

**A CASE FOR A "WATERSHED PROTECTION APPROACH" TO WATER  
RESOURCES USE AND ALLOCATION - THE MERRIMACK RIVER  
WATERSHED**

by  
Judith L. Boshoven

B.S., Landscape Architecture  
University of California, Davis  
(1986)

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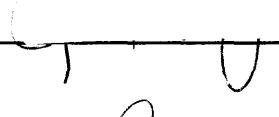
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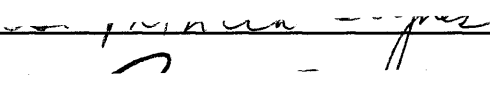
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Signature of Author

  
Department of Urban Studies and Planning  
May 1992

Certified by

  
Professor H. Patricia Hynes  
Thesis Supervisor

Accepted by

  
Professor Ralph Gakenheimer  
Chair of the MCP Committee

Rotch  
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**ABSTRACT**

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This thesis addresses the need for a "Watershed Protection Approach" to water resources use and allocation in the Merrimack River watershed. This approach attempts to integrate the multiple functions of the watershed ecosystem, and recognizes the interdependencies between the multiple uses and jurisdictions within the watershed region.

The present laws, policies, and programs for protecting and managing water resources in the watershed are characterized by fragmented administrative and programmatic structures, within and between all levels of government. I contend that differences in water resource management strategies, coupled with a lack of coordination across state boundaries, present constraints to balancing the multiple uses of water resources, and protecting the natural resource values of the watershed. Currently there is no defined long-term process for resolving uncertainties with respect to balancing and protecting multiple interests, and for coordinating laws, policies and programs for water resource use and allocation within the watershed.

The purpose of this research effort is fourfold: 1) to explore the need for a coordinated interstate water resources use and allocation strategy for the watershed; 2) to examine alternative institutional arrangements and their various strengths and weaknesses related to water use and allocation; 3) to outline particular features of an approach, and key functions of an interstate water resource use and allocation strategy; and finally, 4) to provide recommendations for improving interagency coordination for managing and protecting the water resources of the Merrimack River watershed. These tasks are major components of a project within U.S. Environmental Protection Agency, Region I, entitled the Merrimack River Initiative, as well as the Merrimack River Watershed Council's Water For All Program.

Thesis Supervisor: Professor Patricia Hynes



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## CHAPTER 1 INTRODUCTION AND OVERVIEW

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### INTRODUCTION

The present laws, policies, and programs for protecting and managing water resources in the Merrimack River watershed are characterized by multifarious and fragmented administrative and programmatic structures within and between all levels of government. Policies at both the federal and state levels, implemented on a program by program basis, focus on regulating individual users and uses rather than consider the watershed in its entirety. Furthermore, there is little coordination between government agencies that share responsibility for the management and protection of the water resources in the watershed. This report addresses the need for a more holistic strategy to managing water resources use and allocation, with respect to both policy and institutional structure. I contend that a "Watershed Protection Approach"<sup>1</sup>, which integrates the multiple functions of the ecosystem and recognizes the interdependencies between the multiple uses and jurisdictions, is a necessary approach to developing a water resources use and allocation strategy for the Merrimack River watershed.

Several recent innovative and coordinated programs headed by the U.S. Environmental Protection Agency, Region 1 (EPA), and the Merrimack River Watershed Council (MRWC) have endeavored to tackle inter-jurisdictional resource

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<sup>1</sup> Robert H. Wayland III, the director of EPA's Office of Wetlands, Oceans, and Watersheds, outlined the features of this comprehensive approach in an article entitled "EPA's 'New Kid on the Block' - The Watershed Protection Approach" (1992).

protection issues. Under the Clean Water Act's National Estuaries Program, Comprehensive Conservation Management Plans have been devised to protect large regions that encompass multiple jurisdictions. In line with the National Estuaries Program, the EPA is continuing a holistic approach to resource management through Special Regional Initiatives, and the Watershed Protection Program<sup>2</sup>. During the coming years, the Region I office of the EPA will be the lead agency on the Merrimack River Initiative, a planning process for the Merrimack River watershed. Given that the Merrimack River watershed is roughly three quarters in New Hampshire and one quarter in Massachusetts, one of the greatest challenges of the Merrimack River Initiative will be to devise a strategy for long-term coordination between the two states and the federal agencies responsible for the protection and management of the watershed.

A parallel effort by the Merrimack River Watershed Council, the Water For All Program, hopes to encourage "grass-roots" support for interstate action and cooperation in the development of a comprehensive natural resources protection and water supply plan for the Merrimack River watershed. This effort aims to engage the general public and the private sector in planning and implementation activities. Both the EPA and the MRWC programs advance a "Watershed Protection Approach" to environmental planning and management that considers the watershed boundary as defining the elemental planning unit.

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<sup>2</sup> This is a movement within EPA's Office of Wetlands, Oceans and Watersheds, which was created in 1991 to facilitate a comprehensive approach to environmental protection and to focus efforts within naturally defined geographic areas or watershed.

## **Purpose of Research**

The purpose of this research effort is fourfold: 1) to explore the need for a coordinated interstate water resource use and allocation strategy for the watershed; 2) to examine alternative institutional arrangements related to interstate water use and allocation and their various strengths and weakness; 3) to outline particular features of an approach, and key functions of an interstate water resource use and allocation strategy; finally, 4) to provide recommendations for improving interagency coordination for managing and protecting the water resources of the Merrimack River watershed. These tasks are major components of both the EPA and MRWC projects.

This research primarily focuses on the critical issue of water use, or the allocation of water flowing in the Merrimack River and its tributaries. It is stressed throughout the report, however, that we must look at the interplay between water quantity and other resource issues in the watershed. The intent of this work is that the process undertaken to formulate recommendations regarding water use and allocation will serve as an example from which the Initiative and the Water For All programs may explore the complete array of issues surrounding the Merrimack River watershed, including water quality, and river corridor protection.

## **Report Outline**

The remainder of this chapter is an overview which describes the problem of institutional and regulatory fragmentation with respect to water use and allocation in the Merrimack River Watershed, current efforts underway to remedy these problems,

and an approach to developing solutions. This overview is intended to set the stage for the following research.

The next chapter, **Chapter 2**, is a description of important features of the Merrimack Watershed region, and the difficult issues the region is facing. This chapter characterizes the various uses and users of the watershed's water resources, and potential conflicts between these multiple uses. This chapter is intended to establish the importance of the multiple-use character of the resource, and the need for a coordinated strategy to balance and preserve these uses. **Chapter 3** contains a survey of the current federal and state policies and regulatory processes pertaining to water use and allocation. This chapter concludes with a description of how inconsistencies in the policies present constraints to sound watershed water resources use and allocation. **Chapter 4** is a discussion of institutional arrangements, both past and present, for water resources management. It begins with a brief history of interstate coordination, with respect to water resource issues, in the United States and in the New England region. It also includes an outline various alternative institutional arrangements devised nation-wide for managing water resources on a watershed basis. The chapter concludes with a summary of key aspects of these arrangements. **Chapter 5** describes important features of the approach that should be undertaken for devising a water resources use and allocation strategy, which are consistent with EPA's "Watershed Protection Approach". **Chapter 6** describes important functions of a strategy that require a watershed perspective to be effectively implemented: data collection, water conservation, and drought planning. Finally, **Chapter 7** contains



recommendations for coordinated interstate water resource use and allocation for the Merrimack River watershed.

## **OVERVIEW**

### **The Problem - Programmatic and Administrative Fragmentation**

The 118 mile Merrimack River forms a 5,010 square mile watershed, comprised of portions of New Hampshire and Massachusetts, as well as numerous layers of laws, policies, and programs at all levels of government. To date, both the federal and state governments have focused most of their water resource efforts on improving water quality. EPA's primary role in water resources management has been to regulate pollution sources through the National Pollution Discharge Elimination System (NPDES) and to provide financial assistance for wastewater treatment plants, both through the 1972 Federal Clean Water Act. EPA's relationship to the states has been to provide policy and technical guidance and funding, while the state water pollution control agencies carry out much of the day-to-day water quality and effluent monitoring, and enforcement of water quality standards<sup>3</sup>.

Unlike water quality, water use and allocation issues are, for the most part, not under the purview of the federal government. Hence, the two states exercise virtual autonomy in water use and allocation matters. As a result, each state has its own set of policies, regulations, standards and procedures to govern water resources which are not always consistent across state boundaries. For example, the states have

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<sup>3</sup> Massachusetts and New Hampshire do not have primacy under the Clean Water Act. Therefore primary responsibility for issuing NPDES permits is with the EPA, not the state.

very different programs for regulating interbasin transfers and allocating withdrawals of water from the river. While Massachusetts, under its Water Management Act, has an administrative system in place for regulating large withdrawals from a watershed, the state of New Hampshire does not currently have such an allocation system in place. In addition, while Massachusetts has an administrative process in place for reviewing and approving significant transfers of water from one watershed into another, New Hampshire does not. Both states are currently in the process of reviewing important aspects of their respective water resources management policies. The differences between the states are more fully addressed in Chapter 3 of this report.

The differing approaches and lack of coordination across state boundaries regarding water use and allocation policy has been identified as a key issue of concern by the MRWC as well as other government and non-government participants of the Merrimack River Initiative. The fragmented approach to water resource management creates uncertainties with respect to balancing the multiple uses and users of water and planning for future water supply development. As early as 1978 the New England River Basins Commission recognized that a major planning problem in the Merrimack River watershed was the need to balance future municipal and industrial water supply development within the two states with other water demands (New England River Basins Commission, 1978)<sup>4</sup>. These demands include, among others,

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<sup>4</sup> EPA's Merrimack River Initiative is not the first attempt at watershed-wide planning for the Merrimack River watershed. Comprehensive water resources planning originated with the New England-New York Inter-agency Committee in 1955 and ended with the abolition of the New England River Basins Commission in 1981. Charles H. W. Foster traces the history, successes and failures, of these two regional agencies in his book Experiments in

hydroelectric power development, recreation, restoration of anadromous fisheries, and maintenance of water quality. They foresaw that the possibility of major interbasin diversions, and that the controversy that would inevitably surround such development would further complicate these planning problems (New England River Basin Commission, 1978). Still today major uncertainties with respect to future water supplies remain a significant concern to both water users, and conservationists. These uncertainties include the magnitude and impact of future withdrawals and the degree to which current instream and out-of-stream uses of water would be preempted by their development. Both states are under pressure from environmental and recreation groups to improve their water resource use and allocation practices so that they pay closer attention to the need to protect critical water dependent wildlife habitat and recreational uses.

Presently New Hampshire does not have a watershed planning process that projects the future need for, and supply of water resources, or assesses impacts of water withdrawals and interbasin transfers on the resources within the state's portion of watershed. Instead water supply studies are conducted, as required, at the regional and local level. Massachusetts, by contrast, evaluates water supplies on a watershed basis. Under its water supply planning process, which is currently being reassessed, the state is scheduled to develop a plan for the Merrimack River watershed in 1994. But, as it stands, Massachusetts has no assurance for an adequate quantity or quality of water flowing over the New Hampshire state line to meet its water supply purposes. Its plans will be futile without some assurances from New Hampshire with

Bioregionalism: The New England River Basins Story (1984). The work of the Commission is described in Chapter 4.

purposes. Its plans will be futile without some assurances from New Hampshire with regard to water quality and flow. Additionally, neither state can be confident that sufficient water will remain in the river to protect important instream uses.

Will the Merrimack River be able to meet future demands for water and maintain sufficient instream flows within the entire watershed? What are sufficient instream flows along the length of the Merrimack River and its many tributaries that will serve to protect the system's natural resources? How will these decisions be made? The present multiple uses of the water resources are not mutually exclusive, but a balance must continually be struck between the natural functions of the water resources and the diverse user groups to ensure the sustained integrity of the watershed environment. Currently there is no defined long-term process for resolving uncertainties with respect to future withdrawals, or for balancing competing demands for a potentially scarce resource.

#### **Present Efforts - The Merrimack River Initiative and Water For All**

In the late 1980s, both the Merrimack River Watershed Council and EPA began individual efforts to address the above concerns. The Merrimack River Initiative is a multi-agency collaboration, spearheaded by the U. S. Environmental Protection Agency, Region 1 (EPA). Its objective is to coordinate plans for managing and protecting the Merrimack River watershed. The Initiative began in 1988 with the signing of an agreement between the EPA, the states of New Hampshire, Massachusetts, and the New England Interstate Water Pollution Control Commission.

These agencies realized that no single community or government agency has the complete authority, money, or staff to protect and restore all the resources along the Merrimack River and its associated watershed. They envision that by taking a "Watershed Protection Approach" to planning, resources can be optimized - an approach that diverges from the traditional program-by-program response to water resources management.

EPA's Region 1 office anticipates that the Initiative will be funded for four years, beginning in fiscal year 1993. One of the primary objectives of the Initiative participants is to devise a strategy for the long-term management of water resources, that will endure beyond Initiative efforts. Participants, especially those representing environmental interests, have identified interstate coordination on water use and allocation as an important issue to be addressed by the Initiative process.

In 1989, the Merrimack River Watershed Council, a citizens based organization, elected to address its concerns for multi-state water supply issues by developing its ongoing Water For All Program. The goal of the program is to begin a process of reaching consensus among public agencies and private entities on an integrated plan to protect and manage the river and watershed.

Although there are many programs and activities that affect the watershed<sup>5</sup>, there has, to date, been no means by which to monitor and coordinate them. The Merrimack River Initiative and the Water For All Program are opportunities to

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<sup>5</sup> The MRWC is compiling a directory of all programs that effect the watershed. It currently lists more than 150 programs.

integrate many existing programs into a single concerted effort centered on the Merrimack River watershed.

### **Sustainable Solutions - A "Watershed Protection Approach"**

Water resource-related issues and events are rarely contained within conventional boundaries defining a community, town, regional planning agency area, state, or even country. Thus management decisions must be addressed at levels beyond those of fixed political jurisdictions. Integrated decision making, in which problems are considered with regard to their interrelated totality, is required by the nature of the primary resource being managed - flowing water.

It is an onerous challenge to require all who benefit from the commonly held water resource to contribute equitably towards managing and protecting it. The Merrimack River watershed is a sizable region. It is likely that many of the 200 towns that lay within the watershed boundary do not realize their role in protecting the larger ecological community of which they are an integral part. Further, there appears to be little link between those entities that bear the cost of clean-up and conservation, and those that reap the benefits. A municipality or industry that elects to adopt water conservation activities primarily benefits downstream users. In this respect, a watershed system is more complex analytically and operationally more difficult to manage and protect than other resource systems. The costs and benefits of environmental actions are not always immediately tangible and perceptible, and the costs and benefits are not always borne by the same group of individuals.

The fact remains, however, that if water resources management is to be environmentally sound, and equitable among diverse interests and instream uses, it must be carried out at the watershed level. Thus, we must begin to move away from the traditional fragmented decision making and actions that have characterized our present water resource use and allocation schemes in the Merrimack River watershed, and move toward a new approach that emphasizes natural boundaries over artificially imposed municipal and state boundaries. Inter-jurisdictional solutions must be a prime mechanism for implementing watershed efforts for the Merrimack - in fact, they are the only realistic approach in light of the current demands on the Merrimack River watershed's surface and ground water resources and fragmented regulatory and institutional structure.

The concept of "bioregionalism" offers some important principles for framing inter-jurisdictional strategies for management. An important tenet of this movement is an integrated process for environmental and development decision making, and a ecosystemic approach to natural resources management. Bioregionalism begins with the realization that natural resources related matters rarely respect conventional political boundaries. The word "bioregional" comes from **bio**, the Greek word for forms of life, and **regio**, Latin for territory to be ruled. Together they mean life-territory , a place defined by its life forms, its topography and its biota, rather than by human dictates; a region governed by nature, not legislature<sup>6</sup>.

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<sup>6</sup> Foster, in his book Experiments in Bioregionalism: The New England River Basins Story (1984), explains that bioregionalism in the United States has its roots in the early conservation movement. Notable environmental activists such as New England's Henry David Thoreau and California's John Muir were perhaps the first bioregionalists. But in the 1920s and 1930s bioregionalism truly blossomed during the era of the New Deal. One

Foster, in his book Experiments in Bioregionalism: The New England River Basins Story (1984) contends, "If we are to begin managing natural systems in their entirety as the ecologists would have us do, we must accelerate the search for approaches and institutions that can address resources regionally while remaining credible in conventional political terms". He argues that in a time of declining federal presence and activity, the states must undertake effective bioregional resource management. We are in the midst of a changing societal perception of government's role. "An underpinning of 'Reaganomics' is less governmental interference, especially at the federal level." He envisions a growing role for the states in devising new ways to "bridge jurisdictional differences so that natural resources and environmental matters can be addressed in the context within which they occur." Bioregionalism is a notion that goes beyond environmental concerns as such, and speaks to the full array of socio-economic organization. It recognizes that a truly holistic approach means looking at all implications of choices, both in the natural and interlinked societal systems. No jurisdiction can develop in isolation of others; hence the pursuit of sound environmental policy and planning requires a new orientation in inter-jurisdictional relations. The principles of bioregionalism should be kept in mind as we frame water use and allocation strategies for the Merrimack River watershed.

