THE SUSTAINABLITY OF NEW HAMPSHIRE'S SURFACE WATERS

Lakes Management Advisory Committee and the Rivers Management Advisory Committee

January 2008

Summary

The lakes and rivers of New Hampshire are essential elements of the State's unique natural beauty, tourist based economy, quality of life and livelihood for many businesses and municipalities. However, much of New Hampshire's waterways are already developed, lack capacity to further dilute additional pollutants, and the natural aquatic biota have already been greatly challenged. This is the last opportunity for New Hampshire to substantively protect and manage its current waters resources in an economic and comprehensive manner. The future sustainability of our surface waters requires an aggressive, coordinated, cross-disciplinary and watershed based approach.

The Lakes Management and Rivers Management Advisory Committees (LMAC and RMAC) are comprised of representatives from numerous state agencies and public and private sector groups with water interests. These committees are legislatively charged with advising the New Hampshire Department of Environmental Services (DES) on maintaining water quality and quantity. The LMAC and RMAC are concerned that even with the present programs and despite more than three decades of work, our water resources will deteriorate under current efforts. As the quality of our lakes and rivers worsens property values and tourism will decline, recreational experiences will diminish, and it will be more costly to restore our surface waters to their present or better condition. If we do not collectively address this issue immediately with adequate funding and staff our New Hampshire quality of life will change for the worst.

The Commissioner of the Department of Environmental Services authorized the Lakes Management Advisory Committee and the Rivers Management Advisory Committee on January 3, 2007 to undertake a Sustainability Initiative. The Sustainability Initiative will develop environmental and programmatic indicators and recommendations to address the eight key tools, strategies, and issues identified in this document. This document is the preliminary roadmap for that Initiative. It:

1) Provides an overview of the issue;
2) Explains and defines Sustainability and its companion concept Anti-Degradation;
3) Evaluates the overall success for the legislative elements of the Rivers Management and Protection Program and the Lakes Management and Protection Program;
4) Reviews a subset of past legislation, regulations and policies produced or enacted by the State and other organizations over the last 30 years to assess their efficacy in achieving water quality and quantity (See Appendix - Summary and Evaluation of Major Programs and Efforts to Address Water Quality and Water Quantity in New Hampshire);
5) Describes eight key tools, strategies and specific issues to be addressed to achieve Sustainability; and
6) Recommend by September 2008 the next steps for a Sustainability Initiative with specifics for the eight issues including an inventory of ongoing efforts and existing roadblocks, the development of options to consider, prioritizing the eight issues, development of criteria to determine success, and outline the resources needed.

1) The Issue – Why the Concern

New Hampshire's 1,000 freshwater lakes and ponds and 10,000 miles of perennial rivers and streams provide abundant recreational opportunities, historic, cultural and economic values and critical natural assets.[1] A study conducted in 2002 determined that just four uses of our surface waters, boating, fishing, swimming, and drinking water supply services, contribute up to $1.5 billion annually

in total sales to the state's economy and our surface waters boost tax revenue by an estimated $247 million per year in property taxes.[2] More recently, a survey of boaters, anglers, and swimmers determined that if these user groups perceived degradation in water clarity and purity their use of these surface waters would decline, resulting in an economic loss of $51 million in total sales, $18 million in income and more than 800 jobs statewide.[3]

For the past 40 years, New Hampshire's population has grown twice as fast as the rest of New England and this rapid growth is projected to continue. In areas of the state where the most development and land conversion is occurring, land conservation has lagged behind land development. Land development has outpaced land conservation in 130 communities, or 56% of all cities and towns. New Hampshire is losing about 17,500 acres of forestland every year.[4] Research performed throughout the country has determined that impervious cover is a good general indicator of landscape change impacts on stream hydrology and biological health. The findings from over 225 research studies predict that most water quality indicators decline when watershed impervious cover exceeds 10%, with severe degradation expected beyond 25% impervious cover.[5]

Climate change is occurring here in New Hampshire and around the world. Local meteorological records indicate that spring is arriving earlier, summers are growing hotter and winters are becoming warmer and less snowy.[6] These weather changes will impact our aquatic resources; some species may not be able to tolerate the warmer water temperatures. Warmer weather will extend the water recreation season and more and more people will use our waters seeking relief from increasing temperatures. Droughts may occur with greater frequency and duration, stressing those surface waters that supply drinking water. Storm events are expected to be more severe and frequent, contributing greater volumes of nutrient laden waters into our lakes and rivers.

