North, NY	57,627	75,111	73,380	81,303	86,304	81,005	15
Total US Basin Population:	335,871	370,041	412,207	464,563	510,077	540,983	100

Table 3.
US population:
Lake Champlain
watershed areas,
1950-2000.

Source: US Department of Commerce, Bureau of the Census, 1950, 1960, 1970, 1980, 1990, 2000.
Watershed population analysis by Holmes & Associates for the Lake Champlain Basin Program (2001).

Since 1950, the Mallets Bay watershed area has experienced the most growth among the nine areas; at 177%, its growth rate was three times the average for the Basin. Other high growth areas of the Basin over the past 50 years are the Lake George watershed area and Broad Lake, Vermont watershed area (Table 4).

Also very important to the Basin economy are the seasonal homeowners and residents. According to the 1990 Census data, there were 38,530 seasonal homes in the Basin, or approximately 14.6% of all Basin housing units. Approximately 9,118 of the seasonal homes are located in the Lake Champlain shoreland areas, or 24% of all seasonal homes in the Basin. The 38,530 seasonal homes would equal a population increase of approximately 116,000 people if they were each occupied by three individuals, amounting to a seasonal increase in Basin population by about 20%. Considering shoreland seasonal homes only and a seasonal household size of three to six people, those 9,118 homes add 27,000 to 55,000 people to the Lake Champlain shoreland population in July and August. The year-round population of 19,030 for the Missisquoi Bay area in Québec more than doubles during the summer with the influx of 21,274 summer residents.

Associated with population growth are development and changes to the landscape, among the primary human impacts on water quality in the Basin. Quantifying the type and magnitude of change is an essential part of understanding the impacts, both positive and negative, of land use changes. In a project that combined federal, state, and local resources, the Lake Champlain Basin Program developed

a map of the landscape of the Basin using data from 1993. These efforts yielded a complete land use and vegetative cover inventory and a database that can be used to describe the relationship between land use and water quality in the Basin. For example, analysts have developed a numerical model that describes the rate at which phosphorus enters Lake Champlain as a function of the amount of urban, agricultural, and forested land in the Basin.

Satellite data has yielded important information about the Basin. The terrestrial part of the Basin is predominantly forested (about 64%), including deciduous trees (33%), mixed woods (16%), and conifers (14%). Agricultural landscape categories, including pasture and orchards, cover about 16% of the Basin. The open waters of Lake Champlain and smaller lakes and rivers comprise the next largest component of the landscape, approximately 10% of the surface area. Wetlands, a vital hydrological and ecological component of the Basin, comprise less than 4% of the surface. Lastly, the areas developed for transportation

and utilities, residential, commercial, and industrial, have grown to cover a little more than 5% of the landscape.

A major landscape issue facing the Basin is sprawled development, a cumulative process that results from the incremental growth of low-density residential and urban development, typically scattered along a highway. Sprawled development tends to begin at the edge of traditional community centers and extends outward into previously rural areas, requiring new or larger roads, water and sewer capacity, and utility lines. Although sprawl is not new to the Basin, the amount and rate of this form of development has made it a topic of concern and study in some parts of the Basin.

The effects of sprawled development in the Basin may result in a reduction of water quality from increased urban runoff and loss of wetlands. As the landscape becomes increasingly fragmented, wildlife habitat, farmlands, and forests become less productive. The discussion of both the positive and negative

Lake Champlain Watershed/Lake Segment	Percent (%) Change					
	1950-60	1960-70	1970-80	1980-90	90-2000	1950-2000
Missisquoi Bay	-6.4	3.2	13.6	10.7	11.4	35.4
Inland Sea	5.0	7.3	5.2	14.7	10.6	50.3
Malletts Bay	1.3	43.2	37.2	20.1	16.1	177.4
Broad Lake, VT	8.3	18.4	11.4	9.5	7.4	67.9
South Lake, VT	13.0	-0.2	11.7	10.6	6.5	48.6
South Lake, NY	-2.5	8.5	2.0	10.2	3.8	23.5
Lake George	29.5	14.9	12.2	-3.2	13.6	83.7
Broad Lake South, NY	7.7	-2.1	9.8	5.5	5.2	28.5
Broad Lake North, NY	30.3	-2.3	10.8	6.2	-6.1	40.6
Total Change:	10.2	11.4	12.7	9.8	6.1	61.1

Table 4.
Population change: Lake Champlain watershed areas, 1950 to 2000.

Source: US Department of Commerce, Bureau of the Census, 1950, 1960, 1970, 1980, 1990, 2000.
Watershed population analysis by Holmes & Associates for the Lake Champlain Basin Program (2001).

impacts of sprawl on the landscape, culture and economy of the Basin has taken on an increased importance in view of recent development trends.

ECONOMIC DATA FOR THE QUÉBEC PORTION OF THE MISSISQUOI BAY DRAINAGE BASIN

Recreation and Tourism around Missisquoi Bay

After agriculture, the economic engines in the Missisquoi Bay basin are recreation and tourism. It is easy to imagine the major impact the seasonal influx of vacationers can have on the economy of several municipalities. When a population doubles or even quadruples during a period of several months, it drives up annual sales of local businesses. However, there have yet to be any specific studies on the economic impact of seasonal population growth in the Missisquoi Bay drainage basin.

The area of the drainage basin offers a wealth of recreational, regional tourism, and destination tourism opportunities. Agricultural and forest areas are popular spots for skiing, hiking, and hunting, activities that are less directly affected by water quality. The same is not true, however, for other recreational activities such as swimming, fishing, and boating. These activities, which are practiced primarily on the shores and in the waters of the bay and its main tributaries, the Brochets and Missisquoi

ivers, are increasingly compromised by the degradation of water quality as a result of the excess concentration of phosphorous. Water quality at the bay's public beaches is usually very good, according to the safety standards of the Environment-Plage program of the Ministère de l'Environnement du Québec. In fact, of the five public beaches in Venise-en-Québec, four received an annual average rating of A (excellent) in 2000, and the other, a B rating (good). Even so, these beaches had to be closed in mid-summer recently because of a major blue-green algae bloom.

Wastewater and Drinking Water Infrastructure for Québec Municipalities around Missisquoi Bay

In the Québec portion of the Missisquoi Bay drainage basin, 50% of the population is connected to a sewerage system, 86% of which is served by a wastewater treatment plant. Seven municipalities already have a sewerage system with treatment plants and another is in the process of installing one. These systems serve 10,471 people at a total construction cost of \$23,616,800 (Canadian).

Eight municipalities in the basin have a drinking water supply system connected to a filtration plant. These systems serve roughly 10,000 people. The system furnishing water to the city of Bedford and the Philipsburg area of Saint-Armand has trouble maintaining water quality standards when the suspended solids or microscopic algae content in the bay are too high. Several drinking water warnings have had to be issued since the start-up of the filtration plant.

Employment, Income, and Agricultural Statistics for Missisquoi Bay

A general economic portrait emerges by calculating the averages of the indicators for the three regional county municipalities making up the basin area (Haut-Richelieu, Brome-Missisquoi and Memphrémagog). In 1999, the average annual per capita income in the Missisquoi Bay area was around \$22,000 (Canadian currency). The average labor force participation rate in 1996 was around 61.7%; the employment rate, 55.2%; and the jobless rate, 10.4%.

Agriculture and natural resources account for 5.6% of the labor market, manufacturing and construction for 29.9%, and transportation, trade, and services for 64.5%. Agriculture is the economic mainstay in the Missisquoi Bay drainage basin. According to Statistics Canada (1996 census), farms cover 45.5% of the basin area, 24.6% of which is under cultivation. Corn and fodder are the two main crops, accounting for 21.5% of the total farm area. This translates into 700 farms, including 400 in the Brochets sub-river basin. In terms of livestock production, there are 1.4 animal units (AU) per hectare (1 AU = 500 kg live weight), with beef cattle accounting for 46.2% of production; pigs, 43.4%; poultry, 6.8%; and other animals, 3.6%.

Population Change and Land Use in the Missisquoi Bay Region

The population of the Missisquoi Bay drainage basin is distributed over two Québec administrative regions (Montérégie and Estrie), three regional county municipalities, and 29 municipalities.

The total population in this area was 21,638 in 2000. The population grew by 3.8% between 1996 and 2000. Eastman is the only municipality in the entire basin to have experienced significant population growth (44%) between 1996 and 2000. There has been almost no change in the population of the other basin municipalities.