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functions. Partly as a result of the Hoover Commission's findings of natural resources overlap and inefficiency, institutional experimentation began in the water resources field. An innovative endeavor was the Delaware River Basin Commission, an agency with statutory management function for this major interstate river basin.



## **CHAPTER 2**

### **DESCRIPTION OF THE WATERSHED, ITS USES, AND USERS**

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This chapter has several objectives. The first is to define some basic terminology and concepts commonly used in the fields of watershed management and water allocation, and throughout this report. The second is to describe several important characteristics of the Merrimack River watershed, river flows, and the historical use of the river and its resources. The third is to present a profile of the major functional roles and beneficial uses of the water resources of the Merrimack River watershed. The intent of this chapter is to emphasize the importance of the multiple-use character of the watershed's water resources, and to establish that there is a critical need for a coordinated approach to use and allocation management in order to balance these uses.

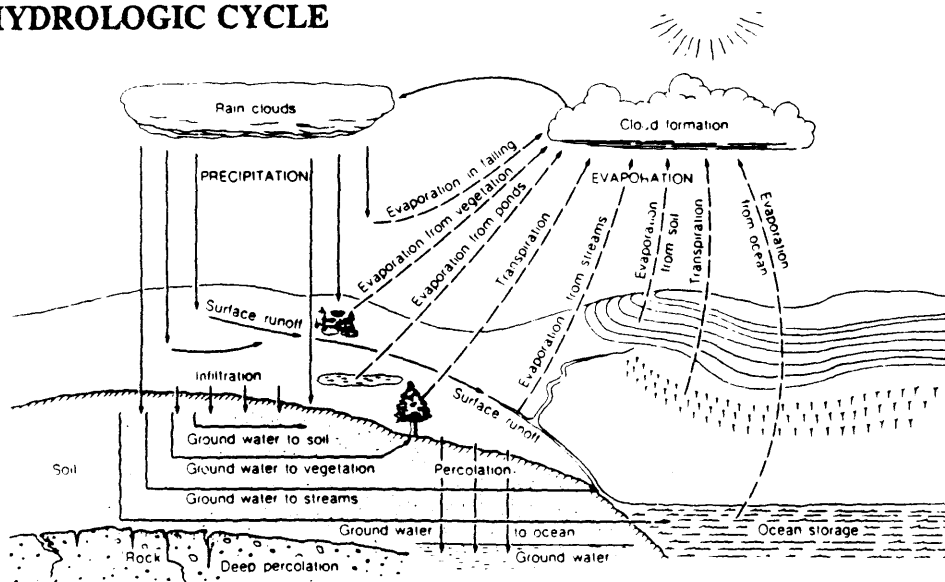
#### **BASIC TERMINOLOGY AND CONCEPTS IN WATERSHED MANAGEMENT AND WATER ALLOCATION**

##### **Hydrology and the Hydrologic Cycle**

Hydrology describes the ways in which water moves around the earth. The hydrologic cycle is basically the movement of water from the atmosphere, its inflow, temporary storage on land, and its outflow to the primary reservoir, the oceans. The cycle consists of three principal phases: precipitation, evaporation, and surface and groundwater runoff. Each phase involves transport, temporary storage, and a change in the state of water [see Figure 1 on page 26].

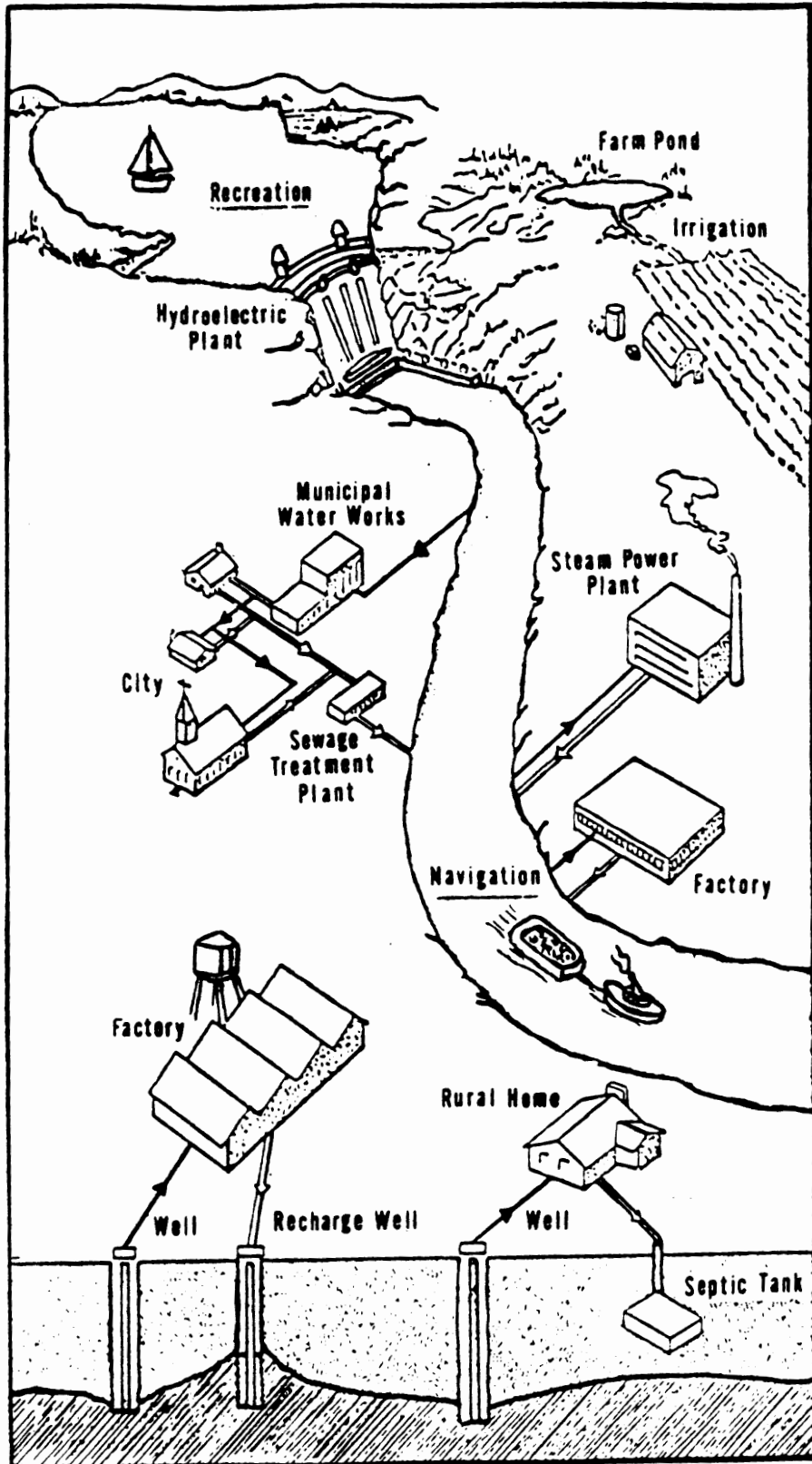
The activity of water is subject not only to natural fluctuations, but to human activity. Because people are major agents in the hydrologic cycle, the hydrologic cycle is an appropriate framework for analyzing human modification of land and water resources. People alter the land surface, manipulate the quantities of water stored in various parts of the cycle, and radically change the characteristics of water with respect to the concentrations of sediment, solutes, temperature, and biota. Examples of the means humans have developed to deal with natural variability of water supplies include the construction of reservoirs to delay surface runoff, development of groundwater resources, and importation of water from adjacent basins with greater natural supplies. Hydrologic considerations, such as the paths that water takes, what the water is doing at various stages along each path, and how the quantity, quality, or any other characteristic of the water that is altered by human action, are of great interest to water resource planners. (Dunne, 1978). [See Figure 2 on page 27.]

**Figure 1**  
**THE HYDROLOGIC CYCLE**



Source: Council on Environmental Quality, 1981, Washington, D.C.

Figure 2  
THE MANY USES OF WATER



## **Watersheds and Rivers**

A watershed is the total land area from which water drains into a particular river, lake, or other water body. All land is part of one watershed or another. When rain falls, much of the water runs across the surface of the land toward a river, for example, as surface runoff. A watershed is the fundamental geographic unit of hydrology. The New England Region lies predominantly within one major watershed draining into the North Atlantic. The region is then divided into 11 smaller sub-watersheds over the six New England states, including the Merrimack River watershed.

Watershed systems have geologic, hydrologic and biotic components, each of which can be viewed as a system in its own right. In order to fully understand the role of one operation, for example water withdrawals, within a watershed, an interdisciplinary view that combines all of the components of the watershed system is required.

Watersheds are also referred to as drainage basins or river basins. For the purposes of this thesis, the term "watershed" is used for consistency. The term "river" can be confusing since, although it is sometimes used to connote the entire watershed, it is generally understood, and will be used in this thesis, to mean only the channel with water flowing through it.

## **Streamflow and Minimum Instream Flow**

Streamflow refers to water, at a given amount, moving down a stream bed. Streamflow is measured as the discharge or volume of water which passes a given channel cross-section over a given unit of time. Streamflow is typically described in terms of cubic feet per second (cfs) or million gallons per day (mgd). (One cubic foot per second equals 0.647 million gallons per day.)

The concept "minimum instream flow", sometimes called "reasonable streamflow", "reasonable instream flow", or "protected instream flow" is used to define how much water must be available in a river during low flow periods to meet current and projected instream water uses and maintain habitat values. Throughout the United States there are a variety of approaches for establishing protected instream flows. Most are in western states, although the number of eastern states with flow protection measures is increasing. Ideally, once minimum instream flow values can be established, then regulators can determine how much additional water can be allocated for future uses while still sustaining existing instream and out-of-stream water uses.

## **Water Allocation**

Water allocation refers to the strategy or process of deciding how much water can reasonably be allowed for particular water withdrawals. It is the quantitative distribution of water, based on an estimation of water resources requirements. In Massachusetts allocation is administered by the state agencies with permitting and/or

planning authority. New Hampshire relies on the common law system of riparian rights as the rule to allocate water resources, though some allocations must be approved by the Legislature.

### **Safe Yield**

One of the key concepts used in water resource planning is the concept of safe yield. Safe yield is a determination of the amount of water that can be withdrawn from a watershed (or from a source within a watershed) without either unacceptably depleting other, interconnected components of the hydrologic system or causing the source itself to become depleted. (Colburn, 1990)

## **DESCRIPTION OF THE MERRIMACK RIVER WATERSHED**

### **Physical Characteristics of the River and Watershed**

The Merrimack River watershed extends from the White Mountains Region of north-central New Hampshire southward into the east, central part of Massachusetts. [Figure 3 on page 32 shows a map of the watershed, the towns within it, and the river.] The fourth largest river watershed in New England, it has an area of 5,010 square miles, 76% of which is in New Hampshire and 24% in Massachusetts. The Merrimack River proper is formed by the convergence of the Pemigewasset and Winnepesaukee Rivers in Franklin, New Hampshire and flows for 118 miles, the last 22 miles of which are tidal. The river travels through varied terrain, past the major cities of Concord, Manchester and Nashua, New Hampshire, into Massachusetts

where it flows southeasterly through Lowell, Lawrence, Haverhill, and empties into the Atlantic Ocean in Newburyport. The total vertical descent of the Merrimack from Franklin, New Hampshire to mean sea level is approximately 245 feet. Major tributaries of the Merrimack River include the Pemigewasset, Winnepesaukee, Contoocook in New Hampshire, and the Sudbury, Assabet, Concord, Nashua, Stoney Brook, and Shawsheen in Massachusetts.





### **River Flows**

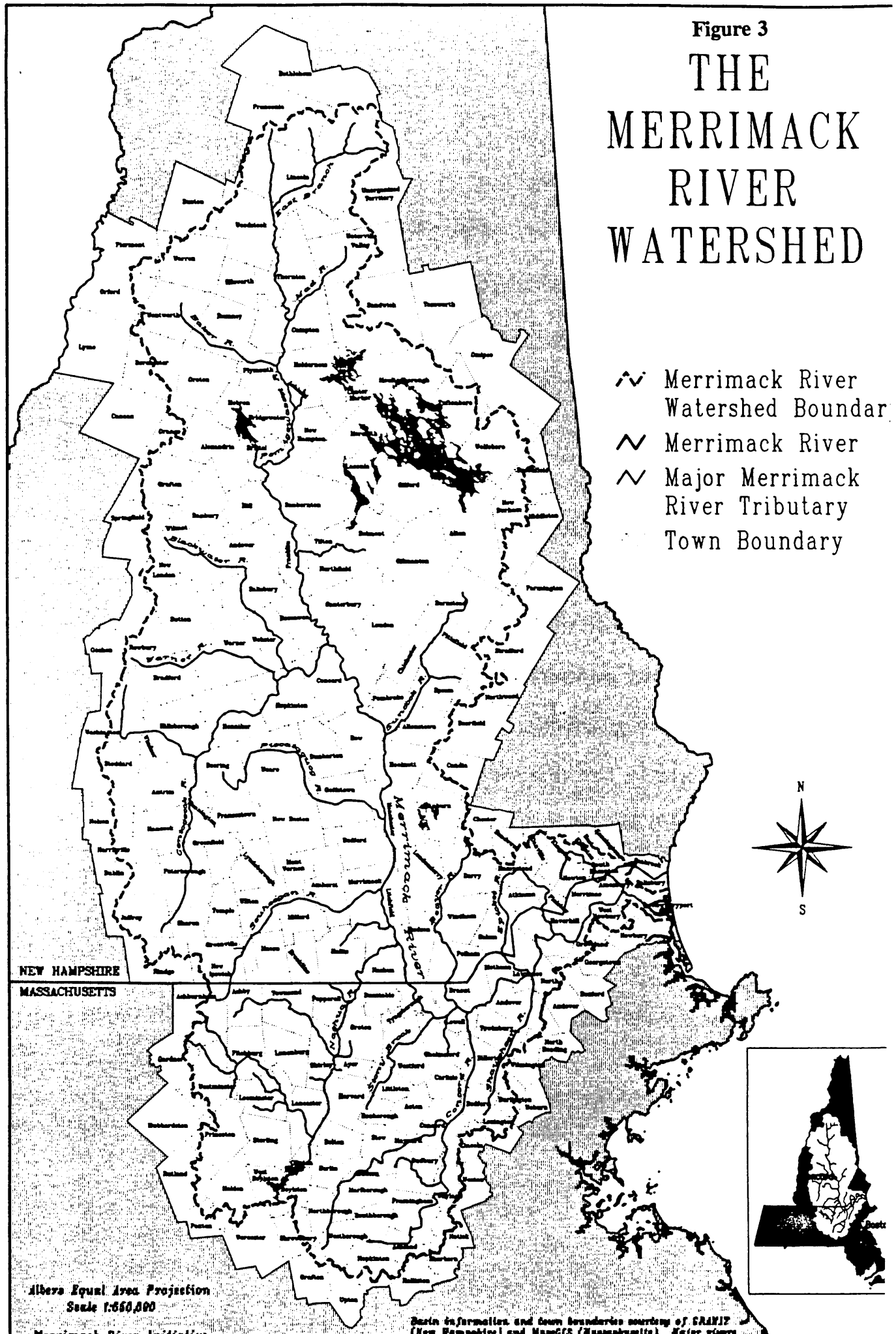
The Merrimack River watershed runoff flows through an interconnected system of surface and ground waters. Although surface waters are the most visible manifestation of runoff and available water supply, river water is derived primarily from groundwater via subsurface flow. National surveys estimate that 60% of stream flow comes from groundwater. An unresolved planning and management problem centers around the lack of understanding of the basins groundwater hydrology, and the interconnection between groundwater and surface water.

The Merrimack River and its tributaries are not free flowing, but are greatly influenced by impoundments in numerous locations. Six dams have been constructed on the main stem so that water can be stored during wet periods and released during dry periods to augment flows for power generation, flood control, water supply, and other purposes.

Figure 3

# THE MERRIMACK RIVER WATERSHED

-  Merrimack River Watershed Boundary
-  Merrimack River
-  Major Merrimack River Tributary
-  Town Boundary



NEW HAMPSHIRE  
MASSACHUSETTS

Albers Equal Area Projection  
Scale 1:660,000

Basin information and town boundaries courtesy of EAHNIP  
(New Hampshire) and MassGIS (Massachusetts). Water colors by [unreadable]



Weather in New England is highly variable. Though severe drought is not common, there have been periods of severe drought every twenty years, including one in the mid 1960s. Shorter term dry conditions are present most years during the period from July through October, and during February and March. This can result in relatively lower flows for periods ranging from a few days during normal years to more than a week during extreme conditions.

River flow in the Merrimack River's main stem is measured at three gauging stations by the United States Geological Survey (U.S.G.S.), at Franklin Junction and Goffs Falls in New Hampshire and Lowell, Massachusetts. The data from these stations is used to calculate various flow frequencies. The 7-Q-10 flow<sup>7</sup> at Franklin Junction is 550 cfs/346 mgd, and at Goffs Falls is 664 cfs/429 mgd, while further downstream at Lowell is 930 cfs/602 mgd. The lowest flow at the mouth of the River of 199 cfs/128 mgd, was recorded on September 23, 1923. (Nashua Regional Planning Commission, 1989).