Accelerating development and increasing impervious surfaces in our watersheds are causing deterioration of our surface waters. The volume and frequency of stormwater runoff is increasingly more damaging to aquatic systems. Climate change is altering our weather and our environment. Given these facts the State cannot assume that conducting business as we have – maintaining the status quo – will ensure the long-term sustainability of our surface water resources. There is too much to lose economically and environmentally.

2) Sustainability and Anti-Degradation

The concept of *sustainability* is not a new one and it marries two important insights: that environmental protection does not preclude economic development and that economic development must be ecologically viable now and in the long run. Sustainable development, which requires an integration of economic, social and environmental polices, cannot be achieved by individual state agencies acting separately. It relies on policy coherence, based on common principles, across all levels of local, regional and state government. Sustainability can only be achieved through an interdisciplinary approach that emphasizes long-term resource management. This approach balances environmental integrity, economics and human behavior by providing supporting data and analysis and effective planning tools to guide decision-makers toward environmental sustainability and sustainable development.[7]

The concept of *anti-degradation* is closely linked to sustainability. In essence, anti-degradation means that, whatever the current state of the surface water is, human activity <u>should not</u> make it worse unless there is an overriding social or economic reason to do so. The LMAC and RMAC concur that the current state of surface water should not be degraded, but also emphasize that surface water quality must be improved where necessary. While this is explicitly an element of the water quality standards under the federal Clean Water Act and incorporated into the State's water quality standards in Env-Ws

1700[1], New Hampshire has not yet truly embraced and instituted an "anti-degradation approach" to water quality management and protection.

For the purposes of this paper, the LMAC and the RMAC have developed the following functional definition of sustainability to achieve our goals:

> ***"to institute anti-degradation measures to preserve and protect water quality and quantity, to maintain intact ecological linkages between surface waters and their surrounding watersheds, to achieve the appropriate balance between different human uses while protecting the biological integrity of the resource, and to restore and improve existing degraded systems."***

The LMAC and RMAC are recommending that a more aggressive approach be undertaken by the State to achieve sustainability of our surface water resources. If we maintain the status quo, within another 25 years, we will not only have poorer water quality, but the State will have to spend significantly more money to restore additional impaired waters. The longer we wait the greater the cost.

3) Assessment - Rivers and Lakes Management and Protection Programs

Since the establishment of the Clean Water Act in 1977, numerous state and federal laws have been enacted to address water quality and quantity. Within the last 30 years New Hampshire has established various programs to protect our surface waters. The Rivers and Lakes Programs, RSA 483 and 483-A, were established by the Legislature in 1988 and 1990, respectively. The Programs reside within the Water Division of the NH Department of Environmental Services (DES).

Over the past 18 years the two Programs have made significant contributions to river, lake and watershed management in New Hampshire. The Programs are comprehensive in their scope and composition and tools and mechanisms exist within the programs to address water quality and quantity concerns. Review of the completion or lack thereof, of the statutory elements of these laws is appropriate to ***determine if these Programs are sufficient to protect and maintain water quality and quantity now and in the future***. It is important to note that due to limited staff and financial resources these Programs have not accomplished many of the direct and indirect statutory requirements. The following table outlines the major statutory elements of each program and provides an assessment of its progress to date. While the Programs are complementary in nature, as written they have different structures, different statutory requirements, and therefore different regulatory authority and purview.

The Rivers Management and Protection Act established a statewide rivers program based on a two-tier approach to river management and protection:

- ***State:*** review and designate locally nominated rivers, and protection and management of instream values, water quality and state-owned lands for those designated,
- ***Local***: nomination of rivers for designation with the development and adoption of river corridor management plans and a formal local advisory committee once a river is designated.