The population increases substantially during the summer, particularly in the three municipalities of Venise-en-Québec, Saint-Georges-de-Clarenceville, and Saint-Armand. The seasonal population is 7000 in the summer, with the population of Venise-en-Québec quadrupling, and that of Saint-Georges-de-Clarenceville doubling. This results in a veritable urban concentration in a narrow strip along the shores of the bay during a time of year when the environmental conditions in the bay are the most sensitive. Numerous cottages and several summer campgrounds are located in these municipalities. Tourism leads to a seasonal influx of people in other basin municipalities as well, such as Frelighsburg, Dunham, Sutton, and Eastman.

Only 5% of the area of the Missisquoi Bay drainage basin is urbanized, and there are no major agglomerations. Approximately 45% of the basin area is farmland, and the remaining 50% forest and water.

HIGH PRIORITY ACTIONS

(not listed in priority order)

1) Update Socioeconomic Data for the Lake Champlain Region

During the early 1990s, the LCBP developed an economic database for the Lake Champlain region based on the results of the 1990 census. The database provides important information on employment by industry and occupation, as well as economic activity generated by agriculture, forestry, mining, and other natural resource-based industries. The study also analyzed the regional tourism economy and the economic benefits generated by various recreational activities, such as fishing, hunting, hiking, and camping. Data on tourism from Québec and use of Lake Champlain by Québec boaters were also included in the report. This database now needs to be updated with information soon to be available from the most recent census data in New York, Vermont, and Québec.

Potential key LCBP partners: State and regional economic development agencies and tourism offices

Cost estimate: \$40,000 to \$50,000 per year for two years.

Potential funding sources: USEPA, NPS, NRCS, VTACCD, NYS Empire State Development

Timeframe: 2002-2003

Benchmark: Completion of database update

2) Support Cost-Benefit Analyses of Pollution Prevention Projects

The LCBP funds many demonstration and implementation projects to prevent pollution in the Basin. To provide essential information about pollution prevention strategies and to

guide funding priorities, it is important to assess the costs and benefits of potential actions to project or assess their effectiveness in various parts of the Basin.

Potential key LCBP partners: federal, state and local agencies, universities.

Cost estimate: \$5,000 to \$10,000 per project assessed

Potential funding sources: USEPA, NPS, NRCS, VTACCD, NYS Empire State Development

Timeframe: Ongoing

Benchmark: Completion of cost-benefit analysis for key actions

3) Support Cost-Benefit Analyses of Aquatic Nuisance Species Control Efforts

Management decisions about the control of aquatic nuisance species in the Basin would benefit from improved economic information about the available options, especially to guide the allocation of limited resources. To provide essential information about aquatic nuisance species management strategies, studies to assess the costs and benefits of potential actions and to project their effectiveness in various parts of the Basin should be supported and encouraged.

Potential key LCBP partners: Federal, state, and local agencies, universities.

Cost estimate: \$5,000 to \$10,000 per project assessed

Potential funding sources: USEPA, NPS, NRCS, VTANR, NYSDEC, VTACCD, NYS Empire State Development

Timeframe: Ongoing

Benchmark: Completion of cost-benefit analysis for key actions

4) Work with Federal, State, and Local Communities to Identify Brownfield Redevelopment Areas that May Be Eligible for Federal and or State Funding

The LCBP should take a proactive role to work with local communities to identify locations within the Basin which are in need of environmental cleanup and eligible for federal and state funding for brownfield redevelopment.

Potential key LCBP partners: USEPA, VTDEC, NYSDEC

Cost estimate: \$15,000

Potential funding sources: USEPA

Timeframe: Ongoing

Benchmark: Development of report that identifies eligible sites

5) Continue an Integrated Approach to Environmental, Cultural Resource, and Recreation Management

For more than a decade, the LCBP has worked on water quality, recreation management, and cultural heritage programs through a variety of funding sources. Regional tourism is directly tied to a clean environment, improved recreational access, and increased understanding of our cultural heritage resources. In 2001, the LCBP established a cultural resource and recreation advisory committee consisting of local officials, historic preservation experts, and state agency representatives to provide input and recommendations on regional recreation and cultural resource initiatives within the Basin. New and exiting opportunities exist to expand regional cooperation on cultural

heritage tourism and recreation management, which are detailed in other sections of this Plan. Successful implementation of these regional initiatives depends on water quality protection and improvement projects.

Potential key LCBP partners: Landowners, businesses, nonprofits organizations, local and county governments and tourism offices, regional commissions, chambers of commerce, housing and conservation boards, NPS, USEPA, NYSDEC, VTANR, NYSOPRHP, VTDHP, and Québec Societe de la Faune et des Parcs

Cost estimate: \$75,000 to \$150,000 per year

Potential funding sources: NPS, USEPA, VHCB, non profits organizations, USDA-NRCS, HPF, HUD, National Trust for Historic Preservation, USDA-FMHA

Timeframe: Ongoing

Benchmark: Synthesis of regional marketing goals and their integration into recreation and tourism plans (see Action Items 6 and 7 in chapter 4 and creation of an appropriate regional marketing effort for the Basin.

6) Update Land Use/ Land Cover Database

Satellite data and locally derived information has yielded important facts about the Basin. Sixty-four percent the landscape in the Basin is still forested, and agricultural lands cover approximately 16% of the Basin. The urban landscape currently represents only 5% of the total land use. However, urban areas contribute a far larger portion of phosphorus loadings to Lake Champlain than other land uses on an acre by acre basis. Continuing urbanization and sprawled development have the potential to add additional phosphorus loadings to the Lake and its tributaries unless specific mitigation measures are taken. The effects of sprawl potentially include not only reduction of water quality but also increasingly fragmented and less productive wildlife

habitat, farmlands, and forests. The most recent land use and land cover data for the Lake Champlain Basin was published by LCBP in 1993. In order to track changes in land use and its related impacts, more current land use data must be acquired to assist managers in setting priorities and implementing management programs, and this information must be made available to the public.

Potential key LCBP partners: USEPA, USGS, USACOE, VTDEC, NYSDEC, APA, universities, local/regional planning agencies

Cost estimate: \$100,000 to \$250,000

Potential funding sources: USEPA, USACOE

Timeframe: 2002-2003

Benchmark: Updated land use/ land cover report

CONCLUSION

The available economic data and analyses demonstrate that the priority actions for improving water quality will have a strong positive impact within the Lake Champlain Basin in all sectors of the economy. From clean drinking water to recreational, aesthetic, and cultural values, the public strongly endorses maintaining clean water and preventing pollution in the Basin. The positive economic importance of maintaining clean water is very significant, especially for local economies that depend on seasonal tourist expenditures for their annual revenue. Moreover, the economic cost of remediating polluted areas is far greater than the cost of maintaining clean water in the first place.

It is important to facilitate efficient and equitable distribution of the costs and benefits throughout the Plan implementation process. The economic analyses should provide guidance in that direction. Increased attention to the collection and analysis of economic data is recommended, and the continued inclusion of economic interests in the planning process for protecting Lake Champlain is essential.



LCBP

A father and daughter show off a great catch at the annual Vermont Fish and Wildlife Kid's Fishing Day.

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A **acceptable management practices (AMPs)**
a phrase used in Vermont to indicate a forestry practice or pollution control mechanism that is effective in reducing nonpoint source pollution to surface water and groundwater.

Acquisition

to obtain property through direct purchase, easement, donation, or other means, in order to protect, enhance, or restore habitat functions and values.

Algae

small aquatic plants that occur as single cells, colonies or strands. Algae use carbon dioxide and nutrients such as nitrogen and phosphorus to make their own food through photosynthesis. Algae form the base of the aquatic food chain.

Algae bloom or algal bloom

the growth and rapid reproductions of algae caused by excess nutrients.. Algae blooms are dense mats on the surface of the water and can cause unpleasant conditions for swimmers or boaters.

Alternative wastewater treatment technologies

ecologically engineered systems that remove nutrients, solids, bacteria, and trace metals from wastewater, such as constructed wetlands and ponds containing aquatic plants that naturally filter wastewater.

Alternative watering systems

drinking water arrangements for farm animals such as a trough or tank served by a pipeline from a spring or well that keep livestock away from streambanks and riparian zones and out of streams and rivers.

Aquatic

growing in, living in, or dependent upon water.

B **arnyard runoff system**
an installed system for the interception, collection, and safe disposal of runoff water from a barnyard or concentrated feedlot.

Basin

the surrounding land that drains into a waterbody. For Lake Champlain, the land that drains through the many rivers and their tributaries into the Lake itself.

Benchmark

a standard against which the success of a program or action may be measured.

Best management practices (BMPs)

practices or activities that reduce the amount of pollution entering a body of water.