### **Historic Use of the River and Watershed**

The Merrimack River and its largest tributaries and headwaters (where many believe the American industrial revolution began) have been used for more than 150 years to support economic growth and development of the region<sup>8</sup>.

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<sup>7</sup> The 7-Q-10 flow refers to the lowest 7 day sustained flow which occurs once in 10 years. The 7-Q-10 flow is often used as the minimum flow for waste assimilation in calculating wasteloads.

<sup>8</sup> Personal interview: Ralph Goodno, Director, Merrimack River Watershed Council, 1992.

As the primary economic base of the region was agrarian in the 1700s, the rivers in the Merrimack River watershed were used primarily as a source of food and water, with numerous falls and rapids limiting travel upstream from Lowell. With the opening of the Middlesex Canal in 1803, water transportation became a major means of travel. In the mid-1800s, industries began to develop along the Merrimack River as the first major dams were constructed at Manchester, Nashua, Lowell, and Lawrence to harness the river's water. The manufacture of textiles, paper and leather goods dominated the economic base of the main stem communities. With the growing use of railroads, river transportation decreased, and the use of the river for water power became more prominent through the turn of the century.

In addition to being used for transportation and power, the Merrimack River has long been used as a public water supply. The water quality of the Merrimack became a public health concern by the end of the 1800s. Water supply studies conducted by the Lawrence Experiment Station in 1887 showed evidence of high levels of industrial and domestic pollution in the river, requiring Lowell and Lawrence to temporarily discontinue use of the river as a public supply until filtration facilities could be constructed.

Water quality continued to deteriorate through the 1960s as discharges of raw sewage and industrial wastes increased and the river was labelled as one of the 10 most polluted in the nation. Today, after two decades and 1/2 billion dollars in Federal and State expenditure, the condition of the river has improved dramatically. The improvement is mostly due to funding programs established for municipal

wastewater treatment facilities and the National Pollution Discharge Elimination System (NPDES) limitations on effluent discharges, both results of the Clean Water Act.

Ironically, the degraded condition of the River protected its shores from further development for many years. But the improved condition of the Merrimack, coupled with the economic boom of the 1980s, sparked renewed interest in the river and in development within its corridor. As a result, many demands are placed upon the Merrimack River as it flows from northern New Hampshire to the Atlantic Ocean as the diversity of uses has once again returned. Recreational uses and fisheries, in addition to increasing demands as an important water supply, have raised additional issues and concerns regarding future water use. (Commonwealth of Massachusetts, 1990)

Water in the Merrimack River basin is a finite resource. It is difficult to determine how much water may be allocated to various users and how much must remain in the river to support multiple functions. Today the Merrimack River provides energy for power production, water for drinking and domestic, industrial, commercial, and agricultural purposes, dilution for wastewater discharges, and an aquatic environment which supports many forms of wildlife and outdoor recreation. The challenge is to balance the water needs of the many competing uses and to use water wisely to ensure the biological and chemical integrity of the river and sustain it as a vital life force in the region.

## **MULTIPLE USES AND USERS OF THE WATERSHED'S WATER RESOURCES**

An estimated 1,484,000 people lived within the 200 towns and cities of the Merrimack River watershed in 1980; 532,000 in New Hampshire and 952,000 in Massachusetts. This represents an overall increase of 14 percent over the 1970 population of 1,304,000, an increase of 38 percent in New Hampshire and 7 percent in Massachusetts. (Nashua Regional Planning Commission, 1989). The economy of the watershed is based largely upon manufacturing and service industries. Wholesale and retail trade, medical and professional services, public administration and utilities have represented about 85% of the employment within the watershed in recent years. (Nashua Regional Planning Commission, 1989). This larger population and industrial base placed much greater demands on the river for the dual purposes of assimilating wastes and a clean drinking water supply.

As a multiple-use river, the capacity of the Merrimack River to support competing uses is limited. For example, the removal of large quantities of water for public and private water supplies could affect the river's capacity for waste assimilation, and in turn impact its ecological integrity and use as a water supply. It is therefore important to maintain a balance between the many river uses and users to ensure the continuation of the multiple use capabilities and the protection of river's important natural resources.

Water resources managers divide the functional roles and beneficial uses of the water resource into two general categories: instream values and out-of-stream values. Uses of water within a river channel, or instream values, include fish and wildlife

population maintenance, aesthetic and recreation activities, hydroelectric power, waste assimilation and ecosystems maintenance. Out-of-stream values are associated with water withdrawn for purposes outside of the river itself such as water supply for domestic, agricultural, commercial, and industrial uses. The withdrawn water may, or may not, be returned to the river system from which it came. Withdrawals which are returned in equivalent volume to the stream are called non-consumptive uses; whereas, those withdrawals which are not available to replenish the river system are called consumptive uses.

An important consideration when reviewing the following information and establishing a context is that very few water uses are totally consumptive. The great majority of uses return all or most of the withdrawn water back to the hydrologic system. Consumptive uses include evaporation and out-of-basin transfers. For example, estimates show that public water supplies generally return 80% to 90% of the water quantity back to rivers and streams through wastewater treatment plants. Below is a summary of important instream and out-of-stream functions of the Merrimack River's water resources.

### **Water Supply**

**Public Water Supplies:** A critical out-of-stream use of the water resources is for public water supplies. The Merrimack River itself is a public drinking water supply for over 300,000 people. The New Hampshire Department of Environmental Services, Water Resources Division water use data shows the major direct

withdrawals for public water supplies in the New Hampshire portion of the river to include Pennichuck Water Works, serving Nashua and Merrimack (12.6 mgd) and Manchester Water Works, in Manchester (15 mgd). Data provided by the Massachusetts Department of Environmental Protection, Division of Water Supply shows the cities of Lawrence (9.5 mgd), Methuen (4.59 mgd), Andover (6.75 mgd), and Lowell (13.8 mgd), Haverhill (6.06 mgd), and North Andover (2.66 mgd) as the major users who withdraw water directly from the Merrimack River for public water supplies. The U. S. Geological Survey estimates that the ground and surface water resources of the watershed provide water for almost two million citizens of the two states [see Figure 4 on page 39]. The volume of water coming from the watershed, used for domestic purposes is about 112 mgd. Some of the communities withdraw water directly from the river and either store it in holding ponds or use it immediately after treatment. Others rely on groundwater sources very near the river and there is believed to be some direct recharge of the aquifers from the river.

It should be noted that the Boston's Metropolitan District Commission (MDC)/Massachusetts Water Resources Authority (MWRA) draws water from the Merrimack River watershed to supply water to communities outside the watershed. Water is transferred from the Quabbin Reservoir in the Chicopee basin to the Wachusett Reservoir in the Nashua sub-basin of the Merrimack River watershed. From the Wachusett Reservoir, 126 mgd of water is transferred to the Boston metropolitan area, outside the watershed, via the Cosgrove and Wachusett aqueducts to serve 35 communities in the greater Boston metropolitan area.

**Figure 4**  
**POPULATION SERVED FOR WATER SUPPLY WITHIN THE MERRIMACK WATERSHED**

Public Supply (in thousands)	MA	NH	Totals
Ground Water	267.49	166.34	433.83
Surface Water	663.42	259.75	923.17
Totals	930.91	426.09	1357.00
Self Supplied	341.21	267.70	608.91
<b>Total Supplied</b>	<b>1272.12</b>	<b>693.79</b>	<b>1965.91</b>

(source: Summary of information from the U.S.G.S. Aggregated Water Use Data System database, 1990)

New withdrawals from the Merrimack for water supply purposes have recently been proposed and some have been approved in both states. Pennichuck Water Works of New Hampshire was recently assured a withdrawal of 30 mgd by the New Hampshire Legislature. Other New Hampshire water suppliers, such as Manchester Water Works and the Southern New Hampshire Water Company are looking at the Merrimack River for meeting growing demands<sup>9</sup>. A study by the Southern New Hampshire Water Supply Task Force indicates a shortage of water in many communities in and outside the basin (State of New Hampshire, 1990). In Massachusetts, throughout the 1980s the MWRA has looked toward the Merrimack River as an alternative supply of water to meet the growing demands of the Boston

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<sup>9</sup> Personal interview: Ralph Goodno, Director, Merrimack River Watershed Council, 1992

region<sup>10</sup>. An application by the town of North Reading (located in the Ipswich River basin) to transfer water from the town of Andover (located in the Merrimack River basin) was recently approved by the Massachusetts Water Resources Commission<sup>11</sup>. These proposed allocations sparked much debate between environmentalists, resource managers, and water suppliers throughout the public review process which has heightened awareness and concern for the long range cumulative impacts of future withdrawals from the Merrimack River Basin (Merrimack River Watershed Council, 1990).

**Other Out-of-stream Uses:** Although public water supplies for domestic use are by far the largest consumptive use, water in the Merrimack river watershed is used for commercial, industrial, and agricultural purposes as well. Percentages by category of use, compiled from the U.S.G.S data, are shown in the pie chart below in Figure 5. Volumes (in mgd) by use category are shown in Figure 6 [see page 41]. Hydroelectric power, although the largest use of water by volume, is not included in the table because it is, for the most part, a non-consumptive use.

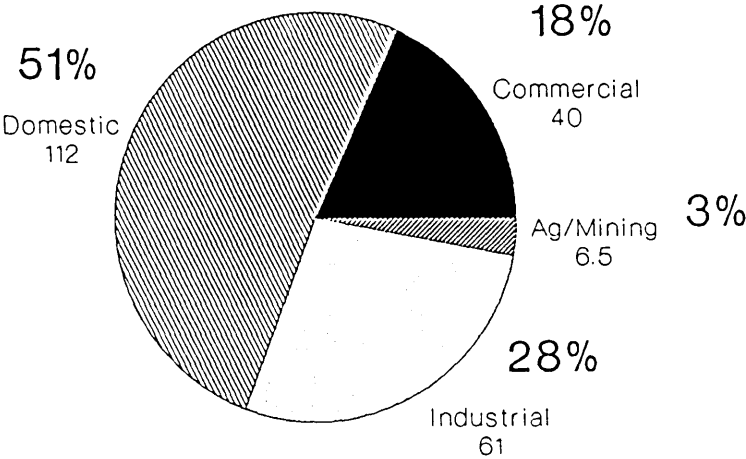
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<sup>10</sup> A diversion of 120 mgd from the Merrimack was an alternative proposed in the "Long Range Water Supply Study and Environmental Impact Report - 2020" by the Massachusetts Water Resource Authority (MRWA) in 1986. This was the only alternative under study which alone could satisfy the entire projected MWRA water needs for 2020. The alternative posed several problems: The source water is of poor quality and therefore would require a high level of treatment; the operation of the alternative would result in an impact of downstream hydropower facilities; there are, on the average, only 186 days per year on which minimum streamflow requirements for other water uses, including anadromous fish and wastewater dilution would not be affected by the diversion. In 1986, the Board of Directors committed the MWRA to an aggressive five year strategy of water conservation, demand management a better use of water resources, instead of developing new sources of water.

<sup>11</sup> On May 11, 1990, the Town of North Reading, in the Ipswich River basin, submitted an application to increase the rate of its interbasin transfer. North Reading proposed to purchase up to an additional 1 mgd of water from the Town of Andover, whose water supply is derived entirely from the Merrimack River watershed. On January 14, 1991, the Water Resources Commission approved the application, provided that the Town of North Reading furnished that it has completed conservation measures, thus fully complying all of the six applicable criteria required under the Interbasin Transfer Act.



**Figure 5**  
**Merrimack River Watershed**  
**Water Use in 1990**  
(Million gallons per day)



Source: U.S.G.S

**Figure 6**  
**WATER USE WITHIN MERRIMACK WATERSHED**  
(million of gallons/day)

	MA	NH	Totals
<b>Commercial Use</b>			
Self Supplied			
Ground Water	4.46	0.14	4.60
Surface Water	13.42	0.05	13.47
Totals	17.88	0.19	18.07
Public Water Supplies	10.97	10.48	21.45
Totals	28.85	10.67	39.52
<b>Domestic Use</b>			
Self Supplied			
Ground Water	5.49	17.39	22.88
Surface Water	0.00	0.00	0.00
Totals	5.49	17.39	22.88
Public Water Supplies	58.31	30.39	88.70
Totals	63.80	47.78	111.58
<b>Industrial Use</b>			
Self Supplied			
Ground Water	14.75	0.14	14.89
Surface Water	4.92	1.58	6.50
Totals	19.67	1.72	21.39
Public Water Supplies	30.37	9.60	39.97
Totals	50.04	11.32	61.36
<b>Mining Use</b>			
Ground Water	0.00	0.02	0.02
Surface Water	3.00	1.54	4.54
Totals	3.00	1.56	4.56
<b>Livestock Use</b>			
Ground Water	0.18	0.30	0.48
Surface Water	0.13	0.09	0.22
Totals	0.31	0.39	0.70
<b>Irrigation Use</b>			
Ground Water	0.00	0.06	0.06
Surface Water	0.16	0.62	0.78
Totals	0.16	0.68	0.84
<b>Total</b>	<b>146.16</b>	<b>72.40</b>	<b>218.56</b>

(Source: Summary of information from the U.S.G.S. Aggregated Water Use Data System database, 1990)

A commercial use of water in the Merrimack is for snow making for Ski Areas in the White Mountain region of New Hampshire. A review of the Revised Draft Environmental Impact Statement (RDEIS) is in process for a proposed withdrawal from the Pemigewasset River for snow making at Loon Mountain Ski Area. This review is being carried out by the U.S. Forest Service, who proposes to approve a special-use permit that would allow Loon Mountain Recreation Corporation to construct a new ski area on nearby South Mountain in the White Mountain National Forest. A critical environmental issue expressed by EPA and in an opinion by the Attorney General for State of New Hampshire<sup>12</sup> regarding this case has been whether there would be enough water in the watershed of the East Branch of the Pemigewasset River to make snow for the new ski area without degrading the river<sup>13</sup>. As in the case of the Town of Lincoln's withdrawals from the East Branch of the Pemigewasset River<sup>14</sup>, municipal water systems often raise public trust issues<sup>15</sup> because they place

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<sup>12</sup> The opinion, dated August 2, 1989, by the Attorney General, Environmental Protection Bureau, for the State of New Hampshire, takes the position that the proposed increased water withdrawals by the Loon Mountain Recreation Corporation would exceed the scope of water use permitted to littoral and riparian land owner, and the proposed increases in water use constitute infringements of the State's public trust interest in Loon Pond and the East Branch. Therefore, legislative action conveying the right to make such withdrawals is required.

<sup>13</sup> Comments on the RDEIS were outlined in a letter to the Forest Supervisor of the White Mountain National Forest from the Regional Administrator of EPA, dated March 4, 1991.

<sup>14</sup> The opinion, dated August 2, 1989, by the Attorney General, Environmental Protection Bureau, for the State of New Hampshire, takes the position that major withdrawals of water from the Loon Pond watershed by recent alterations to the Town of Lincoln's drinking water withdrawal system (brought to light during the environmental review of the ski area expansion), also exceed the riparian right of the Town to make reasonable use of public waters. They also concluded that the existing and proposed Town withdrawals are likely to deplete water supplies in Loon Pond the East Branch watershed with significant implication for fish habitat, recreational use, and environmental preservation, and therefore these withdrawals require legislative authorization in light of the State's public interests.

<sup>15</sup> Under the public trust doctrine, the rights of the public, state, and federal government, have greater priority than the rights of the individual.

heavy demands on State surface waters that may conflict with other public interests. In fact, the vast majority of legislative actions in New Hampshire, conveying the right to make water withdrawals, have related to requests by private or municipal water works entities<sup>16</sup>.

The New Hampshire opinion by the Attorney General affirmed that the Town of Lincoln's right to withdrawal from the Pemigewasset River must be "reasonable" in light of the paramount public rights of the State, as well as those of other water users. Furthermore, the opinion contends that, although New Hampshire courts have not addressed the issue directly, there is a prevailing rule in other jurisdictions that any withdrawal of water for public distribution is not a recognized riparian use. Consequently, all water withdrawals used for public distribution require legislative authorization to avoid conflict with the State's public trust rights (State of New Hampshire, 1989).

As a result of these past events, both privately owned water supply companies and public utilities have great uncertainties with regard to future water withdrawals from the Merrimack River watershed. Their main interest is in ensuring that there is enough quality water available to meet the long-term future consumption needs of their consumers. Although state-wide and national organizations exist, water suppliers have not traditionally been organized at the regional, or watershed level. And self-supplied users (e.g.: many industrial withdrawers) are even less organized.

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<sup>16</sup> A memorandum from Donald R. Hunter to New Hampshire Representative Douglas Woodward, dated June 18th, 1984, listed 157 legislative authorizations for water supply withdrawal between 1850 and 1984). (State of New Hampshire, 1989).

Both groups are just recently becoming aware of the need to follow legislative and government agency activities on the watershed level in order to protect their interests. They are now interested in participating in a process to define the criteria by which water supply will be allocated at a watershed level<sup>17</sup>.