Table 1: Evaluation of the Rivers Management and Protection Program

Statutory Requirement	Question	Answer	Implication/Trend
RSA 483: 6 River Nominations	How many rivers have been nominated for protection?	15 rivers have been nominated and designated encompassing 822 miles of rivers and streams.	*Less than 1% of all river and stream miles in the State have been designated and thus protected under the RMPP.
RSA 483: 8 VI and 483: 14 Disposition of state owned land adjacent to or providing access to a river	Has the RMAC reviewed and made recommendations regarding the disposition of state-owned land adjacent to or providing access to a river?	Yes. The RMAC has a very thorough process whereby it evaluates and comments upon proposed state-owned land dispositions.	***The State is receiving the input and expertise of the RMAC prior to making a decision regarding the disposition of state-owned land on or near a river or stream.
RSA 483: 8-a, III (c) Local River Corridor Management Plans	Have local river corridor management plans been developed and implemented?	12 out of 15 designated rivers have existing management plans. Implementation is minimal. Direct funding and assistance for development and implementation is inadequate.	**Insufficient resources are available to assist local river management advisory committees and the rivers coordinator to develop and implement management plans that can be adopted at the local level.
RSA 483: 9, 9-a, 9-aa, and 9-b Designated River Water Quality	What percentage of designated river segments meet class B water quality standards (excluding mercury)?	Only 61% of designated river segments have been assessed for aquatic life and of those only 20% fully support this designated use. Only 49% of designated river segments have been assessed for primary contact recreation and of those 50% fully support this designated use. Only 53% of designated river segments have been assessed for secondary contact recreation and of those 98% fully support this designated use.	**Insufficient data is available to make reasoned river management decisions on all designated rivers.
RSA 483: 9-c Protected Instream Flow	Have protected instream flows been established for all designated rivers?	No. The current pilot study includes establishing protected instream flows for the Souhegan River and the Lamprey River.	**RSA 483 called for the establishment of protected instream flows in 1990; the current pilot project began in 2003. The protected instream flow for the Souhegan River is expected to be established in early 2008.
RSA 483: 10-a Designated River Long Range Management Plans	Have long-range management plans been established for all designated rivers?	No. River selection criteria for a pilot project have recently begun.	*RSA 483 called for the long range management plans in 1990. As of Fall 2007 none have been developed.

The Lakes Management and Protection Act established a statewide lakes program to provide state agencies, the Legislature, public and private sector interest groups, municipalities, and the general public with appropriate guidance and recommendations regarding lake management in the State. The Lakes Program has no regulatory authority. Unlike the Rivers Program, lakes are not designated; therefore there are no local advisory committees and no formal mechanism for local involvement regarding activities on or near a lake. Further, there is no provision in the Lakes statute for the adoption of a lake management plan as an adjunct to the municipal master plan, such as exists in the Rivers statute.

Table 2: Evaluation of the Lakes Management and Protection Program

Statutory Requirement	Question	Answer	Implication/Trend
RSA 483-A: 5 I, a-f Lakes Management Criteria for NH State Agencies Note: See p. 13 of the Appendix for a more thorough evaluation of this document.	Has the Management Criteria document been prepared and submitted to the State Legislature?	Yes. In 1996 the document was submitted to the Legislature and to the Council on Resources and Development (CORD).	***The document included 106 recommendations to address the 5 specific criteria in 483-A:5 I. **Note: As of 2006, of the 106 recommendations 33 had not yet been addressed and/or the implementation was not known.
RSA 483-A: 5 II Disposition of state owned land adjacent to or providing access to a lake	Has the LMAC reviewed and made recommendations regarding the disposition of state-owned land adjacent to or providing access to a lake?	Yes. The LMAC has a very thorough process whereby it evaluates and comments upon proposed state-owned land dispositions.	***The State is receiving the input and expertise of the LMAC prior to making a decision regarding the disposition of state-owned land on or near a lake or pond.
RSA 483-A: 7 I Guidelines for Local Lake Management and Shoreland Protection Plans	Has the Guidelines document been developed?	This document has been developed and is scheduled for release in August 2008.	***This document is a valuable tool which lake stewards can use to develop a management plan specific to a lake and its watershed. Note: The document includes the Comprehensive Lake Inventory which that allows lake stewards to collect and assess information specific to the lake and its watershed.
RSA 483-A:7 II & III Provide technical assistance and information in support of lake management and shoreland protection planning.	What percentage of lakes have management plans?	Of the nearly 1,000 lakes and ponds in the State, about ten have management plans. Funding and assistance for development and implementation is inadequate.	*About 1% of all lakes and ponds have a management plan; the state's lakes and ponds are not being managed and protected sufficiently.