Bioaccumulation

the retention and buildup in the tissues of an organism from breathing contaminated air, drinking contaminated water, or eating contaminated food.

Biocriteria (biological criteria)

numerical or descriptive measures of the characteristics of a biological community. Biocriteria are used as an index of the health of the community.

Biodiversity

the variety of plants and animals, their genetic variabilities, and their interrelationships and ecological processes, including the communities and landscapes in which they exist.

Bioenergetic models

mathematical or conceptual illustrations of an ecosystem that account for all or some known characteristics of a food web. Bioenergetic models predict how changing one part of the food web affects the rest of the food web.

Bioenergetics

the study of energy flow through the food web.

Biological indicators (bioindicators)

biological characteristics at the cellular, organism, population, or community level that are representative of a given habitat or its ecological condition.

Biomagnification

the process whereby harmful substances become increasingly concentrated in tissues or internal organs of organisms with each step up the food chain.

Biota

the animal or plant life of a region.

Bioturbation

the stirring up of sediments caused by biological activity.

Blue-green algae/cyanobacteria

The most primitive group of algae, some of which produce natural toxins. No known human health problems have arisen in the US from these toxins. However, the USEPA is considering putting one of the toxins on its list of water contaminants.

Brownfields

abandoned, idled, or under-used industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination.

Buffer zones (strips)

protective land borders that reduce runoff and nonpoint source pollution loading to critical habitats or water bodies. Buffer zones lessen the negative effects of land development on animals and plants and their habitats.

C

arrying capacity

in recreation management, the amount of use a recreation area can sustain without deterioration of its quality. In wildlife management, the maximum number of animals an area can support. Carrying capacity depends upon the conditions of the habitat.

Catch basin

typically a human-made area that drains to a watercourse or waterbody.

Concentration

the amount of a material dissolved in a solution.

Contaminant

a substance that is not naturally present in the environment or is present in amounts that can adversely affect the environment.

Contamination

in water resources, the impairment of water quality by waste to a degree that creates a hazard to public health or living resources through poisoning or the spread of disease. Air and soil can also be contaminated in a similar way.

Cost-effective

in environmental policymaking, the least-cost means of achieving a predetermined environmental objective. Costs include long-term, short-term, direct, and indirect costs to producers, society, and the environment.

Cost-share

a method for sharing installation costs for conservation practices, including BMPs, between a governmental body (federal, state, local) and a farmer or landowner/land user.

Criterion

a standard, rule, or test by which something can be judged or its valued measured.

Critical habitat

any area which has unique or fragile natural, historic, geological, archeological, or wildlife value. Areas essential to the conservation of an officially listed endangered or threatened species and require special management considerations or protection are also critical habitats.

Cryptosporidium

a disease-causing microorganism found in water contaminated by fecal matter and that can cause stomach and intestinal illness when ingested.

Cultural eutrophication

eutrophication that is caused by additions of extra nutrients from human activities (see eutrophication).

Cultural heritage

historic and archeological past reflected in existing culture.

Cultural heritage resources

the physical record and memory of the past.

Cumulative impacts

environmental impacts that add up over time and space from a series of similar or related individual actions, contaminants, or projects. Although each action may seem to have a negligible impact, the combined effect can be severe.

D **atabase**
a collection of data arranged for ease and speed of retrieval.

Dioxin

any of a family of compounds known chemically as dibenzo-p-dioxins. Dioxins are sometimes generated by industrial processes, and can contaminate water and soil. Tests on laboratory animals indicate that it is one of the most toxic human-made chemicals known.

Drainage basin

land area from which water flows into a river or lake, either from streams, groundwater, or surface runoff (see Watershed).

E **assessment**
an agreement by which a landowner gives up or sells one of the rights on his/her property. For example, a landowner may donate a right of way across his/her property to allow community members access to the Lake.

Ecological communities

a group of interacting plants and animals inhabiting a given area.

Ecological integrity

a structurally sound and fully functional ecosystem. Such an ecosystem is self-maintaining and resilient when disturbed.

Ecologically sensitive areas

an area that is prone to disruption of the ecological processes if there is alteration of biotic or abiotic systems in the area. Also commonly used to mean any area that contains rare and endangered species.

Ecosystem

a group of plants and animals occurring together, and the physical environment with which they interact.

Ecosystem approach

a way of looking at socioeconomic and environmental information based on the boundaries of ecosystems, such as the Lake Champlain Basin, rather than based on town, city, and county boundaries.

Ecosystem-based management

an approach to making decisions based on the characteristics of the ecosystem. This style of management takes into consideration interactions between the plants, animals, and physical characteristics of the environment when making decisions about land use or living resource issues.

Elevated levels

levels that are higher than natural background levels for an area.

Endangered species

a species in immediate danger of becoming extinct.

End-of-pipe

at the point of discharge to the environment.

Erosion

the loosening and subsequent transport of soil away from its native site. Erosion often results from wind or the removal of vegetation, or the wearing away of the land surface by running water, wind, ice, or gravity.

Eutrophic

from Greek for “well-nourished.” It describes a lake with low water clarity and excessive plant growth caused by high concentrations of nutrients.

Eutrophication

the slow natural process of aging of a lake, estuary, or bay. Dissolved nutrients enter the waterbody, often leading to excess plant growth and decreased water quality. As the plants die, they are decomposed by microorganisms, which use up dissolved oxygen vital to other aquatic species, such as fish. Over very long periods of time, the decaying plant matter builds up and causes the lake to fill in to form a bog or marsh. Cultural eutrophication speeds up this natural process.

Exotic species

a species that is nonnative or that is introduced from another location.

Failed, failing, or faulty septic system
a septic system that releases untreated or inadequately treated wastewater to surface or groundwater by surfacing and overland flow of effluent or by subsurface percolation.

Fee title

indicates ownership of land.

Fishery

the act, process, occupation, or season for taking fish.

Fish passage facility

a structure that is built, installed, or established to help fish bypass impediments in a waterway.

Food web

the pattern of food consumption in a natural ecosystem. A food web is composed of many interconnecting food chains.

Furan

a colorless liquid, prepared from wood tar and used as a solvent for resins and plastics or as a tanning agent.

Geographic Information Systems (GIS)
a computer system that is used to compile, store, analyze, and display geographic and associated data tables. This system can be used to produce maps that overlay information layers of locations of various environmental and physical features.

Geomorphic assessment

an analysis of drainage patterns, river channels, floodplains, terraces, and other watershed features and how they have changed over time.

Geomorphology

is the study of surface forms of the earth and the processes that developed those forms.

Giardia

a protozoan which causes stomach and intestinal illness.

Grassland agriculture

the use of grass, legumes, and/or hay to achieve livestock dietary requirements without the need for corn silage.

Guidelines

standards or principles by which to make a judgement or determine a policy or course of action.

Habitat
the place where a particular type of plant or animal lives. An organism's habitat must provide all of the basic requirements for life and should be free of harmful contaminants.

Habitat conservation

the protection of plants and animals to habitat to ensure that the use of that habitat by the animals or plants is not altered or reduced.

Habitat corridor

a strip of habitat that joins two larger blocks of habitat and permits movement of wildlife during dispersal or migration, such as a wooded area along a river.

Habitat degradation

reduction of the quality of the environment in which an organism or biological population usually lives or grows.

Habitat restoration

the artificial manipulation of a habitat to restore it to its former condition.

Hazardous waste

any solid, liquid, or gaseous substance that is a by-product of society and classified under state or federal law as potentially harmful to human health or the environment. Hazardous wastes are subject to special handling, shipping, storage, and disposal requirements and possess at least one of the following four characteristics: ignitability, corrosivity, reactivity, or toxicity.

Health risks

anything which may reduce human health. Risks are ranked as high, moderate, or low.

Household hazardous waste

substances found in the home that contain hazardous materials. These substances should be disposed of properly to prevent pollution to the air, groundwater, and surface water.

Hydrodynamics

the study of how water flows from one area to another.

Infiltration

a process in which something passes into or through a substance by filtering or permeating, such as rainwater filtering through the soil to the roots of plants.

Institutional framework

formal and informal relationships among organizations, agencies, and individuals responsible for implementing the Plan.

Integrated crop management

an agricultural practice that uses a systems approach to manage the application of nutrients and pesticides in an efficient and environmentally sound manner to reduce pollution of water, land, or air and to preserve soil fertility.

Iterative process

a process that involves repetition and gradual refinement.

Invertebrate

small organisms, such as worms and clams, that do not have a backbone.

Lake Champlain Byways

a bistate program to implement a transportation corridor management plan that supports economic development and tourism infrastructure improvements within an historic and landscape context.