### **Hydroelectric Power**

Hydroelectric power facilities, which generate electricity at dams throughout the watershed, are by far the largest users of water, by volume, in the Merrimack River. Although water use for hydroelectric power is a non-consumptive use, flow regulation through dams have had significant impacts on instream flows, and thus upstream and downstream uses of the river. There are 5 hydroelectric power dams on the main stem of the Merrimack River, 6 on the Winnepesaukee River, and 3 on the Pemigewasset River, most of which are run-of-river facilities.

Flow requirements for hydroelectric power may potentially conflict with other river water demands. A large water supply withdrawal, such as the 1986 MWRA proposal, could conceivably interfere with hydroelectric power facilities by diminishing flows; and likewise, hydroelectric power facilities may hinder uses such as recreation, and fisheries, by modifying natural flow regimes.

Hydroelectric power companies and associations, such as Consolidated Hydro in Massachusetts and Granite State Hydropower Association in New Hampshire, are primarily concerned with maintaining an adequate flow of water along the river

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<sup>17</sup> Personal interview: Tom Macaloon, Chief Engineer, Pennichuck Water Co., February, 1992; The Merrimack River Watershed Consortium held by EPA, Region 1, 1992

throughout the year to generate electricity. For example, they would like to explore alternatives for "ponding" water from the river during heavy flows, for release during the summer months so that water flows can be more consistent throughout the year<sup>18</sup>.

### **Waste Assimilation**

Another important function of instream flows is waste assimilation. Unlike the Quabbin Reservoir system, in the Merrimack River system it is impossible to protect the drinking water sources by comprehensively excluding many point and non-point sources of pollution. Point sources of pollution include discharges from an identifiable source such as a pipe. All point sources of pollution that discharge to surface water are required to obtain a permit under the 1972 Federal Clean Water Act's National Pollutant Discharge Elimination System (NPDES). NPDES permits specify effluent limitations, compliance schedules, and monitoring and reporting requirements. Under the NPDES process, discharges are categorized either as municipal or industrial, as well as major or minor<sup>19</sup>.

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<sup>18</sup> The Merrimack River Watershed Consortium held by EPA, Region 1, 1992

<sup>19</sup> A major municipal discharge has one of the following characteristics: 1) a flow equal to or greater than 1 million gallons per day (mgd), 2) an impact on downstream uses, or 3) discharge upstream of a public water supply. The classification of major industrial discharges is based on a more complex point system that considers toxic pollutant potential, wastewater flow rate, type of wastewater (non-contact cooling water or process water for example), amounts of conventional pollutants, heat load, presence of downstream water supply, and water quality limitations of the stream.

**Industrial Discharges:** The economy of the watershed region, within both states, is based largely on the manufacturing and service industries. Throughout the years industries, such as Anheuser-Busch and W.R. Grace Co., have been attracted to the river corridor as a water supply for industrial processing, and a site to discharge waste. The Merrimack River Basin presently has 24 major permitted industrial dischargers, and 141 minor dischargers (U.S. EPA, 1987).

**Municipal Discharges:** Seventy-one municipal facilities discharge into the Merrimack, of which 4 are drinking water purification plants, 52 are secondary or advanced wastewater treatment plants, and the remaining 15 are primary treatment facilities. The ones providing primary treatment are being upgraded. Nineteen of these municipal plants are required to have an industrial waste pretreatment program. Unfortunately, the wastewater collection systems for several of the older Merrimack River communities were designed to convey both sewage and stormwater. During storms these facilities, called combined sewer overflows (CSOs), have flows in excess of system capacity and raw sewage is discharged into the river<sup>20</sup>.

**Non-point Source Pollutants:** Non-point source pollutants, such as urban and agricultural run-off, must also be assimilated the by Merrimack River. However, because non-point sources of pollution are not easily identified and, in many instances, have more than one origin, the effects of these sources are difficult to

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<sup>20</sup> Combined sewer overflows have been cited as a major contributing factor in violations of NPDES permits for significant municipal discharges in the Merrimack. The wastewater collection systems for several of the older Merrimack River communities, Manchester and Nashua New Hampshire and Lowell, Lawrence and Haverhill Massachusetts were designed to convey both sewage and stormwater. When flows are in excess of system capacity during storms there are discharges through combined sewer overflows to the Merrimack River. The EPA has estimated that it will cost 500,000 million dollars to fully correct the problem. Unfortunately federal funding through the Clean Water Act for the construction grants to assist municipalities to construct or upgrade wastewater treatment facilities has declined significantly during the past decade.

assess and hard to control. New Hampshire and Massachusetts reported non-point sources of pollution as a major reason why stream segments are not meeting designated uses<sup>21</sup>.

**Water Quality Status:** Because of both point, and non-point sources of pollution, the Merrimack River has significant water quality problems. These are: bacterial contamination from combined sewer overflows; low levels of dissolved oxygen; excessive nutrients and toxic pollutants<sup>22</sup>. The primary sources of these problems include wastewater treatment plants, urban runoff, industrial discharges, landfills, and septic systems<sup>23</sup>.

Under the 1972 Federal Clean Water Act, states must submit biennial reports on water quality which estimate the percentage of the streams they have evaluated that are meeting the water quality standards relating to designated uses for the stream segments<sup>24</sup>. According to the 1990 reports for Massachusetts and New Hampshire, only 52.4% of the streams in the Merrimack Basin meet the state's water quality classification<sup>25</sup>. The following pie charts [see Figure 7 on page 49] show percentages of river segments meeting designated use.

As withdrawals increase for water supply, the capacity of the river to

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<sup>21</sup> EPA estimates 50% of pollution comes from non-point sources of pollution.

<sup>22</sup> Information compiled from New Hampshire and Massachusetts 305(b) reports of 1990.

<sup>23</sup> EPA has estimated that one third of the pollutant load to Massachusetts Bay comes from the Merrimack River.

<sup>24</sup> These are referred to as the 305(b) Report after section 305(b) of the 1972 Federal Clean Water Act.

<sup>25</sup> This figure does not reflect recent changes to the classification of river segments in New Hampshire, or include all river segments in the watershed.



assimilate waste will deteriorate further. Industrial dischargers and wastewater treatment facilities believe that, over the past decade, they have made great strides in improving their waste treatment processes. They are concerned that if flows in the river are diminished further, the total volumes of waste water discharged must also decrease or receive a higher degree of treatment<sup>26</sup>.

## **Recreation**

In addition to the river water's instream functions as a energy source and for waste assimilation, it provides numerous recreational opportunities to the residents of the communities along its banks, to the region, and to the two states. The many parks within the watershed, and public access facilities supporting recreational uses of the river, are resources that are in high demand. The Merrimack River is the key attraction of the spectacularly successful Lowell National Heritage Park, state heritage parks in Lowell and Lawrence, Minuteman National Park, portions of the White Mountain National Forest, and many other parks and refuges. Activities such as boating, canoeing, kayaking, rowing, fishing and swimming take place in many locations on the river, and depend on an adequate flow and quality of water. River corridor protection programs at the Federal, State, and local levels are a primary mechanism for preserving and planning for additional recreational resources.

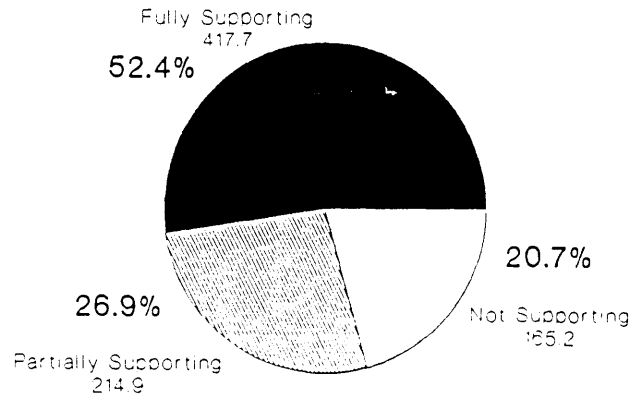
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<sup>26</sup> The Merrimack River Watershed Consortium held by EPA, Region 1, 1992

**Figure 7**

# Designated Use Support Merrimack River Basin

Number and Percent of River Miles Meeting Designated Use

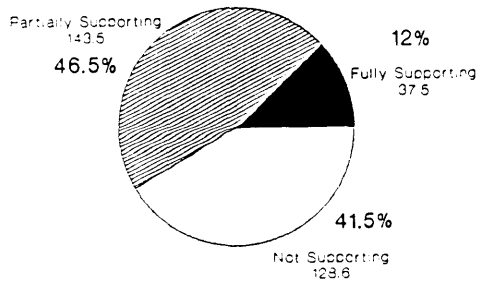


Data interpreted by EPA from NH and MA 1990 305(b) Reports

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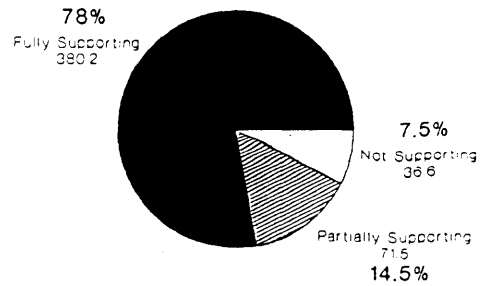
## Designated Use Support Merrimack River Basin - MA

Number and Percent of River Miles Meeting Designated Use



## Designated Use Support Merrimack River Basin - NH

Number and Percent of River Miles Meeting Designated Use



Three areas within the Merrimack watershed are currently under review for Wild and Scenic Rivers designations by the National Park Service. These are the Merrimack River from Franklin to Hookset, the Pemigewasset River between Thorton and Ayers Island dam and the Concord, Sudbury, Assabet River system<sup>27</sup>. In addition to the Federal Wild and Scenic Rivers Program, the New Hampshire Legislature passed an amendment during the 1990 session designating five segments of the river within the Merrimack River watershed into the New Hampshire Rivers Management and Protection Program. The five segments of river include the upper Merrimack, lower Merrimack, the Pemigewasset, the Contocook, and the north branch of the Contocook. Under this designation, instream flows will be maintained in a manner that will enhance or not diminish the enjoyment of outstanding characteristics of the river segment. New Hampshire is currently working to establish a mechanism to set protected instream flows on designated rivers.

It is clear that recreation is important to the economic well-being of many communities along the river system. But the magnitude and distribution of the economic benefits of water-based recreation in the watershed are uncertain. A primary concern in sustaining and enhancing water-based recreation is that there is an adequate flow of water is needed such that sufficient water quality is maintained for water contact.

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<sup>27</sup> In 1968, the Congress passed the Federal Wild and Scenic Rivers Act. The Act establishes a system for designating and protecting river corridors based on three classes of rivers: wild, scenic, and recreational. These classifications are based on the level of development already existing in the river's corridor. Prior to inclusion in the system, a detailed study of the river's characteristics is conducted by the National Park Service. During this study period, the river is granted the same level of protection against impoundments as a designated river. Upon completion of the study, the river may be nominated by Congress for inclusion in the system.

## **Fisheries and Wildlife**

The fisheries and wildlife of the Merrimack River watershed are important natural and economic resources. The health and viability of these resources are directly related to water quality and supply. Rare and endangered species habitats, inland and coastal wetlands and fisheries are examples of natural resources associated with the river and its watershed that support a diversity of uses, and require an adequate flow of water to be protected. Although these resources, especially fisheries, were diminished by industrial discharge and water development in the 1800s, improvements in water quality have led to widespread recovery (New England River Basins Commission, 1978).

**Wetlands:** Once thought of as wastelands and areas to be filled, the important role that wetlands play in the hydrologic and ecological health of an area is now recognized. Wetlands perform many important functions such as flood control and natural stream flow regulation, erosion control, and water purification while providing nursery grounds and wildlife habitat for numerous species<sup>28</sup>.

**Fish and Wildlife:** The Merrimack River corridor provides habitat for a diversity of fish and wildlife including species on federal and state lists of endangered and threatened species, such as the bald eagle. A variety of habitats such as wetlands, forests, fields, streams support a diversity of species in quantities healthy

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<sup>28</sup> Section 404 of the Federal Clean Water Act regulates the discharge of dredge and fill material in the Nation's waters, including wetlands. All dredge and fill activities are required by the CWA to obtain a permit from the U.S. Army Corps of Engineers prior to commencing the activity. Massachusetts and New Hampshire, as well as many local entities have wetlands protection laws, regulations, and programs, in place.

enough to ensure continuation of the species. Maintenance of quality habitat is important to survival of all species<sup>29</sup>.

Anadromous fish populations, once an important component of the Merrimack's fisheries were severely affected by industrial activity and its associated pollution and dam building. Yet today, anadromous fish species, such as salmon and shad, are beginning to return to the river as a result of the anadromous fish restoration program begun in 1969. This program is a cooperative effort between the Massachusetts and New Hampshire state fisheries agencies, the U.S Fish and Wildlife Service and the National Marine Fisheries Service.

In order to maintain species diversity and abundance, certain water quality and quantity requirements have to be met to provide a sustaining environment for the continuous "survival" of the biological community. Environmental interests today are demanding more emphasis on the value of protecting living nature for its own sake, aside from its economic and recreational values as resources for the use and enjoyment of humans. Environmentalists are concerned that an "artificially-induced" drop in water levels may lead to a marked decline in the quality and quantity of habitat for water-dependent species in the river, wetlands and other hydric ecosystems, especially during drought periods. They are also concerned about increasing barriers, such as dams, to up-stream and downstream fish migration. They

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<sup>29</sup> The Federal Endangered Species Act of 1973 (last amended in 1988) requires protection of critical habitat for endangered or threatened species. Both states have respective policies and programs with regard to rare and endangered plant and animal species.

believe that protecting naturally-occurring flow patterns and volumes as much as possible is the best strategy for protecting ecological water needs<sup>30</sup>.

### **THE NEED TO BALANCE THE MULTIPLE FUNCTIONS OF THE WATERSHED**

The Merrimack River provides energy for power production water for domestic, industrial, commercial and agricultural purposes, dilution for wastewater discharges, and an aquatic environment which supports many forms of wildlife and recreation. As a multiple-use river, the capacity of the Merrimack River to support numerous and competing uses is limited. Each instream and out-of-stream water user has their own specific, and sometimes overlapping requirement for streamflows. Yet, satisfying the water resources demands for one particular water use category may pose significant hardships for the others. For example, one large withdrawal or the cumulative impact of a number of smaller withdrawals has the potential to create serious problems related to the quantity and, consequently, the quality of water available for other uses. In order to prevent potential irreversible environmental damage the watershed ecosystem, we must consider the watersheds multiple functions simultaneously. As of yet, however, no comprehensive hydrologic study, inventory and assessment of the watershed's resources, or summary of aggregate water use has been compiled on a watershed-wide basis.

Each water user seeks to protect its individual interest, and must rely on the State to exercise proper judgement in balancing the water needs of the multiple interests. If

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<sup>30</sup> Personal interview: Russell Cohen, River Advocate, Riverways Program, Massachusetts Department of Fisheries, Wildlife and Environmental Law Enforcement, March, 1992; The Merrimack River Watershed Consortium held by EPA, Region 1, 1992.

we are to ensure the continuation of the multiple-use capabilities of the Merrimack River, federal, state, and local courts, administrators, and legislatures have the formidable charge of striking a delicate balance between the many water needs, while simultaneously protecting the watershed ecosystem. The various roles and responsibilities of these government entities are described in Chapter 3.





## **CHAPTER 3**

### **CURRENT WATER USE AND ALLOCATION STRATEGIES AND CONSTRAINTS TO A WATERSHED APPROACH**

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Water resources use and allocation strategies in effect in the Merrimack Watershed are a combination of: federal, state, and private water rights under the common law; and federal and state administrative agency actions under specific statutory mandates. The federal government and the two states have instituted differing degrees of legislative and administrative authority to protect and manage water resources. The following is an description of the strategies under the common law and statutory law for allocating water resources which come into play in the Merrimack River watershed. The primary objective of this chapter is to establish that the inconsistencies across state boundaries with respect to water management strategies present constraints to balancing the multiple uses and protecting the natural resources of the watershed.

#### **CURRENT STRATEGIES FOR WATER RESOURCE USE AND ALLOCATION**

##### **Common Law**

**Private Rights:** Water rights can be established in a number of ways. Until the middle of this century, and to a large extent even today, legal protection of water resources has been, and continues to be, based largely in common law. Water rights in the New England states is based on the **Riparian Doctrine**. The basis of this doctrine is that persons owning land fronting on a natural watercourse possess the

rights to use the water flowing by their land. Riparian use is further limited by the reasonable use rule. This rule allows a riparian owner to divert water for any purpose if the use is reasonable with respect to other riparian owners, that is, the use does not unreasonably interfere with a legitimate riparian use or pose undo burden on downstream users. Riparian rights extend to the water edge of a navigable waterway while non-navigable river or streams may be privately owned, and are therefore not subject to this doctrine.

Two doctrines govern consumptive rights to water under the riparian system: the natural flow doctrine and the reasonable use rule. The natural flow doctrine entitles each proprietor along a water course to have the water flowing through their land remain in its natural condition, not perceptibly retarded, diminished, or polluted by others. The reasonable use rule allows each riparian landowner to use water for any beneficial purpose if the use is reasonable with respect to other riparian needs and does not interfere unreasonably with their legitimate water uses. Reasonableness is a question of fact to be resolved on a case-by-case basis by the courts. (Ausness, 1983).