Key to Implication/Trend Status	
	*Indicates minimal progress made towards programmatic goals due to lack of resources or implementation strategies.
	**Indicates some progress made towards programmatic goals, but additional resources are needed to meet goal.
	***Indicates programmatic goal has been met or significant steps have been taken towards meeting the goal.

4) Assessment – Major Programs/Efforts to Address Water Quality and Water Quantity

In addition to the Rivers and Lakes Programs, New Hampshire has devoted a significant amount of time, energy, staff and financial resources to the development of reports and recommendations to address water quality and quantity concerns and to document degradation. All of these reports strive to protect and, where necessary, advocate for the restoration of the state's surface waters.

The staff of the Lakes and Rivers Programs reviewed and evaluated a cross-section of past and present reports, programs, and recommendations developed and administered by the State and other organizations, to determine ***if they are sufficient to protect and maintain water quality and quantity now and in the future***. A total of 22 reports, six programs and two pieces of legislation were reviewed and analyzed to determine their relationship to RSA 483 and 483-A. This analysis can serve as a framework to understand what has and has not worked and to develop future actions to sustain our lakes and rivers.

The reports and programs are listed below by subject; please see the Appendix for a more complete summary and evaluation. The following does not include reports or projects that were produced by consultants or engineering firms. It also does not include every water quality and quantity related program administered by DES. For example, programs such as Alteration of Terrain or the National Pollutant Discharge Elimination System were not reviewed or evaluated.

Rivers Management & Protection Program - New Hampshire Department of Environmental Services
Lakes Management & Protection Program - New Hampshire Department of Environmental Services

Climate Change
Northeast Climate Impacts Assessment - *Confronting Climate Change in the U.S. Northeast: New Hampshire – Science, Impacts and Solutions:* 2007

Growth and Development
NH Office of State Planning - *Managing Growth in New Hampshire: Changes and Challenges*: 2000
NH Office of Energy and Planning - *Achieving Smart Growth in New Hampshire*: 2003
New Hampshire Department of Environmental Services - Watershed Management Approach: 2003
New Hampshire Estuaries Project - *Management Plan Update*: 2005
Society for the Protection of New Hampshire Forests - *New Hampshire's Changing Landscape*: 2005
New Hampshire Department of Environmental Services & New Hampshire Estuaries Project - *Land Conservation Plan for New Hampshire's Coastal Watersheds:* 2006
NH DES, NH Lakes Association, and NH Rivers Council - *The Economic Impact of Potential Decline in New Hampshire Water Quality*: 2007

Lake Management
NH Office of Energy and Planning - *Lakes and Great Ponds Report, Vol. 1 & 2*: 1985
Lakes Management Advisory Committee and the Lakes Management and Protection Program - *Lakes Management Criteria for New Hampshire State Agencies*: 1996

Public Access
NH Office of Energy and Planning - *Public Access Plan for New Hampshire's Lakes, Ponds, and Rivers*: 1991
NH Fish and Game Department - *New Hampshire Public Access Needs Assessment Statewide Summary Report:* 1998
Appalachian Mountain Club - *An Analysis of Public River Access for Motorized Watercraft in Massachusetts, Vermont, New Hampshire, and Maine:* 2005