Land trusts

organizations dedicated to conserving land by purchasing land, receiving donations of land, or accepting conservation easements on land from landowners.

Load (also loading)

the amount of a material entering a system from all sources over a given time interval.

Load allocation

the maximum desirable pollutant load from one or more sources needed to meet desired load reduction.

Local watershed

in this Plan, any watershed within a sub-basin of Lake Champlain.

Manage
to control the movement or behavior of; to manipulate.

Management (natural resources management)

to make a conscious, deliberate decision on a course of action to conserve, protect, restore, enhance, or control natural resources, or to take no action.

Mass balance approach

an approach to managing chemicals that relies on balancing inputs and outputs.

Mesotrophic

a moderately nutrient-enriched lake, between oligotrophic and eutrophic.

Mitigation

actions taken to compensate for the negative effects of a particular project. Wetland mitigation usually takes the form of restoration or enhancement of a previously damaged wetland or creation of a new wetland.

Mitigation bank

credits and debits that account for habitat restoration, creation, or enhancement undertaken as mitigation prior to future development actions that will incur unavoidable habitat losses.

Multimedia reduction strategies

approaches to controlling toxic contaminants that prevent them from entering water, air, sediment, and biota.

Nongame species

wildlife species, such as songbirds and raptors, that are not commonly hunted, killed, or consumed by humans.

Nonnative

in this Plan, not originating naturally in the Lake Champlain Basin.

Nonpoint source pollution

nutrients or toxic substances that enter water from dispersed and uncontrolled sites, rather than through pipes. Sources of nonpoint source pollution include runoff from agricultural lands, urban and forest land, and on-site sewage disposal.

Nuisance species

species having adverse ecological and/or economic impacts.

Nutrient

a substance or ingredient that nourishes life. These are essential chemicals needed by plants or animals for growth. If other physical and chemical conditions are appropriate, excessive amounts of nutrients can lead to degradation of water quality by promoting excessive growth, accumulation, and subsequent decay of plants, especially algae. Some nutrients can be toxic to plants and animals at high concentrations.

Nutrient management

an integrated approach designed to maximize the efficient use of nutrients, particularly phosphorus, which is found in animal manure and fertilizer.

Oligotrophic
from the Greek for “poorly nourished” describes a lake with low plant growth and high clarity. Oligotrophic lakes contain little organic matter and have a high dissolved oxygen level.

Optimum sustainable yield

the amount of a natural resource harvested that is best economically for humans but that also ensures that the resource is not depleted.

Pathogens
organisms—usually viruses, bacteria, or fungi—capable of causing disease.

Perennial streams

streams where surface waters flow sufficiently to produce a defined channel year round.

Persistent contaminants

harmful compounds that do not readily degrade in the environment.

Phosphorus coefficient

an average value for the amount of phosphorus that runs off from a unit area per year. This number is used to estimate phosphorus loading from nonpoint pollution sources to waterbodies.

Phytoplankton

very small, free-floating plants found in waterbodies.

Point source pollution

nutrients or toxic substances that enter a waterbody from a specific entry point, such as a pipe. For example, the discharge from a sewage treatment plant is point source pollution.

Pollutant

something that pollutes.

Pollution

impairment of land, air, or water quality caused by agricultural, domestic, or industrial waste that negatively impacts beneficial uses of the land, air, or water or the facilities that serve such beneficial uses.

Pollution prevention

any action—such as the efficient use of raw materials, energy, and water—that reduces or eliminates the creation of pollutants. In the Pollution Prevention Act, pollution prevention is defined as source reduction (see source reduction).

Polychlorinated biphenyls

a group of manufactured chemicals—including about seventy different but closely related compounds made up of carbon, hydrogen, and chlorine—used in transformers and capacitors for insulating purposes. If released to the environment, PCBs do not break down for long periods and can biomagnify in food chains. PCBs are suspected of causing cancer in humans and other animals and are an example of an organic toxic chemical.

Polycyclic or polynuclear aromatic hydrocarbons

a class of complex organic compounds, some of which do not easily break down and may cause cancer. These compounds are formed from the combustion, or burning, of organic material and are widespread in the environment. PAHs are commonly formed by forest fires and by the combustion of gasoline and other petroleum products. They often reach the environment through atmospheric fallout and highway runoff.

Pond reclamation

the control or restoration of an unbalanced population of fish in a pond through the use of chemicals, nets, weirs, biological controls, regulations, or water-level control. The pond is then restocked with a balanced population of fish.

Population

the number of inhabitants in a country or region. In ecology, a population is a group of organisms of the same species living in a specified area and interbreeding.

Population of concern

a population that has been designated as one in distress or need of help.

Rare species

a species not presently in danger, but at risk because of low numbers.

Restoration

any action taken to repair, maintain, protect, and enhance the ecological integrity of the Basin.

Retrofitted stormwater management

the installation of best management practices (BMPs) in existing developed areas to improve water quality and lessen other negative impacts associated with urbanization.

Riparian (habitat or zone)

habitat occurring along rivers, streams, and creeks that provides for a high density, diversity, and productivity of plant and animal species.

Rotational grazing

a pasture management system that uses several paddocks during a grazing season, alternating paddocks to allow for forage regrowth. Livestock generally graze for less than a week before being rotated to another paddock. This system improves vegetative cover and reduces erosion and nutrient runoff.

Runoff

water from rain, melted snow, or agricultural or landscape irrigation that flows over the land surface into a waterbody.

Sale of development rights

the process of selling the legal right to develop a parcel of land.

Salmonids

a member of the family Salmonidae, which includes salmon, trout, and whitefishes.

Scenic byway

a transportation route and adjacent area of particular scenic, historic, recreational, cultural, and archeological value that is managed to protect such values and encourage economic development through tourism and recreation.

Sedimentation

the deposition or accumulation of sediment, such as sand, silt, or clay.

Sites of concern

areas where toxic substances are found in concentrations greater than acceptable levels, or where several toxic substances are found together.

Source reduction

any practice that reduces the amount of any hazardous substance, pollutant, or contaminant entering wastewater. Source reduction decreases the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants. Technology modifications, process or procedure modifications, reformulation or redesign of products, substitution of raw materials, and improvements in housekeeping, maintenance, training, or inventory control are all examples of source reduction.

Spoil sites

places where waste material is deposited.

Sprawl

low density development outside compact urban and village centers, along highways, and in the rural countryside.

Stewardship

caretaking based on the premise that we do not own resources, but are managers of resources and are responsible to future generations for their condition.

Stormwater runoff

precipitation running off saturated soils and impervious surfaces, such as paved parking lots, streets, or roofs.

Stream flow management regimes

different management scenarios of stream flow past a dam, including management of the upstream impoundment and the flows downstream. Each management scenario selected has positive effects on some fish and wildlife species and negative effects on others.

Sub-basin

a smaller drainage area within a large drainage basin, such as the Saranac River sub-basin of the Lake Champlain Basin. In this Plan, “sub-basin” refers to one of the thirty-four drainage areas (larger than 26 sq. km.) to Lake Champlain.

Surface water conveyance

a mechanism for transporting water from one point to another, such as pipes, ditches, and channels. Or the drainage facilities, both natural and human-made, that collect and provide for the flow of surface water and stormwater from the highest points on the land down to a receiving water. Natural systems include swales or a wetland streams and human-made systems include gutters, ditches, pipes.

Sustainable tourism

see Carrying capacity.

Sustainable yield

the amount of harvest of a natural resource able to be maintained over a long period of time with no destruction of the productivity of the resource.

Terrestrial species

species that live on the ground rather than in the water.

Threatened areas

areas that in imminent danger of being degraded by pollution.

Threatened species

a species with a high possibility of becoming endangered in a short period of time.

Total Maximum Daily Load

the maximum amount (load) of a single pollutant from all contributing point and nonpoint sources that a waterbody can receive and still meet water quality standards.

Toxic

poisonous, carcinogenic, or otherwise directly harmful to life.

Toxic substances

any substance which upon exposure, ingestion, inhalation, or assimilation into any organism causes death, disease, genetic mutations, physiological malfunctions, or physical deformation. Examples of toxic substances are cyanides, phenols, pesticides, and heavy metals.

Tributary

a stream or river that flows into a larger stream, river, or lake.

Urban runoff

stormwater from city streets and adjacent domestic or commercial properties that may carry pollutants of various kinds into the sewer systems and/or receiving waters.

Waste Exchange

any transaction whereby the waste of one person's, business, or industry become the raw materials for another person's, business, or industry.

Watershed

the geographic reach within which water drains into a particular river, stream, or body of water. A watershed includes both the land and the body of water into which the land drains.