In essence, water use can expand until adverse impacts affected a downstream water user who can then initiate a challenge through the courts. Once an action is brought by an aggrieved party, the reasonable use test is applied. Various factors determine reasonableness, including climate, customs and usages, velocity and capacity of the watercourse, nature and extent of improvements on the watercourse, amount of water taken, previous uses, social importance of the use, and rights and reasonable needs of other riparian users. In the absence of statutory laws, water

allocation in New Hampshire is based primarily on the riparian doctrine, with the exception of some legislative appropriations. Massachusetts, in contrast, has instituted administrative authority, through statutory law to allocate water to individual users. These permitted appropriations supersede water rights under the riparian doctrine.

**States' Rights:** The ownership principle under riparian rights is also subject to the priority of higher rights where the rights of the public, the state and the federal government, have greater priority than the rights of the individual. Under the **public trust doctrine**, certain rights were retained by the King of England and subsequently transferred to the governing body of the newly formed states. Because of their importance to society, the rights to waters of the Great Ponds and navigable streams were reserved in the public trust. Individual water use, therefore, must not only be reasonable relative to other individual water users, but also with regard to the paramount public trust of the state. Consequently, withdrawals which raise public trust issues, because they place heavy demands on state's surface water that may conflict with other public interests, may require legislative authorization.

The courts have established that states also have water rights relative to upstream states. Given the context of controversy between two states over the diversion and use of waters of a river passing from one state to the other, the upstream state does not have ownership or control of the water as to entitle the state to divert and use the water resource regardless of any injury or prejudice to the rights of the downstream state. When states are disputing each other in interstate litigation,

the state is acting in the interests of the state's water appropriators, for the interests of the state are inextricably linked with the rights of the appropriators within the states borders. "But to maintain jurisdiction it must appear that the controversy is a controversy arising directly between [the two states] and not a controversy in the vindication of the grievances of particular individuals" (Louisiana v. Texas, 176 U. S. 1.).

The determination of the relative rights of contending states in respect of the use of streams flowing through them is not governed by the same rules of law that are applied within each state for the solution of similar questions of private right (Kansas v. Colorado, 185 U. S. 125), or in the case of the Merrimack River the riparian rights doctrine. Instead, such disputes have been settled by the courts on the bases of **equality of rights**. This is not to say that there must be an equal division of the waters of an interstate stream among the States through which it flows. It means that the principles of right and equity are applied with regard to the "equal level or plane on which all the states stand, in point of power and right, under our constitutional system" and that, upon a consideration of the pertinent laws of the contending states and all other relevant facts, the court will determine what is an equitable apportionment of the use of such waters. (Wyoming v. Colorado, 259 U. S. 419)

**Federal Rights:** A basic policy area that lends authority for federal control of streamflows is the **reserved water rights doctrine**. The reserved rights doctrine limits federal claims to quantities necessary to fulfill the purpose of a federal land

reservation. The reserved water rights doctrine stems from the Winters Doctrine<sup>31</sup>, which established water rights for Indian reservation lands held in federal trust. The doctrine has developed through the broad application of "Winters Rights" protection for Indian reservations, and has been further broadened to include other federal reservations as well. Although non-Indian reserved rights have generally been restricted to those purposes clearly recognized as primary in the legislation setting aside the land. (Shelby, 1992).

### **Statutory Law**

**Federal Authority:** The federal government has the ability to restrict water withdrawals and protect instream flows through a variety of legal and administrative policies. Federal protection of instream flow stems from direct statutory control, as well as from less direct authority.

Through its permitting authority, the Federal Energy Regulatory Commission (FERC) must include in its hydropower license and relicense deliberations consideration of conditions that will ensure adequate facility-bypass flow for instream resource protection. Under the **Federal Power Act of 1920** (last amended 1990), FERC must engage in comprehensive planning and achieve a balance of potential resource value in its licensing decisions. Flows necessary for recreation, aesthetic quality, and maintenance of fish populations must be balanced against cost such as

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<sup>31</sup> The Winters Doctrine was established by the U.S. Supreme Court decision in *Winters v. the United States* (207 U.S. 546 of 1908), which determined that the reservation of land for the Assiniboine Indian Tribe carried with it reservation of waters from an adjoining river that were needed for the productive use of the reservation lands.

revenue loss from reduced power generation.

Consultation requirements are included in several federal laws, a number of which can be related to instream flow protection. The most direct applicable statute is the **U. S. Fish and Wildlife Service consultation** on fish and wildlife affected by water projects constructed, licensed, or permitted by the federal government. This statute identifies fish and wildlife resources as valid elements of a development project, and it provides for mitigation or enhancement of these resources.

The pioneer of federal environmental legislation is the **National Environmental Policy Act of 1969<sup>32</sup>** (NEPA). NEPA declares a federal commitment to environmental protection and requires careful consideration of environmental impacts, mitigation, and alternatives to federal actions. This legislation requires the preparation of an Environmental Impact Statement (EIS) for each major federal action that may significantly effect the quality of the human environment. Federal actions are broadly defined in NEPA to include not only construction, but also licensing, permitting, and funding of a project as well.

NEPA specifically requires coordination with appropriate federal, state, and local agencies, as well as general public involvement, in the process of preparing and reviewing the EIS. Federal officials are required to consult with, and obtain the comments of any agency that has jurisdiction or special expertise with respect to any environmental impact involved. These considerations should include instream flow for any federal project that may alter flow in an existing watercourse.

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<sup>32</sup> 42 U.S.C. 4331 et seq

Other environmental legislation also has the potential for engaging federal involvement in instream flow protection or enhancement. For example, the **Federal Clean Water Act** of 1977<sup>33</sup> allows consideration of reservoir storage and releases not only for maintaining downstream water quality, but also for recreation, aesthetics, and fish and wildlife<sup>34</sup>.

The most direct statutory mandate for federal instream flow protection is found in the **Federal Wild and Scenic River Act** of 1968<sup>35</sup>. The law specifies the types of valuable resources that might cause rivers to be protected under the act, and it establishes a connection between these resources and free-flowing streams<sup>36</sup>. Once designated, the river segments are protected from federal water resources projects such as federally approved dams, or other projects needing federal approval that would negatively affect the river segment. The Act stipulates that jurisdiction of the states and the federal government over water included in the system "shall be determined by established principles of law... The jurisdiction of the states over waters of any stream included in a national wild, scenic, or recreational river area shall be unaffected by this act." In summary, the Federal Wild and Scenic River Act gives federal agencies the legal means to establish water rights for streamflow. But the needs must be quantified and justified, and the rights need to be filed in a way

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<sup>33</sup> 33 U.S.C. 1251 et seq

<sup>34</sup> section 1252

<sup>35</sup> 16 U.S.C. 1271-1287

<sup>36</sup> "The existence, however, of low dams, diversions works, and other minor structures at the time any river is proposed...shall not automatically bar its consideration for inclusion".

that is compatible with appropriate federal and state water laws (Shelby, 1992). It should be noted, however, that the Act only affects water rights within a designated segment, and not for the river system as a whole.

**States' Authority:** New Hampshire and Massachusetts are primarily responsible for developing their individual set of state policies, regulations, standards and procedures to govern water use within their states. Given the importance of water for sustaining life and servicing economic development, many New England states have adopted permitting and/or planning authority for deciding how much water can reasonably be allowed for particular water withdrawals based on estimation of water use requirements. Laws and regulations define the powers and responsibilities of state agencies which implement water allocation strategies.

The two states with jurisdiction over the Merrimack river watershed vary in their legal approaches. A general description of the legislative processes, the state administrative agencies and programs they administer follows.

### **Massachusetts**

In the past decade, two major water allocation laws were enacted in Massachusetts: the **Interbasin Transfer Act** of 1983 and the **Water Management Act** of 1985. The first law gives the state, through the **Water Resources Commission**, the authority to regulate withdrawals which transfer water and/or wastewater across watershed boundaries. A total of 27 watersheds have been designated in Massachusetts by the Water Resources Commission, in part, to help



administer the Interbasin Transfer Act. The second law authorizes the state regulatory department, the **Department of Environmental Protection (DEP)**, to permit significant surface and groundwater withdrawals within a watershed. These acts have created a framework for coordinating state water supply management protection efforts using the watershed as the fundamental planning unit. Implementation of these regulations is dependent on a practical method for determining water needs and for distributing available water resources to meet these needs.

The Massachusetts Water Resources Commission is the state's water resources policy and planning body, and has chief responsibility for directing activities for the **Executive Office of Environmental Affairs**. Authorized by the Legislature in 1956<sup>37</sup> the WRC was initially established to deal with interstate flood control and with water resources planning issues. Its power was expanded through an amendment to the enabling statute in 1983<sup>38</sup>. The WRC was designated as the body of stature to initiate, coordinate, and oversee implementation of the state's water resources policies and plans<sup>39</sup>. Under the EOE, the **Department of Environmental Management (DEM)**, provides technical staff support to the Commission and is responsible, through the Commission, for long-range water resources planning for the Commonwealth.

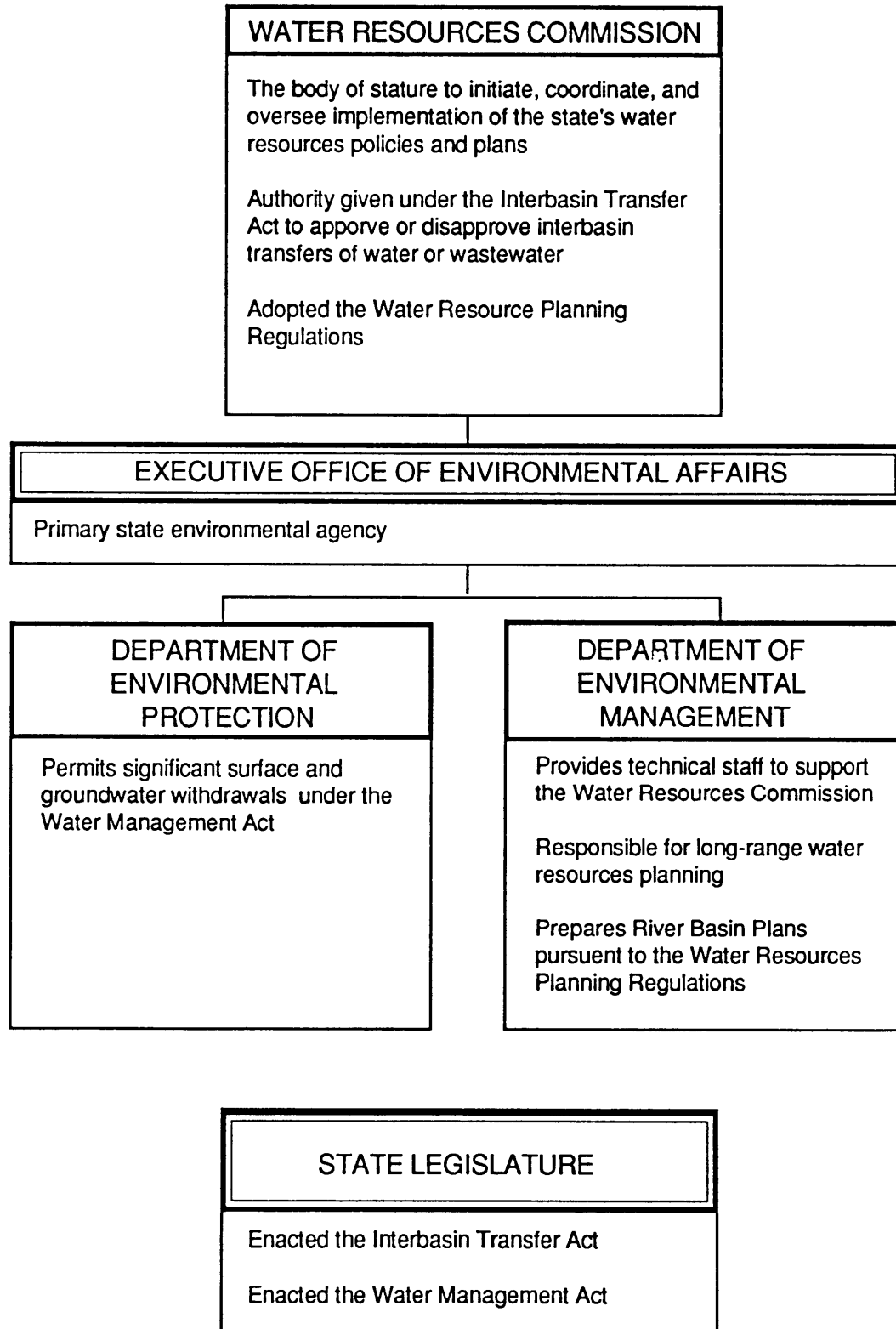
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<sup>37</sup> MGL Chapter 21, section 10

<sup>38</sup> Chapter 589

<sup>39</sup> Its chair is the Cabinet Secretary of Environmental Affairs and has representatives from the five departments with EOE, the secretary of the Executive Office of Communities and Development (EOCD), and six public members appointed by the governor.

Figure 8  
**CHART OF MASSACHUSETTS  
 WATER RESOURCE AGENCIES DEALING WITH FLOW AND  
 ALLOCATION OF WATER**



## River Basin Plans

In 1978, the Water Resources Commission adopted regulations<sup>40</sup> requiring local water resources management plans. Pursuant to the **Water Resources Planning Regulations**, the Division of Water Resources (DWR) is devising a statewide water resources management plan, including the development of a management plan for each of the 27 designated river basins of the Commonwealth. The basin planning process includes local, regional, and state assessments of water needs and the availability of water resources. Staff from the DWR sent out questionnaires to local officials seeking information primarily on their water supplies. This information is being collected and analyzed for each of the watersheds.

The river basin planning process consists of five steps: 1) development of an inventory of the watershed's water supply and demand; 2) analysis of data and identification of future water needs in the watershed; 3) development and analysis of alternatives to meet these projected needs; 4) preparation of a watershed-specific water resources management plan for the approval of the Water Resources Commission; and 5) adoption of the plan by the WRC. The River Basin Plan for the Merrimack River watershed in Massachusetts is scheduled to be completed in 1994.

In the spring of 1991, the Water Resources Commission began a reassessment of the key components of the river basin planning program. As a result, the WRC has developed recommendations for revising the process. The recommendations vary from specific measures which could be implemented

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<sup>40</sup> 310 CMR 2.00

immediately to general recommendations which will require additional work or research by the states administrative agencies. Some principal recommendations are: integrating conservation into the plans, developing a disaggregate demand forecast methodology, changing the way minimum streamflows are referenced and represented in basin plans, and studying the need for additional streamflow values such as for Federal Energy Regulatory Commission facilities, and drought management planning.

### The Interbasin Transfer Act

The Massachusetts Legislature enacted the **Interbasin Transfer Act** of 1983<sup>41</sup> after four years of consideration, giving the Water Resources Commission (WRC) the mandate to approve or disapprove any significant transfer of surface and groundwater, including wastewater, outside a watershed.

The Interbasin Transfer Act was the result of extensive lobbying by environmental organizations, including the Massachusetts Audubon Society, the Water Supply Citizens Advisory Committee, and Environmental Lobby of Massachusetts, the Special Legislative Commission on Water Supply, the Executive Office of Environmental Affairs. The impetus for this law came, primarily, from opponents to a proposed diversion of the Connecticut River to augment water supplies for metropolitan Boston communities (Kline, 1989).

This law gives authority to state agencies for water allocation. Moreover, this water allocation authority was explicitly guided by policies, such as implementation of

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<sup>41</sup> Chapter 658

practical water conservation measures and development of viable local water sources before an interbasin transfer can even be considered. Another policy requirement of the Interbasin Transfer Act is to maintain "a reasonable instream flow in the river from which the water is diverted". The responsibility for determining what is "reasonable" and for regulating interbasin transfers of more than 1,000,000 gallons per day was given by the Legislature to the Water Resources Commission. (Kline, 1989).

Before approval of an interbasin transfer, the Water Resources Commission shall base its decision on findings that:

- 1) all reasonable efforts have been made to identify and develop all viable sources in the receiving area of the proposed interbasin transfer;
- 2) all practical measures to conserve water have been taken in the receiving area;
- 3) an environmental review (MEPA) has been compiled for the proposed interbasin transfer;
- 4) a comprehensive forestry management program which balances water yields, wildlife habitat and natural beauty on watershed lands presently serving the receiving area has been implemented; and
- 5) a reasonable instream flow in the river from which the water is diverted is maintained.

The WRC interprets these criteria to mean that interbasin transfers should be considered only as a last resort after having implemented conservation measures and feasible sources within the applicant's watershed.

Pursuant to the Act, the WRC promulgated regulations<sup>42</sup> defining and delineating the watersheds of the Commonwealth, and establishing application procedures and criteria upon which the Commission shall base its approval or disapproval of an proposed interbasin transfer.