Water Quality
Lakes Region Planning Commission - *Lakes Region Water Quality Management Plan*: 1978
New Hampshire Department of Environmental Services - *Basin Planning Program Report*: 1996
New Hampshire Department of Environmental Services - *Unified Watershed Assessment State of New Hampshire*: 1998
New Hampshire Department of Environmental Services - *New Hampshire's Nonpoint Source Management Plan*: 1999
U.S. Geological Survey - *Effects of Urbanization on Stream Quality at Selected Sites in the Seacoast Region in New Hampshire:* 2001-2003
Jordan Institute - *Report of Ranked Environmental Risks in New Hampshire*: 2002
New Hampshire Department of Environmental Services - *NH Section 305(b) and 303(d) Surface Water Quality Report (SWQ Report):* 2006
New Hampshire Department of Environmental Services - *DRAFT - Anti-degradation of New Hampshire Water:* 2007
NH House Bill 710 - Establishing a Commission to Study the Leasing of State-Owned Real Estate on the Shores of Public Waters: 2007
NH House Bill 383 and NH House Bill 663 - Relative to the *Comprehensive Shoreland Protection Act*: Amendments to RSA 483-B: 2007

Water Quantity
NH Water Resources Board - *New Hampshire Waters Resources Management Plan*: 1984
New Hampshire Department of Environmental Services - Instream Flow Protection Pilot Program: 2002
New Hampshire Department of Environmental Services - *Water Registration Process:* 2005
New Hampshire Department of Environmental Services - Groundwater Withdrawal Program: 1998

Wildlife
NH Fish and Game Department - *Wildlife Action Plan (WAP):* 2006

5) Eight Significant Issues

To provide a workable structure for next steps, eight significant issues relevant to the sustainability of New Hampshire's surface waters follow. The next step should include the development of environmental and programmatic indicators, whereby the State can measure its ability to successfully address these issues, definition of hurdles, options to resolve them, a prioritization of which should be addressed first, and a description of the resources needed to achieve success.

Tools

#1 Lack of Data and Improve Data Access and Management by Data Users
Related Issues: Increase the Network of Stream Gages and Expand and Improve Water Quality Monitoring

The Department of Environmental Services uses all available data collected with quality assurance and quality control procedures to make water quality assessments. This includes data collected by DES as well as volunteer monitoring groups, the U.S. Environmental Protection Agency (EPA), the U.S. Geological Survey and many more. The amount of data collected is insufficient to make sound management decisions regarding New Hampshire's lakes, rivers, streams and ponds.

Stream gages monitor stream flow and its variation over time. This monitoring is fundamental to understanding and managing water resources to meet multiple objectives. We must monitor changing stream hydrology because our climate is changing, thus hydrologic models will need to evolve. In 2004 and 2005, 14 stream gages were decommissioned because of budget constraints even though

water use and water-based recreation increased due to population and economic growth in many watersheds.

Strategy

#2 Lack of a Coordinated Approach

Regulations affecting New Hampshire's rivers, lakes, streams and ponds are divided among many different agencies and among many bureaus and programs within the same agency. Inter-agency communication, as well as communication within agencies, is incoherent and often inefficient at best. Even though DES has a Watershed Management Bureau, it does not practice watershed management. A clear, well-communicated strategy is needed on a state-wide scale to effectively address landscape change and its impacts on water quality and quantity.

Specific Issues

#3 Protect Shorelands and Riparian Buffers

Shoreland buffers are the single most effective protection for surface waters in New Hampshire.[8] However, shoreland buffer protection required under RSA 483-B, the Comprehensive Shoreland Protection Act has not always been effective and does not apply to thousands of miles of smaller order streams. In addition, static setbacks and buffers need to account for the dynamic nature of riparian systems. Buffers filter polluted runoff, provide a transition zone between water and human land use and provide habitat and improve the stream communities they shelter.[9]

#4 Limit Impacts to Water Quality and Quantity from Urbanization and Watershed Development

Stormwater runoff from the natural landscape results in minimal erosion and flooding. Studies by the Center for Watershed Protection and others have shown that when watersheds exceed 10% impervious cover major alterations in stream morphology occur that significantly reduce habitat quality. Similar studies have demonstrated that severe water quality degradation occurs beyond 25% impervious cover.[10] Current and historical data and trends indicate that water quality and quantity is changing and poorly designed and executed landscape change is the primary cause. More stormwater runoff and increasing amounts of impervious surface are negatively affecting New Hampshire's surface waters.