Watershed association

a citizen-based group interested in protecting a nearby waterway and its surrounding drainage area.

Watershed planning

cooperative local and regional land use planning that recognizes watershed boundaries rather than political boundaries and considers water resources management the central planning objective.

Wet ponds

a human-made basin with a permanent pool of water.

Wetland enhancement

to make a wetland more complete (see wetlands).

Wetland restoration

any action that aids in preserving, repairing, maintaining, or enhancing wetlands (see wetlands).

Wetlands

lands that are transitional between land and water where the water table is usually at or near the surface of the land. Wetlands are characterized by unique hydric soils and contain plant and animal communities adapted to aquatic or intermittently wet conditions. Swamps, bogs,

wet meadows, and marshes are examples of wetlands. The boundary of Lake Champlain wetlands has been defined at 105 feet (31.1 meters) above mean sea level.

Wildlife

for the purposes of this Plan, "wildlife" includes any nondomesticated mammal, fish, bird, amphibian, reptile, mollusk, crustacean, arthropod, or other invertebrate or plant.

Willing seller basis

when a landowner of land volunteers to participate in a land purchase or acquisition.

LIST OF ACRONYMS

AAC	Agricultural Advisory Council	NPDES	National Pollutant Discharge Elimination System	UNESCO	United Nations Education, Scientific, and Cultural Organization
AEM	Agricultural Environmental Management	NPS	National Park Service	USACOE	United States Army Corps of Engineers
AMPs	Acceptable Management Practices	NRCD	Natural Resource Conservation District	USDA	United States Department of Agriculture
APA	Adirondack Park Agency	NRCS	Natural Resources Conservation Service	USDOI	United States Department of the Interior
ARS	Agricultural Research Service	NWI	National Wetlands Inventory	USEPA	United States Environmental Protection Agency
ASCS	Agricultural Stabilization and Conservation Service	NYSCC	New York State Canal Corporation	UNESCO	United Nations Education, Scientific, and Cultural Organization
BMPs	Best Management Practices	NYSDAM	New York State Department of Agriculture and Markets	USFDA	United States Food and Drug Administration
CACs	Citizens Advisory Committees	NYSDEC	New York State Department of Environmental Conservation	USFS	United States Forest Service
CAFOs	Concentrated Animal Feeding Operations	NYSDOH	New York State Department of Health	USFWS	United States Fish and Wildlife Service
CHRA	Cultural Heritage and Recreation Advisory Committee	NYSDOT	New York State Department of Transportation	USGS	United States Geological Survey
CNMP	Comprehensive Nutrient Management Planning	NYSOPRHP	New York State Office of Parks, Recreation, and Historic Preservation	VCGI	Vermont Center for Geographic Information
CMAs	Crop Management Associations	NYSSWCC	New York State Soil and Water Conservation Committee	VHCB	Vermont Housing Conservation Board
CREPs	Conservation Reserve Enhancement Programs	PAH	Polycyclic aromatic hydrocarbon	VNRC	Vermont Natural Resources Council
CWA	Clean Water Act	PCB	Polychlorinated biphenyl	VOCs	Volatile organic compounds
E&O	Education and Outreach	QC MAPAQ	Ministry of Agriculture, Fisheries & Food of Québec/Ministère de L'Agriculture, des Pêcheries et de L'Alimentation du Québec	VTACCD	Vermont Agency of Commerce and Community Development
EMAP	Environmental Monitoring and Assessment Program	QC MENV	Ministry of the Environment of Québec /Ministère de L'Environnement du Québec	VTANR	Vermont Agency of Natural Resources
EQIP	Environmental Qualities Incentives Program	QC MNR	Ministry of Natural Resources of Québec/ Ministère des Ressources Naturelles du Québec	VTDAFM	Vermont Department of Agriculture, Food and Markets
FHA	Farmers Home Administration	QC RRSSS	Regional Health and Social Services Office/Régie Régionale de la Santé et des Services Sociaux	VTDEC	Vermont Department of Environmental Conservation
FHWA	Federal Highways Administration	QC SFP	Society of Wildlife and Parks of Québec/Société de la Faune et des Parcs du Québec	VTDFPR	Vermont Department of Forests, Parks and Recreation
FSA	Farm Services Agency	RIBS	Rotating Intensive Basin Studies	VTDHP	Vermont Division for Historic Preservation
GIS	Geographic Information Systems	RMO	Regional Marketing Organization	VTDOH	Vermont Department of Health
HPF	Historic Preservation Fund	RPC	Regional Planning Commission	VTFWD	Vermont Fish and Wildlife Department
HUD	United States Department of Housing and Urban Development	SCS	Soil Conservation Service	VTRANS	Vermont Agency of Transportation
IJC	International Joint Commission	SDWA	Safe Drinking Water Act		
ISTEA	Intermodal Surface Transportation Efficiency Act	SEIS	Supplemental Environmental Impact Statement		
LCB	Lake Champlain Bikeways	SPDES	State Pollutant Discharge Elimination System (New York)		
LCBP	Lake Champlain Basin Program	SWCD	Soil and Water Conservation District		
LCC	Lake Champlain Committee	TAC	Technical Advisory Committee		
LCFWMC	Lake Champlain Fish and Wildlife Management Cooperative	TNC	The Nature Conservancy		
LCMC	Lake Champlain Management Conference				
LCMM	Lake Champlain Maritime Museum				
LCRC	Lake Champlain Research Consortium				
NBS	National Biological Service				
NEIWPCC	New England Interstate Water Pollution Control Commission				
NEPA	National Environmental Policy Act				
NOAA	National Oceanographic and Atmospheric Administration				

PUBLIC LAW 101-596 - NOV. 16, 1990

TITLE III - LAKE CHAMPLAIN

SHORT TITLE

Sec. 301 This title may be cited as the "Lake Champlain Special Desination Act of 1990"

DEMONSTRATION PROGRAM

Sec. 302 Paragraph (2) of scetion 314(d) of the Federal Water Pollution Control Act (33 U.S.C. 1324(d) is amneded by inserting "Lake Champlain, New York and Vermont;" before "Lake Houston, Texas"

LAKE CHAMPLAIN MANAGEMENT CONFERENCE

"Sec. 1270. (a) ESTABLISHMENT.—There is established a Lake Champlain Management Conference to develop a comprehensive pollution prevention, control, and restoration plan for Lake Champlain. The Administrator shall convene the management conference within ninety days of November 16, 1990.

"(b) MEMBERSHIP.—The Members of the Management Conference shall be comprised of.—

- "(1) the Governors of the States of Vermont and New York;
- "(2) each interested Federal agency, not to exceed a total of five members;
- "(3) the Vermont and New York Chairpersons of the Vermont, New York, Quebec Citizens Advisory Committee for the Environmental Management of Lake Champlain;
- "(4) four representatives of the State legislature of Vermont;
- "(5) four representatives of the State legislature of New York;
- "(6) six persons representing local governments having jurisdiction over any land or water within the Lake Champlain basin, as determined appropriate by the Governors; and
- "(7) eight persons representing affected industries, nongovernmental organizations, public and private educational institutions, and the general public, as determined appropriate by the trigovernmental Citizens Advisory Committee for the Environmental Management of Lake Champlain, but not to be current members of the Citizens Advisory Committee.

"(c) TECHNICAL ADVISORY COMMITTEE.— (1) The Management Conference shall, not later than one hundred and twenty days after November 16, 1990, appoint a Technical Advisory Committee.

"(2) Such Technical Advisory Committee shall consist of officials of: appropriate departments and agencies of the Federal Government; the State governments of New York and Vermont; and governments of political subdivisions of such States; and public and private research institutions.

"(d) RESEARCH PROGRAM.— (1) [1] The Management Conference shall establish a multi-disciplinary environmental research program for Lake Champlain. Such research program shall be planned and conducted jointly with the Lake Champlain Research Consortium. [1] So in original. Subsec. (d) enacted without a par.

"[1] The Management Conference shall establish a

"(e) POLLUTION PREVENTION, CONTROL, AND RESTORATION PLAN.— (1) Not later than three years after November 16, 1990, the Management Conference shall publish a pollution

prevention, control, and restoration plan (hereafter in this section referred to as the 'Plan') for Lake Champlain.