The regulations provide that the Commission shall take into consideration in determining reasonable instream flow the impact of the proposed interbasin transfer on the streamflow dependent ecosystems and water uses to include:

- 1) length of stream below the point of withdrawal;
- 2) effects on flood flows, intermediate flows and low flows;
- 3) effects on groundwater and surface water elevations;
- 4) significance of indigenous and anadromous fisheries and effects of the proposed interbasin transfer on these fisheries;
- 5) significance of wetlands and dependent flora and fauna and effects thereon;
- 6) effects on water quality, recreational uses, aesthetic values, areas of critical environmental concern;
- 7) effects on established riparian uses and uses dependent on recharge from streamflow;
- 8) effects on hydropower production;
- 9) effects on other water withdrawals and undeveloped rights within the donor basin; and
- 10) effects on other instream uses.

Maintenance of reasonable instream flows is a difficult criteria to determine.

The WRC relies on a methodology which was developed by a task force and adopted

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<sup>42</sup> 313 CMR 4.00

by the WRC. Data on existing and projected water resources are inventoried and then, based on computer modelling, a flow number is established and, often times, additional constraints are imposed (such as the time of year). The intent of this criterion is to protect the water resources for human and ecological purposes.

### The Water Management Act

The second major piece of water allocation legislation is the **Water Management Act of 1985**<sup>43</sup>. Under this act, Massachusetts has a system for regulating significant new source withdrawals from surface or groundwater sources. Similar to the Interbasin Transfer Act, the Water Management Act's (WMA) intent is to authorize the state to allocate water based on the capability of environmental resources (e.g. aquifers and rivers) to meet current and future water needs.

The Acts passage was the culmination of several years of lobbying by its authors, the Special Legislative Commission on Water Supply, environmentalists, the Associated Industries of Massachusetts and state executives. The Act was and is considered to be far-reaching for a water-rich state (Kline, 1989).

In this law, the state, through the Division of Water Supply in the Department of Environmental Protection (DEP) is responsible for permitting major water withdrawals for any purpose. Unless otherwise specified, the threshold for regulation is 100,000 gallons per day. This was the first time in Massachusetts, the withdrawal and use of water within a river basin was subject to state action.

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<sup>43</sup> Chapter 592

The Act institutes a modified form of prior appropriation doctrine by requiring registration of existing withdrawals, and by requiring a permit for new water withdrawals, for any increase in a registered withdrawal, or for continuation of a withdrawal that was not registered but should have been. However, unlike the common law doctrine, under the Water Management Act appropriation rights are not unlimited, but are restricted by the natural limits of the water resource.

While the specific concern of the Interbasin Transfer Act is to maintain reasonable instream flows; the specific intent of the Water Management Act is to protect water resources by limiting withdrawals to the "safe yield," said yield being set to incorporate environmental quantity and quality factors into allocation decisions.

The determination of "safe yield" by DEP is made according to the WMA's regulation by taking into account at least the following:

- 1) minimum streamflow guidelines as developed by the Department of Environmental Management and the Water Resources Commission;
- 2) the water budget of the water sources;
- 3) the hydrologic impacts of proposed, existing and permitted withdrawals;
- 4) the safe yield of any isolated or severely impacted sub-basin within the water source; and
- 5) any additional applicable information.

The DEP, with guidance from members of the Water Management Act Advisory Committee, at one time decided to use reasonable stream flow calculations as indicators of safe yield. Rather than determine its own reasonable streamflows, the DEP Water Management Act staff relied on the figures generated by the Office of



Water Resources, in DEM, for the Water Resources Commission. The DEM staff applied a reasonable streamflow methodology to each watershed, and DEP regulators took this value and determined whether or not there is sufficient "safe yield" as measured by minimum streamflows to allow for additional water withdrawals from ground or surface water sources. (Kline, 1989).

As a result of a recent evaluation of the DEP streamflow methodology, DEM has abandoned the above strategy. Instead DEP will continue to review permit applications in each watershed based upon local impacts criteria developed in cooperation with DEM and other environmental agencies. DEP will continue to use disaggregated water needs projections developed by DEM; DEM will continue to carry out hydrologic analyses to identify the key characteristics of each watershed that DEP will use in permitting water withdrawals. Additionally, the DEP has established a Bureau of Resource Protection, which includes the Divisions of Water Supply, Water Pollution Control, and Wetlands and Waterways. The Bureau is in the process of developing an integrated approach to water resources regulation. The Bureau is presently trying to synchronize DEM basin planning with DWPC water quality monitoring in order to evaluate both withdrawal and discharge permits at the same time with relevant water quality and quantity information at hand. These evaluations will serve as the basis for assessing the impact of proposed withdrawals<sup>44</sup>.

The WMA recognized historic withdrawals based on water withdrawn between 1981 and 1985. Anyone who withdrew over the threshold volume of 100,000 gallons

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<sup>44</sup> Personal interview: Andrew Gottlieb, Director, Water Supply Division, Massachusetts Department of Environmental Protection, April 1992

per day during a portion of this five-year period was required to register. Registration applied to all public water supply systems, both community and noncommunity, and to all other water users with their own source of water supply, such as industry, agriculture, or golf courses.

The DEP encouraged withdrawers to register so that withdrawal volumes could be protected in the future. This standing is important in the permitting of new withdrawals. The Legislature decided not to take away water already being used even if the consequence was to over-allocate from the natural resource.

As of 1986 permits are required for all withdrawals above 100,000 gallons per day for any consumptive purpose and may be required for volumes below this threshold if DEP chooses to lower the threshold. The DEP grants permits which require implementation of water conservation measures, annual reporting of water use, metering of withdrawals and any other requirements deemed necessary to protect the integrity of local water resources and nearby withdrawers. The main thrust of the permit program is to reduce water use, increase reuse and conservation and minimize the losses of water to a basin through evaporation and out-of-basin discharge (Kline, 1991). The DEP must deny any new permit if the new withdrawal will exceed the safe yield of the resource. Moreover, during periods of water emergency, the department has the authority to reallocate water from permitted withdrawals to meet watershed needs. These needs may include the environmental requirements of aquatic life, as well as water supply demands.

## New Hampshire

Since the industrial revolution, the common law of riparian rights and reasonable use, described previously, has been the rule that applies to water use in New Hampshire. Yet, in order to secure water rights to the greatest extent possible, many municipal and private water suppliers have petitioned the Legislature for specific water appropriations. The Legislature has in turn on many occasions over the past 150 years granted extensive rights for withdrawals from specific lakes, ponds, rivers and streams to various water companies, and municipalities. A later action by the Legislature to reverse its previous position is the only means to repeal a legislatively appropriated water use. Action seeking compensatory damages may be initiated in the court if a legislative appropriation results in hardship to other riparian interests. Legislative appropriations grant rights to use water consistent with a specified purpose. The Legislature is the only body which can grant use of a water resource to water users at the exclusion of others. Appropriations which are, or include, interbasin transfers are handled in the same way as any other water withdrawal<sup>45</sup>. (Stern, 1990).

Although there has not been an act of the Legislature either establishing policy or a program in the state administrative agencies for planning for and regulating water use, the state's administrative agencies play important roles in managing the state water resources. The stated mission of the **New Hampshire Water Resources Division's (WRD)** within the **Department of Environmental Services (DES)** is to

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<sup>45</sup> Personal interview: Kenneth Stern, Chief Engineer, Division of Water Resources, New Hampshire Department of Environmental Services, February, 1992.

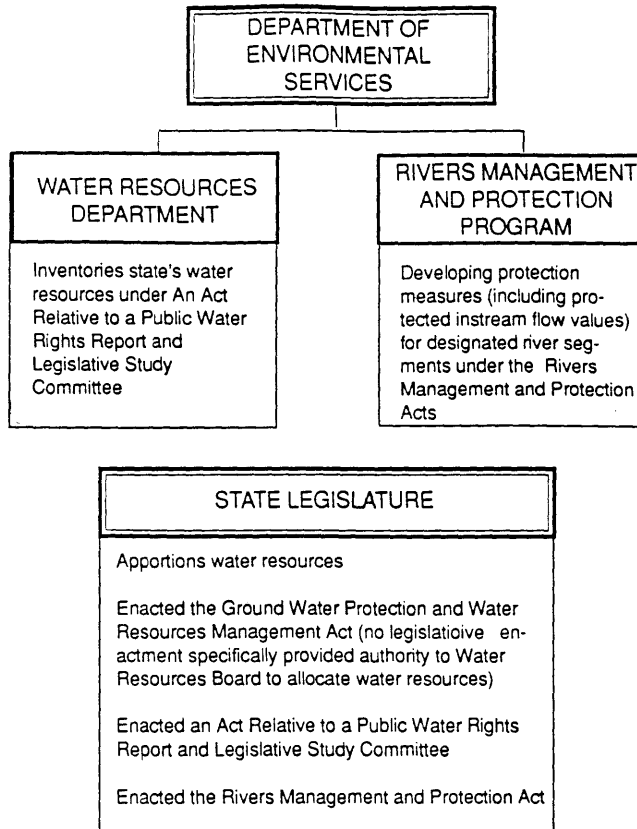
"manage the state's water resources for the benefit of present and future generations." Although dams and water conservation projects are the Division's traditional responsibility, it has also been mandated by the Legislature to provide the state with an overall inventory of the state's water resources, to be used by the DES to develop a water management program. Any facility within New Hampshire withdrawing 20,000 or more gallons of surface water or groundwater per day is required to register with the WRD and to provide information on average and maximum daily water demand. Once registered, the facility must report its monthly water use to the WRD. The division must also approve a new water supply before it may be considered by the Public Utilities Commission. (Merrimack River Watershed Council, 1990).

There is support in the Division for a long-term water resources management plan. The Division states that its current water use registration program is the logical step towards such a program<sup>46</sup>. Additionally, the Water User Registration Program will provide valuable information, on the quantities and types of water users, that can be used if water allocation ever becomes necessary.

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<sup>46</sup> Personal interview: Kenneth Stern, Chief Engineer, Division of Water Resources, New Hampshire Department of Environmental Services, February, 1992

Figure 9  
 CHART FOR NEW HAMPSHIRE  
 WATER RESOURCE AGENCIES DEALING WITH FLOW  
 AND ALLOCATION OF WATER



The Groundwater Protection and Water Resources Management Act

In 1983 the New Hampshire Legislature enacted sweeping legislation which declared surface water and groundwater to be an integrated public resource to be conserved, protected and managed for the public good. The **Groundwater Protection and Water Resources Management Act**<sup>47</sup>, authorized the Water Resource Board to assess the State's water resource, to develop a program for periodic water use reporting by major water uses, and to develop a proposal for the equitable distribution of water resources. In accordance with the Act, the Water

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<sup>47</sup> Chapter 402

Resources Board, which no longer exists, submitted a water resources management plan to the Legislature in 1985. By concurrent resolution, the Legislature endorsed the concept of the Board developing rules regarding the distribution of surplus water resources, but no legislative enactment specifically providing such authority ensued. (State of New Hampshire, 1989).

The Act Relative to a Public Water Right Report and Legislative Study Committee

On August 2, 1989 the Attorney General delivered an opinion defining the Public Trust Doctrine and concluded that businesses and communities desiring to use the State's rivers or lakes for water must obtain permission from the Legislature. The Attorney General held that all water use without a specific legislative appropriation is subject to a challenge of the reasonableness of use. This challenge may be initiated by the state to protect the public interest. The interest of the general public in water bodies for navigation, wildlife habitat, recreation and aesthetics is referred to as the public trust.

As a result of the Attorney General's Opinion the Legislature has enacted **An Act Relative to a Public Water Rights Report and Legislative Study Committee** of 1990, amended in 1991<sup>48</sup>. A legislative committee, the Public Water Rights Study Committee, has been established, consisting of three members of the senate appointed by the senate president, or their designees, and three house members appointed by the speaker of the house. Three more members were added by the 1991 amendment to

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<sup>48</sup> Chapter 148, amendment Chapter 356

represent conservation interests, recreation interests, and water supply interests. The role of the committee is to examine the issue of water rights within the State. The Act also mandated an inventory of water users withdrawing more than 20,000 gallons per day during any week of the year from surface or groundwater, including the amount of the withdrawal, purpose of the withdrawal, and claimed authority for the withdrawal. The charge of the Study Group includes: an analysis of when the public rights in water may be impacted; an analysis of under what conditions conveyance of such rights from the public domain is in the best interests of present and future citizens; a determination of the hydrological relationship between groundwater and surface water in the public domain; the establishing of procedures to systematically evaluate the sustained yield of major watersheds of the State.

#### The Rivers Management and Protection Program

The New Hampshire Rivers Management and Protection Acts of 1988 and 1990<sup>49</sup>, allows any New Hampshire organization or resident to nominate a river or segment of a river for protection by submitting a description of the values and characteristics of the river. The nomination includes an assessment of fisheries, geological and hydrologic features, vegetation, wildlife, historical and archaeological features, open space and recreation features, water quality and quantity, dams, buildings and other man-made structures, riparian interests and other pertinent river bank information. The completed nomination is reviewed by the coordinator and the

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<sup>49</sup> Chapter 483

advisory committee and a recommendation is prepared for the Commissioner of DES. At least one public hearing is required to be held in a community along the nominated river, or river segment, to receive public comment. The Commissioner will review the nomination and determine if the river meets the criteria developed and adopted by the advisory committee and the Commissioner. Nominations approved by the Commissioner must be reviewed and approved by the Legislature for formal designation.

The River Coordinator is assigned the task of preparing and submitting river protection measures for the designated rivers to the Legislature for consideration. In addition, the River Coordinator, with the cooperation of the Office of State Planning, will develop detailed guidelines for river management plans aimed at protecting the shores of the rivers. A prominent feature of this program is the establishment of protected instream flows for designated rivers or river segments<sup>50</sup>. The Commissioner has assembled the Rivers Management Advisory Committee to guide the development of the rivers management and protection program; a subgroup of this larger committee is currently evaluating methodologies for establishing minimum instream flow designations.

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<sup>50</sup> The Act states that "It is the intent of the legislature that.. in-stream flows are maintained along protected rivers, or segments thereof, in a manner that will enhance or not diminish the enjoyment of outstanding river characteristics...". One of the purposes of the protection measures designed as part of the programs is "... that no significant adverse impacts on water quality of other in-stream characteristics shall be permitted; and that adequate flows be maintained for the appropriate use or uses of the river segment or segments of such rivers." Under RSA 483:9-c, the commission will establish protected instream flows. "The Commissioner, in consultation with the Advisory Committee, should adopt rules under RSA 541-A specifying the standards, criteria, and procedures by which a protected instream flow shall be established and enforced for each designated river or segment."



Figure 10

**SUMMARY OF STATES' PRIMARY WATER RESOURCES MANAGEMENT ACTIVITIES**

	<b>Commonwealth of Massachusetts</b>	<b>State of New Hampshire</b>
<b>Hydrologic and Water Use Data Collection</b>	<ul style="list-style-type: none"> <li>- Annual water use data on public water suppliers collected by DEP</li> <li>- Registered and permitted withdrawals greater than 100,000 collected by DEP</li> </ul>	<ul style="list-style-type: none"> <li>- Withdrawals greater than 20,000 gal/day inventoried by DES under Water Use Reporting System</li> </ul>
<b>Protected Instreamflow</b>	<ul style="list-style-type: none"> <li>- Values developed by DEM as part of River Basin Plans (methodology currently being revised)</li> <li>- Considered during permit process by DEP under Water Management Act</li> <li>- Must be maintained for approval of interbasin transfer by WRC under Interbasin Transfer Act</li> </ul>	<ul style="list-style-type: none"> <li>- Must be maintained for designated river segments under the River Management and Protection Act.</li> <li>- The methodology for determining values is in process of being developed under the River Management Act by DES</li> </ul>
<b>Water Withdrawals</b>	<ul style="list-style-type: none"> <li>- New or increased withdrawal greater than 100,000 gal/day must get permit from DEP under Water Management Act after assessment of cumulative impacts on other users and natural resources</li> </ul>	<ul style="list-style-type: none"> <li>- Withdrawals subject to the riparian doctrine and public trust doctrine under common law</li> <li>- No statutory authority to regulate withdrawals</li> <li>- Some appropriations must be approved by legislature</li> <li>- Legislative committee currently examining issue of water rights within the state</li> </ul>
<b>Interbasin Transfers</b>	<ul style="list-style-type: none"> <li>- New or increased transfers greater than one mgd subject to approval by the WRC under the Interbasin Transfer Act</li> </ul>	<ul style="list-style-type: none"> <li>- Interbasin transfers subject to the same policies as other water withdrawals</li> <li>- No statutory authority to regulate interbasin transfers</li> </ul>
<b>Water Conservation Policies and Guidelines</b>	<ul style="list-style-type: none"> <li>- Water conservation plan required for withdrawal permit by DEM or interbasin transfer by WRC</li> <li>- Low flow devices required in new construction under state Plumbing Code</li> </ul>	<ul style="list-style-type: none"> <li>- No state policy for water conservation</li> </ul>
<b>Drought Emergency Planning</b>	<ul style="list-style-type: none"> <li>- It is the policy of DEP to encourage public water suppliers to develop and implement drought management and contingency plans</li> </ul>	<ul style="list-style-type: none"> <li>- DES has developed a drought management plan that establishes the administrative framework for anticipating drought conditions and coordinating response</li> </ul>
<b>Water Supply Planning</b>	<ul style="list-style-type: none"> <li>- River Basin Plans prepared by DEM that identify areas of water supply deficit and recommend solutions</li> </ul>	<ul style="list-style-type: none"> <li>- Regional and local plans prepared on an as needed basis.</li> </ul>

## **CONSTRAINTS TO WATERSHED WATER RESOURCES USE AND ALLOCATION**

The approaches implemented by the two states to manage the water resources within their borders are vastly different, and in the midst of significant change. The primary differences center around two issues: first, the states' processes for water resources planning at the watershed level, and second, the roles adopted by the states' administrative agencies and legislatures to regulate water use. The variations between policies for the use and allocation of water stem, for the most part, from the contrasts between the riparian rights system used by New Hampshire and the administrative strategies exercised by Massachusetts. These differences, coupled with a lack of coordination between states, create constraints to balancing the multiple uses of the water resources, and protecting the natural resources of the watershed.