#5 Determine Carrying Capacity

Related Issue: Provide Adequate Public Access

RSA 483-A:5 (e) states: "recreational uses of lakes shall be consistent with the carrying capacity and character of each lake." To date, the state has not determined the carrying capacity of its surface waters. Carrying capacity refers to the level or type of use beyond which impacts to the lake or the visitor experience exceed acceptable limits. There are three components of carrying capacity:

1) Biological carrying capacity: the capability of the lake to sustain certain activities before the degradation of water quality and/or impacts to aquatic life occur;
2) Social carrying capacity: the maximum combinations of and intensities of human uses without unacceptable diminishment of people's enjoyment of the lake due to the presence and activities of other users; and
3) Physical carrying capacity: the maximum intensity of human use that a lake or river can accommodate.

The NH Fish and Game Department is legislatively mandated to carry out the statewide public boat access program RSA 233-A:4. In addition, other state agencies by virtue of their land holdings also provide public access, both passive and active. The 1991 New Hampshire Office of State Planning (OSP) Public Access Plan recommended that for great ponds, there should be one public access point for each five miles of shoreline or for every 1,000 acres of surface water and for rivers there should be

one public access point for each ten miles of shoreline. These recommendations have not yet been met.

#6 Control Invasive Aquatic Species

Since exotic plants are introduced from outside of the state, they have no established relationships with native fauna that keep their growth in check. When these exotic plants grow without natural controls they encroach into and replace the habitats of native plants, disrupting the food chain, stunting fish growth and degrading wildlife habitat. As of 2007, there were 72 documented infestations of exotic species, including Didymo, in New Hampshire's lakes and rivers. State and volunteer efforts to prevent and monitor the introduction of invasive exotic species must be maintained and research on eradication methods continued.

#7 Consumptive Uses of Surface and Groundwater
Related Issues: Determine and Implement Instream Flow Protection and Groundwater Withdrawal

Although New Hampshire is typically thought of as a water-rich state, it is currently experiencing extensive demand for water as its population and economy expand. In addition, natural water losses due to seasonal variation cause reduced water supplies in the State during certain times of the year and recent droughts have also demonstrated the need to develop effective long-range water supply planning that includes water conservation practices.

RSA 483 requires DES to regulate instream flows of designated river to conserve and protect outstanding characteristics. These characteristics include: recreation, fisheries, wildlife, environmental, cultural, historical, archaeological, scientific, ecological, aesthetic, community significance, agricultural and public water supplies. Developing flow protection for all of these characteristics is challenging, since protection of natural ecosystems is a complex problem.

Sixty percent of New Hampshire's residents are dependent on groundwater for their drinking water supplies. Water levels in some New Hampshire lakes, ponds, aquifers and streams have dropped, largely due to over-mining of groundwater supplies. When private and public wells withdraw more water than the aquifer that supplies them can provide, recharge is pulled from surface waters; this condition can have serious impacts on both public health and the economy.

#8 Address Climate Change Impacts

Potential impacts to New Hampshire's rivers and lakes from climate change include rising sea levels, altered runoff patterns from reduced amounts of snowfall and more frequent extremes in precipitation from drought to floods, and increased water temperatures that could degrade cold water fisheries. Because many of New Hampshire's rivers and lakes are fragmented by dams, the ability of many aquatic species to adapt or migrate to more suitable habitat is challenged. DES has issued a plan to help address climate change through steps that combine sound energy choices with good environmental policy. The plan, called *"The Climate Change Challenge: Actions New Hampshire Can Take to Reduce Greenhouse Gas Emissions,"* depends on voluntary reductions in greenhouse gas emissions through such steps as energy conservation and efficiency, alternative fuels, and local land use planning.[11]