"(2) The Plan developed pursuant to this section shall—

"(A) identify corrective actions and compliance schedules addressing point and nonpoint sources of pollution necessary to restore and maintain the chemical, physical, and biological integrity of water quality, a balanced, indigenous population of shellfish, fish and wildlife, recreational, and economic activities in and on the lake;

"(B) incorporate environmental management concepts and programs established in State and Federal plans and programs in effect at the time of the development of such plan;

"(C) clarify the duties of Federal and State agencies in pollution prevention and control activities, and to the extent allowable by law, suggest a timetable for adoption by the appropriate Federal and State agencies to accomplish such duties within a reasonable period of time;

"(D) describe the methods and schedules for funding of programs, activities, and projects identified in the Plan, including the use of Federal funds and other sources of funds; and

"(E) include a strategy for pollution prevention and control that includes the promotion of pollution prevention and management practices to reduce the amount of pollution generated in the Lake Champlain basin.

"(3) The Administrator, in cooperation with the Management Conference, shall provide for public review and comment on the draft Plan. At a minimum, the Management Conference shall conduct one public meeting to hear comments on the draft plan in the State of New York and one such meeting in the State of Vermont.

"(4) Not less than one hundred and twenty days after the publication of the Plan required pursuant to this section, the Administrator shall approve such plan if the plan meets the requirements of this section and the Governors of the States of New York and Vermont concur.

"(5) Upon approval of the plan, such plan shall be deemed to be an approved management program for the purposes of section 1329(h) of this title and such plan shall be deemed to be an approved comprehensive conservation and management plan pursuant to section 1330 of this title.

"(f) GRANT ASSISTANCE— (1) The Administrator may, in consultation with the Management Conference, make grants to State, interstate, and regional water pollution control agencies, and public or nonprofit agencies, institutions, and organizations.

"(2) Grants under this subsection shall be made for assisting research, surveys, studies, and modeling and technical and supporting work necessary for the development of the Plan and for retaining expert consultants in support of litigation undertaken by the State of New York and the State of Vermont to compel cleanup or obtain cleanup damage costs from persons responsible for pollution of Lake Champlain.

"(3) The amount of grants to any person under this subsection for a fiscal year shall not exceed 75 per centum of the costs of such research, survey, study and work and shall be made available on the condition that non-Federal share of such costs are provided from non-Federal sources.

"(4) The Administrator may establish such requirements for the administration of grants as he determines to be appropriate.

"(g) "LAKE CHAMPLAIN DRAINAGE BASIN" DEFINED— For the purposes of this section, the term "Lake Champlain drainage basin" means all or part of Clinton, Franklin, Warren, Essex, and Washington counties in the State of New York and all or part of Franklin,

Grand Isle, Chittenden, Addison, Rutland, Lamoille, Orange, Washington, Orleans, and Caledonia counties in Vermont, that contain all of the streams, rivers, lakes, and other bodies of water, including wetlands, that drain into Lake Champlain.

“(h) STATUTORY INTERPRETATION— Nothing in this section shall be construed so as to affect the jurisdiction or powers of—

“(1) any department or agency of the Federal Government or any State government; or

“(2) any international organization or entity related to Lake Champlain created by treaty or memorandum to which the United States is a signatory.

“(i) AUTHORIZATION— There are authorized to be appropriated to the Environmental Protection Agency to carry out this section \$2,000,000 for each of fiscal years 1991, 1992, 1993, 1994, and 1995.

Notes on Title 33, Section 1270

SOURCE

(June 30, 1948, ch. 758, title I, Sec. 120, as added Nov. 16, 1990, Pub. L. 101-596, title III, Sec. 303, 104 Stat. 3006.)

FEDERAL PROGRAM COORDINATION

Section 304 of Pub. L. 101-596, as amended by Pub. L. 104-127, title III, Sec. 336(a)(2)(F), Apr. 4, 1996, 110 Stat. 1005, provided that: “(a) Designation of Lake Champlain as a Priority Area Under the Environmental Quality Incentives Program—

(1) IN GENERAL.—Notwithstanding any other provision of law, the Lake Champlain basin, as defined under section 120(h) of the Federal Water Pollution Control Act (33 U.S.C. 1270(h)), shall be designated by the Secretary of Agriculture as a priority area under the environmental quality incentives program established under chapter 4 of subtitle D of title XII of the Food Security Act of 1985 (16 U.S.C. 3839aa et seq.).

(2) TECHNICAL ASSISTANCE REIMBURSEMENT.— To carry out the purposes of this subsection, the technical assistance reimbursement from the Agricultural Stabilization and Conservation Service authorized under the Soil Conservation and Domestic Allotment Act (16 U.S.C. 590a et seq.), shall be increased from 5 per centum to 10 per centum.

(3) COMPREHENSIVE AGRICULTURAL MONITORING.—The Secretary, in consultation with the Management Conference and appropriate State and Federal agencies, shall develop a comprehensive agricultural monitoring and evaluation network for all major drainages within the Lake Champlain basin.

(4) ALLOCATION OF FUNDS.—In allocating funds under this subsection, the Secretary of Agriculture shall consult with the Management Conference established under section 120 of the Federal Water Pollution Control Act and to the extent allowable by law, allocate funds to those agricultural enterprises located at sites that the Management Conference determines to be priority sites, on the basis of a concern for ensuring implementation of nonpoint source pollution controls throughout the Lake Champlain basin.

(b) COOPERATION OF THE UNITED STATES GEOLOGICAL SURVEY OF THE DEPARTMENT OF THE INTERIOR.—For the purpose of enhancing and expanding basic data collection and monitoring in operation in the Lake Champlain basin, as defined under section 120 of the Federal Water Pollution Control Act (33 U.S.C. 1270), the Secretary of the Interior, acting through the heads of water resources divisions of the New York and New England districts of the United States Geological Survey, shall—

(1) in cooperation with appropriate universities and private research institutions, and the appropriate officials of the appropriate departments and agencies of the States of New York and Vermont, develop an integrated geographic information system of the Lake Champlain basin;

(2) convert all partial recording sites in the Lake Champlain basin to continuous monitoring stations with full gauging capabilities and status; and

(3) establish such additional continuous monitoring station sites in the Lake Champlain basin as are necessary to carry out basic data collection and monitoring, as defined by the Secretary of the Interior, including groundwater mapping, and water quality and sediment data collection’

(c) COOPERATION OF THE UNITED STATES FISH AND WILDLIFE SERVICE OF THE DEPARTMENT OF THE INTERIOR—

(1) RESOURCE CONSERVATION PROGRAM.—The Secretary of the Interior, acting through the United States Fish and Wildlife Service, in cooperation with the Lake Champlain Fish and Wildlife Management Cooperative and the Management Conference established pursuant to this subsection shall—

(A) establish and implement a fisheries resources restoration, development and conservation program, including dedicating a level of hatchery production within the Lake Champlain basin at or above the level that existed immediately preceding the date of enactment of this Act (Nov. 16, 1990); and

(B) conduct a wildlife species and habitat assessment survey in the Lake Champlain basin, including—

(i) a survey of Federal threatened and endangered species, listed or proposed for listing under the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.), New York State and State of Vermont threatened and endangered species and other species of special concern, migratory nongame species of management concern, and national resources plan species;

(ii) a survey of wildlife habitats such as islands, wetlands, and riparian areas; and

(iii) a survey of migratory bird populations breeding, migrating and wintering within the Lake Champlain basin.

(2) To accomplish the purposes of paragraph (1), the Director of the United States Fish and Wildlife Service is authorized to carry out activities related to—

(A) controlling sea lampreys and other nonindigenous aquatic animal nuisances;

(B) improving the health of fishery resources; ‘

(C) conducting investigations about and assessing the status of fishery resources, and disseminating that information to all interested parties; and

(D) conducting and periodically updating a survey of the fishery resources and their habitats and food chains in the Lake Champlain basin.

(d) AUTHORIZATIONS.—(1) There is authorized to be appropriated to the Department of Agriculture \$2,000,000 for each of fiscal years 1991, 1992, 1993, 1994, and 1995 to carry out subsection (a) of this section.

(2) There is authorized to be appropriated to the Department of (the) Interior \$1,000,000 for each of fiscal years 1991, 1992, 1993, 1994, and 1995 to carry out subsections (b) and (c) of this section.

One Hundred Seventh Congress of the United States of America

AT THE SECOND SESSION

Began and held at the City of Washington on Wednesday,
the twenty-third day of January, two thousand and two

An Act

To amend the Federal Water Pollution Control Act to authorize the Administrator of the Environmental Protection Agency to carry out projects and conduct research for remediation of sediment contamination in areas of concern in the Great Lakes, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE; TABLE OF CONTENTS.

(a) SHORT TITLE- This Act may be cited as the "Great Lakes and Lake Champlain Act of 2002".

TITLE II--LAKE CHAMPLAIN

SEC. 201. SHORT TITLE.