### **Water Resources Planning**

Important components of the water resources planning process are an assessment of the watershed's hydrology and current water use, and the determination of instream flows for the river that will protect various instream uses. With this information a complete analysis of the river and its tributaries can be conducted to determine the capacity of the watershed to meet the existing and projected needs for water. In situations of managed flow water resources planning is not a clear-cut process; scientific analysis must be carefully coupled with a recognition of the multiple and legitimate riparian interests to devise an effectual plan. The states' differing approaches to water resources planning present several problems.

**Data Collection:** To begin, long-range water resources planning is impossible without specific data on watershed hydrology and water use. Presently the two states have different methodologies for collecting data on current water users. For example, while New Hampshire requires users of more than 20,000 gallons per day to register their use on an ongoing basis, while Massachusetts required withdrawals of more than 100,000 gallons per day to register water use during a period between 1980 and 1985. As a result, the local, state, and federal agencies do not have a complete and consistent set of data to project future water needs, and support the development of a water budget or drought management and water conservation activities.

**Protected Instream Flows:** In addition to inconsistent and incomplete water use inventories, another potential barrier to coordinating water resources planning efforts is the lack of watershed-wide instream flow values. Beyond the limited Federal Energy Regulatory Commission (FERC) minimum for hydropower releases, the minimum streamflows required to sustain the various river uses have not been established by either state for the Merrimack River watershed. Meanwhile withdrawals for out-of-stream uses continue without a quantitative understanding of the rivers instream flow requirements. Without protected instream flows it is conceivable that two water uses that co-exist comfortably during periods of relatively high flows, such as withdrawals used for meeting water supply needs and instream water requirements for meeting biological needs of the river ecosystem, will no longer be compatible during a period of low flow.

Both states are currently evaluating instream flow methodologies.

Massachusetts has scheduled the development of a River Basin Plan for the Merrimack River watershed in 1994, which will include developing instream flow values. But the state is in the midst of amending this planning process. New Hampshire is in the process of devising their instream flow methodology for the first time under the Rivers Management and Protection Program.

Without a bi-state view of the watershed's instream flow requirements neither state will have a complete and consistent basis from which to plan water resources protection and management programs. As the states proceed to develop their individual instream flow values for the Merrimack River and its tributaries, they can only do so effectively and equitably with complete information on the entire watershed system, and consideration of the other state's instream water resource needs. There is currently no process in place for sharing information between the states.

### **Water Use Regulation**

In New Hampshire water is allocated through a system of individual riparian rights. In addition the Legislature that can, at its own discretion, alter, limit or repeal rights exercised by citizens, municipalities or businesses. There is no administrative process in New Hampshire for regulating withdrawals from the watershed, including interbasin transfers of water or wastewater. The water allocation system utilized by New Hampshire limits the ability of both states to apply a rational process that

ensures the availability of sufficient water to meet the needs of various out-of-stream and instream uses while maintaining the viability of the resource.

The water in the New Hampshire portion of the watershed which has been allocated, has been done so on a political basis, with many times no limits on the amount. There are no standards to consider the cumulative effects of these allocation on other watershed water resource uses. The cumulative impacts of a large number of reasonable uses could result in reduced streamflows, in deterioration of water quality, in the destruction of wildlife habitat and in loss of recreation water uses (Sherk, 1984). Water interests, especially environmental interests, have recognized that New Hampshire should not be simply legislatively distributing surface water to whichever region grows the most quickly. Instead, water withdrawals from anywhere within the Merrimack River watershed should be carefully monitored to assess its impacts on the quality and quantity of the water in the River, its tributaries, the groundwater, as well as other instream and out-of-stream users.

Because cumulative impacts are not assessed and water use under riparian rights is unlimited until water for every reasonable use is no longer available, water users in both states cannot be certain of their quantifiable rights on a long-term basis. Furthermore, there are no proactive means for dealing with disputes. Under the riparian system a downstream user must show damages in order to change the behavior of upstream users by court order. Water users will have to resort to litigation to resolve disputes; lawsuits are time-consuming, expensive, and have unpredictable outcomes. The present system of judicial determination of reasonable

use is said to offer little long-term security among individual water users (Stern, 1990).

A final limitation with the riparian rights system is that it does not equip state water managers with the tools needed to control water use and to respond to crises such as a drought situation. Under the riparian system in New Hampshire, if all water users have an equal claim to the diminishing flow of a watercourse, placing limitations on certain water uses would be impossible. Massachusetts, in contrast has a means to control water use through their permitting system. Yet, with uncertainties with regard to upstream conditions, their plans would be meaningless.

## **CHAPTER 4**

### **PAST AND PRESENT INSTITUTIONAL ARRANGEMENTS FOR INTERSTATE COORDINATION**

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What is an institutional arrangement? As stated by Fox, an institution can be either: 1) a rule, such as a law, regulation, or established custom; or, 2) an entity, such as an organization or an individual. "An institutional arrangement is defined as an interrelated set of entities and rules that served to organize societies' activities so as to achieve social goals" (Fox, 1976). Although broad, the definition is useful in realizing that institutional arrangements are not only related to the organizational framework of the entities which govern water resource managements and protection, but also the entities' responsibilities in preparing and implementing actual policies, laws and regulations which govern water resources use.

In essence, institutional arrangements for interstate water resources management may involve: 1) the application of a policy or procedure to apportion water resources between states, usually implemented through conditions outlined in an interstate compact; and/or, 2) the establishment of a watershed entity for ongoing coordination for water resource management activities. These two primary components of arrangements are frequently employed in various combinations.

As explained in Chapter 3, the two states with jurisdiction in the Merrimack River watershed are not legally free, under the common law, to act as sovereigns when their actions have interstate implications. Yet, given the divided political jurisdictions within the watershed, there is no political body which assumes the role

of advancing water resource use and allocation policies that consistently and effectively assures that one state's actions will not adversely effect the other states, and that multiple uses of the watershed's resources will be equitably balanced. Therefore, given the possible institutional arrangements which might fulfill this role, which scheme may most efficaciously be implemented in the Merrimack River watershed? To begin to address this question, one must look to past and to present experiences in interstate water use and allocation.

This chapter opens with a brief historical account of arrangements for interstate coordination with respect to water resources, both nation-wide, and regionally. Following this is a synopsis of the range of present alternative arrangements and a few examples to illustrate how they have been applied throughout the country. Finally, from the alternative arrangements presented, I have gleaned several key aspects that warrant attention: 1) the degree of power and regulatory authority imparted to the arrangement; 2) the extent of the federal-state partnership developed as a consequence of the arrangement; 3) the extent of public-private partnerships fostered as a result of the arrangement; 4) whether the arrangement has a clear sense of direction and purpose, yet a flexible role that can be modified as a result of evolving knowledge about the physical, political and social conditions in the region; and finally, 5) whether the arrangement has adequate administrative support.



## **PAST EXPERIENCES IN INTERSTATE COORDINATION**

### **National Water Resource Planning**

The following is a brief history of national water resources planning and policy in the United States. This overview offers a perspective on what attempts have been made at the federal level for coordinated action with respect to interstate watersheds, and what directions they may take in the future.

Since the turn of the century, the federal government has demonstrated interest in watersheds as units for water resources planning. Senator France G. Newland of Nevada argued for initiating new national water policies in 1901. President Theodore Roosevelt submitted a preliminary report of the Inland Waterways Commission to the Congress in 1908 that emphasized the need for coordinated multipurpose development of waterways under strong federal leadership. In the roughly 50 year period preceding the 1980s, the nation experimented with several arrangements designed to strengthen regional cooperation among the federal, state and local levels of government to manage water resources. (Dworsky, 1991).

**The Federal Interagency River Basin Committee:** One of the first arrangements was the Federal Interagency River Basin Committee, established in the 1940s. The Federal Interagency River Basin Committee encouraged the creation of informal voluntary federal-state river basin committees. As a result, committees were established in several interstate watersheds, including the New England - New York Interagency Committee (NENYIAC) discussed below.

As stated in the report of the Senate Committee on Interior and Insular Affairs in the Water Resources Planning Act, until 1965 the nation "... unsuccessfully sought for a formula for comprehensive river basin planning...many approaches have been attempted. No general planning mechanism has been adopted." - that is, until the following arrangement, the enactment of the Water Resources Planning Act of 1965.

**Water Resources Planning Act:** Sanctioned by Presidents Eisenhower and Kennedy, the Water Resources Planning Act of 1965 was a policy that supported the notion of improved comprehensive and integrated water resources protection and management endeavors. The water policies of the Federal Water Resources Council, established by the Act of 1965, called for the development of comprehensive, coordinated joint plans as part of the tasks to be carried out by the seven federal/state river basin commissions, also created and funded under the Act. From 1964 until 1980 the Water Resources Council and the basin commissions, responsive to the council, worked to develop processes to carry out the intent of the 1965 Act, including means for the implementation of plans and projects in conjunction with the Congress.

In September, 1981, the federal administration disbanded the river basin commissions, including the New England River Basin Commission, also discussed below. In addition, the office of the Federal Water Resource Council was replaced by a Cabinet Committee on Natural Resources and the Environment, which in turn was terminated in 1985, and its purposes transferred to the President's Domestic Council.

Several explanations have been given for the elimination of the river basin commissions. A primary justification is based on the view that the states could manage water resources within their jurisdictions, despite the interstate nature of most of the nation's waters (Frisch 1981; Dworsky, 1991). Other justifications include that, the instruments provided by the Act were ineffective, and the needed federal/interstate coordination could more effectively take place as necessary on an ad hoc basis, without a comprehensive national program. Another view is that both the Congress and the President's Executive Office were either not willing, or did not see the need to grant the council and its commissions the adequate authority necessary to carry out the assigned tasks. (Foster, 1984).

**Since 1981:** Over the years, under the above mentioned programs and others, the principal policy directive for the nation's water and related water resources programs, having large interstate components, has resided in Congress and its committees with the implementing agents being the executive branch departments. By the late 1980s, through congressional leadership, the states and the federal agencies have succeeded in formulating and carrying out programs aimed at comprehensive development for many major interstate watersheds such as the Columbia, Colorado, Mississippi, Delaware, and the Great Lakes. These developments, that were undertaken under the various national policies, could not have been accomplished, however, without the essential support of the affected states. They gained this support because they were responsive, for the most part, to the legitimate concerns of the state and local authorities. Yet, except for the TVA and a few special cases, no

third party coordinating entity has been provided with enough authority to change or bypass the federal authority.

The current era of water resources management and protection is said to represent a marked change from past national programs. It is believed that future water programs increasingly will shift to the state and local responsibilities. Informal interstate/state/local committees to strengthen cooperation around the members of the federal system may be needed to fill the void that has been left by the disappearance of a comprehensive national water resources policy. (Dworsky 1991).

### **The New England Experience**

Charles Foster, in his book Experiments in Bioregionalism: The New England River Basins Story (1984), thoroughly traces the history of thirty years of water resource institutions in New England, from the establishment of the New England - New York Interagency Committee in 1955 to the abolition of the New England River Basin Commission in 1981. To follow is a very brief recount of the chronicle so vividly and completely described in his case study - as it is important that successful and unsuccessful aspects of these past experiences not be overlooked.

**Interstate Compacts:** In the region's early history of interstate action in the realm of water resources management, coordination came in the form of federal-interstate compacts. In 1947, the New England Interstate Water Pollution Control Compact<sup>51</sup> provided a means by which the region's interstate and coastal water

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<sup>51</sup> 61 Stat. 682

would receive continuing water quality classification. In 1957 a Merrimack River Flood Control Compact<sup>52</sup> was ratified to provide for construction of certain dams and reservoirs, for an apportionment of tax and other revenue losses resulting from U.S. acquisition of land for this purpose, and a procedure whereby other dams may be built by the United States or by the states. These compacts served as a testing ground for future, more formalized federal water resources programs, requiring federal and state coordination.

**The New England-New York Interagency Committee:** The New England-New York Interagency Committee (NENYIAC) was a comprehensive resources survey authorized by an item in the Flood Control Act of 1950 and by presidential directive. Under the chairmanship of the Corps of Engineers, the NENYIAC was merely a survey authorization. But its clearly federal dominance, raised suspicion that the investigation was a means to initiate unwanted federal programs in the region. The charge of the committee was to compile a comprehensive survey of land and water resources in the area, to determine what development and conservation projects were feasible and desirable, and to prepare recommendations for specific actions to carry them out. Hydroelectric power development and flood control improvements were the focus of the study.

The NENYIAC started with the approach of the federally directed river basin investigation organized by mutual agreement among the agencies. The states, however, at the outset demanded a measure of direct participation. As a result, an

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<sup>52</sup> 71 Stat. 18

executive council was formed within which state and federal designees would share equally in the decision making process. Individual subcommittees and work groups also had both state and federal participation.

The program had several weak points. For one, the federal government consistently underfunded the Committee. Two, any meaningful input from the state or local participants was impeded by the lack of staff and appropriation provided to them. Third, while private interests were represented on a number of subcommittees, only the utilities made any significant contribution to the studies.

On the positive side, NENYIAC demonstrated that federal-state cooperation could accomplish meaningful results (such as the 46 volumes of useful inventory information), and that coequality between federal and state representatives would work well in practice. State and federal participants alike have spoken with great respect of what they learned from one another during NENYIAC. The dialogue initiated between multiple disciplines during this period is said to have been an enormously valuable experience for all participants.

**Northeastern Resources Committee:** As NENYIAC neared its final stages, the New England governors, pushed by their designees, searched for alternative means to continue interagency cooperation. The Northeastern Resources Committee (NRC) came into being in June 1956 by joint authorization of the Federal Interagency Committee on Water Resources and the New England Governors Conference. Unfortunately many of the criticisms addressed to NENYIAC equally apply to its successor, the NRC. In its own declaration of intent, NRC was to bring about

improved coordination, resolve conflicts between agencies, adjust conflicts of interests, and promote state and federal programs and policies in accord with regional needs. Lacking a central staff and budget, virtually none of these objectives were accomplished to any appreciable extent.

To remedy this situation, the state members of the NRC felt that a formal federal-interstate compact, sanctioned by the state legislatures and by the Congress, was the only practical means by which funds from several sources could be mingled. Given more than ten years without success, the NRC finally transferred its support to the pending national Water Resources Planning Act, which had, by then, been amended to include the coequal provisions so important to New England's interests.

**The New England River Basins Commission:** The governors' unanimously endorsed the river basin commission for the New England region in September of 1965, and in 1967 the New England River Basins Commission (NERBC) was officially established. The functions of the Commission included: to serve as the principal agency for coordination of planning; to prepare and keep up to date a comprehensive, coordinated, joint plan; to recommend priorities for planning and construction, and; to undertake such studies as might be necessary. The NERBC's planning and coordination mandates included the full range of federal, state, interstate, local and nongovernmental activities - unprecedented in the region's history. It was intended to be truly a federal-state organization as reflected in the Commission's staff and budget support. The by-laws also included the unique provision of a coequal vote if consensus could not be achieved. Perhaps most

significantly, it was a federally sanctioned, permanent watershed entity - the type of entity that New England had never been able to institute for itself through the NENYIAC and NRC.

Foster has outlined a number of the strengths that participants and observers noted in NERBC's approach. First, he points out that the Commission successfully gathered and disseminated information related to water resources throughout the region. This information was essential to issue identification in the holistic framework adopted by the Commission. A comprehensive approach and thorough assessment of regional impacts would have been difficult to achieve otherwise through the existing apparatus of state and federal agencies.

Second, the Commission, like its predecessor, facilitated a process of general consciousness raising within the region, and a forum for state, federal, and public participants to pull together to discuss mutual needs and concerns. It was a place get information, to share experiences, and get to know others in the field. It provided a sense of cooperation that never would have resulted from interagency agreements or statutory program directives.

Third, Foster explains that it is hard to say whether conflict resolution was a deliberate or an inadvertent role for NERBC. The Commission did not perform, in a prescribed way, as an arena for dispute resolution. Yet, the Commission tended to quiet problems and keep them contained as a consequence of its functions in informational analysis and transfer, and its availability as a forum to discuss water



resources issues. In this less formal way the Commission served as a forum for conflict resolution. Furthermore there was the statutory requirement of consensus imposed upon it, and the ever present political reality that the fragile balance, essential to the functioning of the Commission, could be easily destroyed by unsettled disputes. Thus there was the incentive to resolve conflict and work toward consensus.