6) Conclusion and Recommendation

A combination of forces, including rapid population growth and urbanization are imposing new stresses on New Hampshire's surface waters and the State's ability to protect, maintain, and when necessary, restore surface water quality. This is the last major opportunity the State has to address critical water issues, before they either become extremely costly to manage or irreversible. To prevent the negative consequences that accompany our growing population we must develop new approaches

that go beyond tasks forces and piecemeal strategies. If we adequately protect the ecological function of our terrestrial and aquatic resources, do not burden them with pollutants, nutrients, toxins, or sediment, or demand more than they can provide, they will be sustainable. To attain and continue to achieve excellent water quality, the State must take the lead by promoting a strong economy and maintaining environmental integrity. However, based on our performance to date we are not attaining these objectives. The LMAC and RMAC recommend that the State move forward with a Sustainability Initiative where the State undertakes an aggressive effort, including addressing landscape change and development and its impact upon water quality and quantity.

Therefore, the LMAC and RMAC propose leading a coordinated approach with DES staff using the eight specific issues outlined in this document to identify how the State can achieve Sustainability for its rivers and lakes. The steps would include cataloging ongoing efforts, describing roadblocks to success, prioritizing the issues, proposing concrete options to consider for each of the eight issues, and proposing environmental and programmatic indicators to measure how well success is achieved. This element would be targeted for completion by September 2008. The development of a Sustainability Initiative will be a major undertaking which cannot be performed by existing staff unless statutory requirements go unmet. For example, Program staff dedicated approximately 225 hours to help research and produce this paper and appendix. An additional half staff person is needed for the LMPP and RMPP to meet the September timeframe. Though the Rivers Program has the equivalent of 2.75 persons and the Lakes Program 1.75 persons, it would be unrealistic to simply add this project to their workload and still expect meaningful outcomes.

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[1] *New Hampshire Environment 2000,* New Hampshire Department of Environmental Services, June 2001.

[2] Shapiro, Dr. Lisa and Kroll, Heidi; *Estimates of Select Economic Values of New Hampshire Lakes, Rivers, Streams and Ponds Phase II Report*; Gallagher, Callahan & Gartrell, P.A., 2003.

[3] Nordstrom, Ph.D., Anne; *The Economic Impact of Potential Decline in New Hampshire Water Quality: The Link Between Visitor Perceptions, Usage and Spending*; The New Hampshire Lakes, Rivers, Streams and Ponds Partnership; May 2007.

[4] *New Hampshire's Changing Landscape 2005 Population Growth and Land Use Changes: What They Mean for the Granite State,* Society for the Protection of New Hampshire Forests.

[5] *Impacts of Impervious Cover on Aquatic Systems,* Center for Watershed Protection, March 2003.

[6] Frumhoff, P.C., J.J. McCarthy, J.M. Melillo, S.C. Moser, and D.J. Wuebbles. 2007. *Confronting Climate Change in the U.S. Northeast: Science, Impacts, and Solutions.* Synthesis report of the Northeast Climate Impacts Assessment (NECIA). Cambridge, MA: Union of Concerned Scientists (UCS).

[7] U.S. Environmental Protection Agency, Office of Research and Development "Sustainability Research Strategy DRAFT;" June 13, 2007.

[8] Env-Ws 17008.01(b) states, in part: "….where the quality of the surface waters exceeds levels necessary to support propagation of fish, shellfish, and wildlife, and recreation in and on the water, that quality shall be maintained and protected unless the department finds, after full satisfaction of the intergovernmental coordination and public participation provisions that, … allowing lower water quality is necessary to accommodate important economic or social development in the area in which the surface waters are located."

[9, 10] Connecticut River Joint Commissions, Inc.; *Introduction to Riparian Buffers*; 1998

[11] Chester L. Arnold and C. James Gibbons. "Impervious Surface Coverage: The Emergence of a Key Environmental Indicator." Journal of the American Planning Association. Spring, 1996. p. 255.

[12] NHDES Webpage, Air Resources Division, Climate Change/Energy Programs, 2007.