This title may be cited as the "Daniel Patrick Moynihan Lake Champlain Basin Program Act of 2002".

SEC. 202. LAKE CHAMPLAIN BASIN PROGRAM.

Section 120 of the Federal Water Pollution Control Act (33 U.S.C. 1270) is amended--

(1) by striking the section heading and all that follows through "There is established" in subsection (a) and inserting the following:

"SEC. 120. LAKE CHAMPLAIN BASIN PROGRAM.

"(a) ESTABLISHMENT-

"(1) IN GENERAL- There is established";

(2) in subsection (a) (as amended by paragraph (1)), by adding at the end the following:

"(2) IMPLEMENTATION- The Administrator--

"(A) may provide support to the State of Vermont, the State of New York, and the New England Interstate Water Pollution Control Commission for the implementation of the Lake Champlain Basin Program; and

"(B) shall coordinate actions of the Environmental Protection Agency under subparagraph (A) with the actions of other appropriate Federal agencies.";

(3) in subsection (d), by striking "(1)";

(4) in subsection (e)--

(A) in paragraph (1), by striking "hereafter in this section referred to as the 'Plan'"; and

(B) in paragraph (2)--

(i) in subparagraph (D), by striking "and" at the end;

(ii) in subparagraph (E), by striking the period at the end and inserting: "and"; and

(iii) by adding at the end the following:

"(F) be reviewed and revised, as necessary, at least once every 5 years, in consultation with the Administrator and other appropriate Federal agencies.";

(5) in subsection (f)--

(A) in paragraph (1), by striking "the Management Conference," and inserting "participants in the Lake Champlain Basin Program,"; and

(B) in paragraph (2), by striking "development of the Plan" and all that follows and inserting "development and implementation of the Plan";

(6) in subsection (g)--

(A) by striking "(g)" and all that follows through "the term" and inserting the following:
"(g) DEFINITIONS- In this section:

"(1) LAKE CHAMPLAIN BASIN PROGRAM- The term 'Lake Champlain Basin Program' means the coordinated efforts among the Federal Government, State governments, and local governments to implement the Plan.

"(2) LAKE CHAMPLAIN DRAINAGE BASIN- The term--

(B) in paragraph (2) (as designated by subparagraph (A))--

(i) by inserting "Hamilton," after "Franklin,"; and

(ii) by inserting "Bennington," after "Rutland,"; and

(C) by adding at the end the following:

"(3) PLAN- The term 'Plan' means the plan developed under subsection (e).";

(7) by striking subsection (h) and inserting the following:

"(h) NO EFFECT ON CERTAIN AUTHORITY- Nothing in this section--

"(1) affects the jurisdiction or powers of--

"(A) any department or agency of the Federal Government or any State government; or

"(B) any international organization or entity related to Lake Champlain created by treaty or memorandum to which the United States is a signatory;

"(2) provides new regulatory authority for the Environmental Protection Agency; or

"(3) affects section 304 of the Great Lakes Critical Programs Act of 1990 (Public Law 101-596; 33 U.S.C. 1270 note)."; and

(B) in subsection (i)--

(A) by striking "section \$2,000,000" and inserting "section--



"(1) \$2,000,000";

(B) by striking the period at the end and inserting a semicolon; and

(C) by adding at the end the following:

"(2) such sums as are necessary for each of fiscal years 1996 through 2003; and

"(3) \$11,000,000 for each of fiscal years 2004 through 2008.";


Speaker of the House of Representatives

Vice President of the United States and
President of the Senate pro tempore

APPROVED

NOV 27 2002



UNITED STATES SENATE

WASHINGTON DC 20510

**LAKE CHAMPLAIN SPECIAL DESIGNATION ACT
STATEMENT OF LEGISLATIVE INTENT**

Three short years ago we began our efforts to create the "Lake Champlain Special Designation Act." Through speeches, hearings, mark-ups and floor statements, each one of us has made recommendations that would ultimately lead to this all encompassing effort. The legislative history reflects the comments and concerns of residents, governmental agencies and Congressional colleagues.

As the Lake Champlain Management Conference embarks on its historic first meeting, we would like to summarize the history and intent of the federal legislation establishing the Conference. As the sponsors of the legislation in the U.S. Senate, we have drawn upon our own recollections and records in order to convey the sense of purpose which led to this Act being passed by Congress and signed into law by President Bush.

While the desire to achieve and maintain good water quality is an overriding concern, the issues surrounding the Lake Champlain basin are much more comprehensive and complex than can be described by mere chemical and physical measurements. And while it may have been the abundance of fish life in the lake that first attracted native Americans, it was along the shore that they would live, and it was also from the woods and hills that they would take their food. Later, as European settlers migrated from the south and from the north, the lake would provide the highway, while the land held the natural resources to transform explorers into settlers. Today, it is the lake which provides the drinking water, but it is the land within the basin which hosts the communities, be they Vermonters, New Yorkers or Canadians.

It is important that the Management Conference look beyond aspects of water quality and address all issues affecting the lake. As one Vermonter put it, "we want it all -- jobs, recreation, and environmental integrity." To meet this vision, it is important that the Management Conference be inclusive rather than exclusive in drawing up its list of issues to be addressed. The Lake Champlain Special Designation Act envisions that all aspects of human and ecological life within the basin be maintained in harmony with one another.

The significance of the Lake Champlain basin is underscored by its recent designation, by the United Nations Educational, Scientific and Cultural organization, as an International Biosphere Reserve. The historic Memorandum of Understanding on the management of Lake Champlain, signed August 23, 1988 by the Governors of Vermont and New York and the Premier of Quebec, speaks of "Lake Champlain and its watershed." And so the legislation envisions a Geographic scope to include the basin as a whole, from the spine of the Adirondacks to that of the Green Mountains; from the swift-flowing trout streams in the south to the fertile farm lands to the north.

The focal point of the Lake Champlain Special Designation Act is the convening of the Lake Champlain Management Conference to develop a comprehensive Pollution Prevention, Control and Restoration Plan. The Conference, to be staffed by personnel of EPA Regions I and II, will be broadly representative of the many parties having an interest in the welfare of the basin. We expect that once the appointments are complete, the principle of broad representation will be upheld.

The Management Conference is charged with selecting a technical advisory committee and establishing a multi-disciplinary environmental monitoring and research program. Within three years of enactment, the Conference will produce its master Plan, which will detail pollution prevention and control strategies; clarify the duties of various state and federal agencies in implementing the strategies; identify corrective actions and compliance schedules; and coordinate federal, state and private funding for carrying out these actions and schedules.

The composition of the Management Conference speaks of the breadth of involvement necessary to coordinate local, state and federal actions. Members of the Conference include citizens, legislators, regulators, researchers and educators. State and federal agencies are to be involved, as are local farmers, fishermen and businessmen. That the legislation envisioned a strong citizens role is evidenced by the statutory inclusion of a Citizens Advisory Committee. We strongly support the current CAC, and the Act is intended to reinforce, not replace, its function. This is particularly true in the area of public outreach and education.

Because the federal government must marshal its resources to consolidate and coordinate activities, the Environmental Protection Agency is given the lead management role, with specific tasks assigned to it and the Departments of Agriculture and Interior. These agencies will work together with State governments, local communities, academic institutions, and the public to develop a plan for pollution research, prevention, management and control.

Much research on Lake Champlain has already been done, although in various formats. Yet, a continuous, comprehensive data base does not exist. In formulating a comprehensive research program, the management Conference is encouraged to identify and use existing research projects and data bases, identify research needs, and establish a comprehensive data base to meet the objectives of the Act.

In addition to the activities outlined in the development of a Pollution Prevention, Control, and Restoration-Plan under Section 120(e), the Management Conference should also examine the impact of growth and development on water quality in the basin, and examine the impact of water quality degradation, as well as mitigation efforts, on cultural resources that are an important part of the region's history.

Some components of the Plan already exist or will be completed soon. As with the research program, these existing efforts should be used in the Management Conference's deliberations and incorporated into the final plan to avoid duplication of efforts and unnecessary expenditures. For example, Vermont was among the first states to have its Non-point Source Management Program approved by EPA, and New York and Vermont are currently conducting a basin-wide phosphorus management program with assistance from EPA.

The Act envisions that the EPA Administrator will make staff available to the Lake Champlain Management Conference, with at least one from Region I and one from Region II. Ideally, these staff persons will be located within the basin in order to conduct regular and periodic meetings with members of the Management Conference, the Citizens Advisory Committee, the Technical Advisory Committee, the Research Consortium and other interested parties.

The Administrator is authorized to make grants to public and private agencies and organizations for the purpose of supporting work necessary for the development of the Plan, and to maintain long-term research efforts necessary to establish a comprehensive data base for the Lake Champlain basin. The Administrator is to consult with the Technical Advisory Committee and the Lake Champlain Research Consortium in developing a multi-disciplinary environmental research program for the basin, giving priority to initiatives recommended by these groups.

In issuing grants to non-federal organizations, the Administrator may fund demonstration and pilot projects for purposes of assessing the feasibility of such projects as mitigation techniques. The Administrator may also fund joint requests by the States of New York and Vermont.

Funds appropriated to the EPA should be evenly distributed on an annual basis between the Management Conference, Grant Program and Research Program. It is recognized, however, that appropriations distributions will, and in some cases should, vary to meet annual priorities within these program areas.

The Lake Champlain Special Designation Act designates the lake basin as a Special Project Area under the Agriculture Conservation Program. While attention should be given to the basin as a whole, current projects conducted by the Department of Agriculture which have proven to be successful in reducing phosphorus and nonpoint sources of pollution should be continued. The Act seeks to enhance, not replace, such efforts.

In order to expand monitoring efforts within the basin, we believe the Secretary of Agriculture should develop a comprehensive monitoring and evaluation network for all major drainages within the basin. Whenever practical, monitoring and associated research shall be developed and conducted jointly with existing efforts in the basin.

The Act also provides for Department of Interior programs. Although the U.S. Geological Survey and Fish and Wildlife Service have limited new authorities, we have always envisioned a much greater effort is needed and should be addressed by the Management Conference. If the Conference identifies areas where state or federal agencies are limited by their current authorities, the Plan should recommend amendments to be pursued by state and federal representatives.

The Secretary of the Interior, acting through the heads of the water resources divisions, should develop an integrated geographic information system (GIS) for the basin. Whenever practical, monitoring and associated research should be developed and conducted jointly with extension efforts within the basin.

Lake Champlain played an essential role in the War of Independence and then in the War of 1812. The lake and its basin hold important regional and national significance. Within this historical archeological context, the Department of Interior plays an important role in protecting cultural resources. The Secretary of the Interior, acting through the National Park Service, is encouraged to consult with the management Conference in carrying out historic preservation and natural landmark programs with the basin. Of special interest is the survey and inventory of lakeshore and underwater historical and archeological resources.

In order to improve and maintain the health of wildlife and fishery resources within the basin, the Fish and Wildlife Service should expand its efforts there. Special attention should be given to threatened and endangered species and their habitats, and to migratory species. Recognizing that aquatic nuisance species are causing great damage to the fishery resources in the basin, the Secretary of the Interior is given clear authority to conduct lamprey control activities and other salmonid restoration work. The secretary should also use, as appropriate, equipment purchased with funds provided through the Great Lakes Fishery Commission.

We also note that appropriated funds for the Department of the Interior should be judiciously distributed between the Geological Survey and the Fish and Wildlife Service, including consideration for the Cooperative Research Unit, and based on annual needs and the priorities of the Management Conference. We intend that funds would be made available by the E.P.A. to the U.S. Corps of Engineers to enable it to provide technical assistance in areas that the Management Conference deems appropriate.

Today, New Yorkers and Vermonters are embarking on one of the nation's first all-encompassing pollution prevention efforts. Again, we ask that the Conferees think comprehensively. The resources of the Lake Champlain basin -- human, cultural and natural -- are precious commodities. We are honored to have helped establish this cooperative Management Conference, and look forward to actions and recommendations to promote a healthier Lake Champlain.

Signed by Senators:

Patrick J. Leahy (VT)
James M. Jeffords (VT)
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November, 1990

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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.

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(b) Handbook of GIS Standards and Procedures for the Lake Champlain Basin Program. Vermont Center for Geographic Information, Inc. March 1993.

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10) A Sustainable Working Forest and Competitive Wood Products Industry. Economic Development Council of Northern Vermont, Inc. July 1997.

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2) Public Input in the Lake Champlain Basin. Results of a series of Public Input Meetings. April-May, 1993. Education & Outreach Committee. October 1993.

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3) Lake Champlain Recreation - User Surveys. Kelly Dziekan. 1995.

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2) 1991-2000 Annual, State of the Lake, and Progress Reports. Lake Champlain Basin Program.

3) Casin' the Basin. Lake Champlain Basin Program Newsletter, 1992-present.

4) Fact Sheet Series 1-6. Lake Champlain Basin Program.

5) Lake Champlain Basin Atlas. Northern Cartographic and Lake Champlain Basin Program. Fall 1999. CD-ROM update issued May 2002.

6) Lake Champlain Wayside Exhibit Manual. Lake Champlain Basin Program. Summer 2001.

7) Nonpoint Source Pollution Posters.. Series of four posters. Lake Champlain Basin Program. Summer 2001.

How to Obtain LCBP Publications

The above publications are all available from the LCBP (with exceptions noted). Contact the LCBP to order by calling (800) 468-5227 (NY & VT) or (802) 372-3213. An up-to-date list of reports is maintained on the LCBP website, www.lcbp.org/reports.htm. Some publications, such as *Opportunities for Action*, the *Casin' the Basin* newsletter, fact sheets, and recent annual reports are also available electronically on the website.

A Process for Developing Phosphorus Loading Targets for Lake Champlain

June 6, 1996

- USEPA, NYSDEC, and VTDEC agree that Lake Champlain is a priority watershed for protection.
- USEPA, NYSDEC, and VTDEC accept the interim management goals specified in the 1993 "New York - Quebec - Vermont Water Quality Agreement: In-Lake Phosphorus Criteria" as suitable goals for developing phosphorus loading targets for Lake Champlain. The goals may be revised in the future, as appropriate, based on new information.
- USEPA, NYSDEC, and VTDEC accept the Lake Champlain Diagnostic-Feasibility Study model as a suitable tool for developing interim phosphorus loading targets, by state, by contributing watershed. USEPA, NYSDEC, and VT DEC will develop a program to enhance the model and to revise/finalize the phosphorus loading targets, as necessary, within five years.
- USEPA, NYSDEC, and VTDEC will proceed as follows to develop total phosphorus loading targets by state, by contributing watershed:

1) Establish individual, allowable point source loads using the following procedure: For all facilities, the point source target values are calculated using either the permitted flow or 1.5 times the current (1995) flow, whichever is less. For facilities that are affected by the 0.8 mg/L policy (i.e. non-lagoon plants larger than 200,000 gallons per day permitted flow), the load targets are calculated using the minimum of either the current (1995) concentration or 0.8 mg/L. For facilities that are not affected by the 0.8 mg/L policy, the load targets are calculated using the current concentration.

2) Establish allowable nonpoint source loads by state, by contributing watershed, using the minimum cost optimization procedure.

3) Establish preliminary total phosphorus loading targets by state, by contributing watershed, by summing the allowable point and nonpoint source loads established in (1) and (2) above, as listed in Table 21. The watershed of Missisquoi Bay is shared by Vermont and the Province of Quebec, and the responsibility for attaining the necessary phosphorus reductions in Missisquoi Bay should also be shared. Vermont will seek an agreement with the Province of Quebec to achieve a target load of 109.7 mt/yr.

4) Allow each state the opportunity to adjust its total loading targets by contributing watersheds as it sees fit, as long as the adjusted loads continue to meet the in-lake phosphorus concentration goals.

During this step each state would keep the other state's allowable loads fixed as in (3) above.

The adjusted loads for each state would then be checked together to ensure that the in-lake goals are achieved.

5) Each state will commit to reduce the differences between existing (1995) loads by contributing watershed, and loading targets by contributing watershed, by 25% every five years for the next 20 years. This commitment is contingent upon the availability of federal and/or state funding of the capital costs of phosphorus treatment at municipal sewage treatment plans, supplemented, as necessary, by local match to the extent that it can be covered by in-kind services. This commitment is also contingent upon the availability of adequate federal and/or state funds to support voluntary nonpoint source implementation.

The first 25% reduction must be incorporated in specific nonpoint source actions or specific point source permit modifications to be identified by October 1, 1996, and implemented in the next five years.

The states are free to choose the appropriate mix of point and nonpoint source actions to be implemented in each contributing watershed.

The specific actions to achieve the remaining 75% reduction will be identified within five years.

Steps 4-5 will be completed by October 1, 1996 and provided by the states as early implementation outputs.

- Final agreement by USEPA, NYSDEC, and VTDEC on the results of this process will be contingent on the acceptance of the adjusted point and nonpoint source loading targets to be specified by the states under steps 4 and 5 above.

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