Fourth, the Commission served as a valuable tool to be utilized by the states to exert leverage on funds and policy positions in ways no single state or organization of states could hope to achieve otherwise. And likewise, the federal agencies found it a useful means of reaching the states to gain support for programs, projects, or policies of particular interest to them.

Although there were many strengths, there were also weaknesses in the NERBC approach. Foster explains that some deficiencies were clearly defined, while others were subject to interpretation. For example, most observers found the program complex and hard to understand - it lacked an apparent direction or sense of purpose. As Foster explains, "in a genuine effort to be democratic, it opened the door wide to so many interests that the net result was occasional anarchy, near paralysis, and an ultimate level of agreement often too modest to be meaningful." The end result, there was perceived an absence, on the part of both federal and state participants, of a meaningful role or function for the Commission in the region.

Associated with the problems of role and function was the absence of a legitimizing constituency. The Commission was a creature of both the states and the

federal government, but had full support from neither. Despite a record of nonintervention by the federal agencies, and even indifference by some of the most powerful (EPA for example), the commission remained haunted by a reputation for being primarily a federal agency. To the states and the few informed members of the public, it was primarily a federal agency. The federal government was the source of the bulk of the commission's funds, state contributions notwithstanding. The commission was also a creature of the Water Resources Council, a federal interagency body. Because of this, program activities tended to follow federal procedures. This perception was shared by the states and the public to the very end. It seems that the states were never really convinced of the need for a federally authorized river basin commission and, consequently, had no sense of ownership in it.

At the same time it was an entity without a defined power base within the federal system; the Commission lacked political clout at the federal level. In the absence of authority and power, ensured by an enabling statute, to do things to or for others, it was unable to bring its plans to fruition. The Commission's inability to implement led to its reputation as a "paper tiger". Ultimately, the Commission was unable to reach decision makers in Washington or at the regional level. Moreover, it never developed a strong public outreach program and, at the end, lacked support from any sphere, including the general public.

**The New England - New York Water Council:** The successor to the NERBC, the New England - New York Water Council, composed exclusively of state officials and using funds transferred from the NERBC, carried on some of NERBC's

functions such as interagency coordination and project prioritization. The seven states formerly in the NERBC formed the Council within the New England Governor's Conference. The Council includes a federal-state steering committee and a citizen advisory representative. The Council's objectives include preparing recommendations to the Governors on regional policies and positions, solutions to regional interstate water resources problems, and priorities for planning and management of resources.

For more than ten years the Council served as a needed communication link between the state representatives on the former Commission. It functioned as a unified voice in response to federal actions in the region. A voice, with the backing of six states, also provided greater leverage for individual representatives when initiating water resource management activities in their own states. The Conference was primarily a state endeavor, with state funding. Given the recession, by 1991 the states could no longer allocate funding to the Council. Although it still exists, it currently consists of little more than a library<sup>53</sup>.

## **PRESENT ALTERNATIVE INSTITUTIONAL ARRANGEMENTS FOR INTERSTATE COORDINATION**

### **Interstate Water Resources Apportionment**

Some institutional arrangements for water resources use and allocation entail devising a policy or procedure to apportion water resources between states. Water apportionment schemes are adopted under three different constitutional scenarios.

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<sup>53</sup> Personal communication, Anne Blackburn, New England Governor's Conference, April, 1992

First, Congressional acts have apportioned water resources, yet Congressional apportionments have been rare and occur only as an adjunct to proposed projects. Second, when disputes between states reach the Supreme Court, the court has made decisions of equitable apportionment. The third, and the most common means utilized to apportion water resources between states is by interstate compact. (DuMars 1990). A compact is a congressionally sanctioned agreement with both federal agencies and states as signatories. Essentially an interstate compact is both a statute and a contract between two or more states to handle a problem that transcends state political boundaries (Hill 1990)<sup>54</sup>. Congressional consent is required if the compact tends to increase the joint political power of participating states at the expense of the otherwise independent power of the individual state governments. An interstate compact is no small order, since it takes an average of eight years for interstate compacts to be negotiated and ratified by Congress<sup>55</sup>.

Nevertheless, many states, in several parts of the country, already have entered into compacts dealing with the allocation of shared water sources. An example is the Colorado River Compact of 1922, whose major purpose is to provide for the equitable division and apportionment of the uses of the water of the Colorado River system, and to avoid conflicts within the area. In the 50 years following 1922,

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<sup>54</sup> The authority for a state to enter a compact is found in the U.S. Constitution, Art. I, sec. 10 cl. 3. The compact, through court interpretation, has received additional authoritative status by virtue of its protection as a contract via the contract impairment clause, U.S. Constitution, Art. I, sec. 10, cl. 3.

<sup>55</sup> Michael French Smith, Ph.D., "Great Lakes Water Diversion: Protecting Michigan's Interests, 1986, original reference from personal communication with Michael Donahue, Director, Chicago Office, Center for the Great Lakes.

more than 30 interstate water compacts have been created to solve a variety of water resources problems. Chief among these are compacts for water allocation, pollution control, flood control and planning, and project development and coordination (Mather, 1984).

It has been said that compacts for water allocation in regions of water shortage are quite efficient in permitting the development of rivers without time-consuming legal battles among neighboring states for their respective water rights (Mather, 1984). Because it is politically difficult to make sweeping changes in institutional structures, avenues for dealing with the lack of coordination between states must sometimes focus on working within the institutional structures already in place. In this respect, a water apportionment compact may be more politically feasible than establishing a new governing entity with apportionment responsibilities. In other respects, compacts which merely apportion scarce water resources between states may quickly become obsolete when new information or changes in water resources conditions necessitate modification of agreements under the compact. Without some provision for information gathering and exchange, modification to compacts, and for long-range water resources planning, disputants will most probably engage in further litigation to challenge the terms of the original apportionment. Consequently, interstate compacts are commonly accompanied by provisions for an administrative structure to oversee interstate coordination activities and conduct long range planning.

## **Watershed Entities**

Developing an administrative structure to coordinate interstate water resources use and allocation activities typically involves instituting a watershed entity.

Watershed entities as the administrative units for carrying out interstate water resources management responsibilities are well represented in virtually all regions of the world. Over time, several different organizational structures have evolved for the purpose of planning and managing water resources. The differences are, in part, due to variations in the principal functions demanded of the organizational structure, and the development of new ideas regarding optimal structures. The diversity of organizational structures range from the powerful watershed authority, to the authoritatively weaker interstate coordinating committees. In between is a array of intermediate watershed entities whose authority is neither defined as broadly as those of the former type of watershed authorities, nor as narrowly as those of the latter type of committees. What follows are summaries of these principal organizational structures.

**Watershed Authority:** The watershed authority concept, an autonomous agency which is consolidated in terms of area and function, was utilized in the formation of the Tennessee Valley Authority (TVA) in 1933. A pioneering institution, the TVA is a development-oriented federal corporation with powers to plan, construct and operate multi-purpose projects, and to achieve economic and social development goals. Although the TVA was copied around the world, its organizational framework was not again used in the United States. This type of

administrative structure has been met with considerable resistance because it provides little coordination with the regular government departments in charge of water resources management or with user interest. As a result, the valley authority concept has rarely been implemented more than once in any individual country.

Most observers feel that the corporation form, since it is somewhat independent in terms of political control and responsibility, is best suited to water construction, operation, and maintenance projects. This does not mean that it could not be used in water activities involving comprehensive planning or regulation of water uses or users, but it is generally felt that those activities might be better handled by an organization formed by an interstate compact (Mather, 1984).

**Watershed Commission:** A watershed commission, resulting from a federal-interstate compact, may be responsible for coordinating water policies of the constituent states sharing parts of the same watershed. Some are authoritatively strong commissions, empowered to develop plans, policies, and projects and to allocate waters, such as the Delaware River Basin Commission. Others are entrusted merely with water apportionment, which has already been spelled out in detail in an interstate compact. An example of this kind of commission is the Upper Colorado River Basin Commission. Still others are purely advisory, with no regulatory power at all, such as the Great Lakes Commission and the Interstate Commission on the Potomac River Basin. What distinguishes the above mentioned collection of basin entities from the river basin commissions created under the Water Resources Act of 1965, such as the New England River Basins Commission discussed above, is that

they have been created on an ad hoc basis for individual river basins as the need for coordination arose, and not by a comprehensive federal program of instituting watershed commissions nation-wide.

An example of a compact which contains provisions giving a commission the authority for controlling water use that has the force of law is the Delaware River Basin Compact<sup>56</sup>. The Delaware River Basin Commission developed as a result of several decades of controversy over water allocation. The Commission is fairly unique in that the United States is a signatory party with several states and the commission is given extremely broad regulatory and enforcement powers. Hence, the Delaware River Basin compact not only gives the Commission planning and management powers, but also has provisions that allow statutory functions. For example, no project that has a "substantial effect" on water resources in the basin can be undertaken by any public or private group without the express consent of the Commission.

The Commission also has the power to allocate water to the various states in a fairly flexible manner under a doctrine of equitable apportionment, and to regulate withdrawal within the watershed. Whenever the Commission finds it necessary to exercise these powers, any withdrawal permits authorized or issued under the laws of any of the signatory states are superseded to the extent of any conflict with the regulation exercised by the Commission. (Delaware River Basin Compact, 1961).

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<sup>56</sup> 75 Stat. 688 (1961)



Although it does not have any power to tax, it does have fairly broad financing power. The Commission may borrow money and accept grants for any of the purposes enabled by the Compact. It may charge fines and assessments, and charge for water and facility use. The signatory parties are required to provide such capital funds required for projects of the Commission in accordance with cost sharing plans.

Moreover, all water projects planned by Federal, state, or local groups must conform to the Basin Commission's comprehensive plan (Mather, 1984). Another important strength of the compact is its provisions for close involvement of the governor's office in each member state, and for federal representation to facilitate integration of federal projects in watershed planning and management.

Like the Delaware River Basin Compact, the Great Lakes Compact<sup>57</sup> was established in 1955 through a process of Congressional ratification. But, in contrast to the Delaware River Basin Compact, the Great Lakes Compact more strictly limits the decision making power of the Great Lakes Commission. The goal of the Great Lakes Commission, as stated in the compact is "...to promote the orderly, integrated, and comprehensive development, use and conservation of the water resources of the Great Lakes Basin." Other provisions of the compact include: an agreement to advise in securing and maintaining a proper balance among various uses and users of the water resources; the power to recommend laws, ordinances, regulations related to the development, use and conservation of water resources; and an agreement between the parties to consider the action the Commission recommends in respect to water

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<sup>57</sup> P.L. 90-419 (1955)

diversions. The Commission's recommendations, however, are not legally binding on member states and provinces. The advisory Great Lakes Commission is without formal federal participation and without substantive regulatory power.

Commissions whose powers are confined to coordination and planning, such as the Great Lakes Commission, have been criticized as ineffectual, however, commissions without strong federal authority represent less of a threat to the powers of state government departments engaged in water resources allocation, and at the same time satisfy the need for some representation of common interests. They, therefore, have been met with less opposition in practice than watershed commissions with legal authority like the Delaware River Basin Commission, or watershed authorities like the TVA (Burchi, 1985).

**Watershed Coordinating Committee/Association:** Yet another alternative institutional arrangement is the creation of an interstate coordinating committee or association. Unlike the above alternatives, committees require no Congressional approval and have strictly advisory roles. For example, in 1981 the five states of the Upper Mississippi River region signed Articles of Association forming the Upper Mississippi River Basin Association, made up of governor appointed representatives. In 1982, advisory membership was extended to five, non-voting, federal agencies. Although the decisions of the Association are advisory only, it may develop strong collective state positions on issues of mutual concern. The Association serves as a cooperative forum that strives to: resolve regional conflicts among the region's institutional entities; serve as a regional body for the coordination of federal, state,

interstate, and local plans for the management of water resources; unify state positions with respect to water resources problems and issues<sup>58</sup>.

Another example of an arrangement for interstate coordination is the Upper Mississippi River Basin Charter, and the Great Lakes Charter, both signed in 1985 by the governors and premiers of the states and provinces within those respective regions. These Charters are non-binding, "good-faith" agreements which provide that it is the intent of the states and provinces to notify and consult with all affected states and provinces prior to approving or permitting any major new or increased diversion or consumptive use of the water resources of the watershed.

Although a Charter is a "good faith" agreement which is limited by the participation of its signatories, it was from its inception a joint effort by the governors of all states and the premiers of the provinces. Accordingly, a Charter is a strong statement of unity (Williams, 1990). Whether the "good faith" agreement can become an enforceable vehicle for the expression of regional water resources management is still uncertain (Hill, 1990).

Coordinating committees and associations have potential strengths and weaknesses. Because this type of arrangement does not require Congressional ratification, they may be less likely to have federal participation. Some maintain that in an interstate watershed there is no effective substitute for federal participation. States have leaned heavily on the federal government, as a signatory to interstate

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<sup>58</sup> Personal communication: Barbara Naramore, Program Director, Upper Mississippi River Basin Association, 1992

compacts and a member of commissions, to assist in devising water allocation strategies (Dworsky, 1991).

Although a charter does not resolve legal issues and is advisory only, its members can agree, among other things, that cooperation is required among jurisdictions for monitoring, planning, and conservation activities within the watershed. A charter can be a major step forward in establishing a framework, albeit non-binding, for the development of a regional water resources use and allocation program. It is an expression of the participants' mutual concern and shared stewardship of the watershed resources.

Figure 11

**SUMMARY OF STRENGTHS AND WEAKNESSES OF ALTERNATIVE INSTITUTIONAL ARRANGEMENTS**

	<b>Strengths</b>	<b>Weaknesses</b>
<b>Congressional Act and Supreme Court Decision</b>		<ul style="list-style-type: none"> <li>- May result in less mutually agreeable outcomes for affected states.</li> <li>- Does not provide forum for ongoing cooperation and conflict resolution between affected parties.</li> </ul>
<b>Interstate Compact</b>	<ul style="list-style-type: none"> <li>- May provide directive for close representation and involvement between agencies.</li> <li>- May be means to avoid imposition of undesirable apportionment by Congress or Supreme Court decision.</li> <li>- May define authority of watershed commission, ranging from regulatory authority, over and above that possessed by the individual states, to strictly advisory.</li> </ul>	<ul style="list-style-type: none"> <li>- Takes a long time to develop and achieve Congressional ratification</li> <li>- Inflexible if compact does not provide mechanism for modification such as a watershed entity as an ongoing governing structure.</li> </ul>
<b>Watershed Authority</b>		<ul style="list-style-type: none"> <li>- Provides little coordination with other government agencies.</li> <li>- May be met with considerable political resistance, because of autonomy and authority.</li> </ul>
<b>Watershed Commission</b>	<ul style="list-style-type: none"> <li>- May have broad regulatory authority beyond which is possess by states individually.</li> <li>- Provides for interagency cooperation that does not exist in strict interstate apportionment arrangements.</li> <li>- May have financing power</li> </ul>	<ul style="list-style-type: none"> <li>- May be met with considerable political resistance by states because suspicions that their sovereignty over water allocation may be weakened by the presence of a commission.</li> </ul>
<b>Coordinating Committee</b>	<ul style="list-style-type: none"> <li>- Possesses political sanction if funding through states and formal ties to regulatory agencies.</li> <li>- Potential to develop strong collective state positions on issues of common concern.</li> <li>- Provides for the creation of a unified voice through building consensus among participants.</li> <li>- Most expedient alternative to develop and institute.</li> </ul>	<ul style="list-style-type: none"> <li>- May not include provisions for federal participation, because does not require federal endorsement.</li> <li>- May lack provisions for federal administrative support, such as funding and staff.</li> <li>- Limited to coordination and planning functions.</li> </ul>

## KEY ASPECTS OF ALTERNATIVE INSTITUTIONAL ARRANGEMENTS

The institutional structures attempted in New England over the 30 year span of water resources history have been diverse in composition, configuration and execution. The NENYIAC was purely a federal endeavor that provided for state representation; the NRC was a state endeavor that lacked federal legislative sanction and permanence; the NERBC took advantage of federal enabling legislation to create a federal-state entity with permanence, and; the New England-New York Water Council is a state institution with allowances for federal participation.

In the search for institutional arrangements for interstate management of water resources use and allocation for the Merrimack River watershed, we must look, not only to the region's past, but nation-wide at present arrangements. Myriad institutional arrangements, in many regions of the United States, are devised to coordinate interstate activity at the watershed level.

The future direction of water resources programs should not necessarily follow any particular previous organizational pattern or be bound by the functions and procedures followed by other arrangements. But it is important that we do not overlook successful and unsuccessful aspects, and incorporate lessons learned from these past and present experiences. Several key aspects of these past and present experiences in interstate coordination, which should not be overlooked as the process of water resources management continues in the Merrimack River watershed, are described below.

## **Authority**

Past experiences reveal that arrangements lacking adequate authority have resulted in an inability to bring even the best plans to fruition. These experiences also demonstrate that authority comes from various sources.

A fundamental source of authority is the ability to regulate with the force of law. Regulatory authority over and above that possessed by the individual states may only be given by Congress when the United States becomes a signatory party to an interstate compact. Federal-interstate compacts may, therefore, provide the necessary governing structure to make watershed-wide regulatory decisions and see to it that these decisions are backed with enforcement powers to be implemented. An example is the broad regulatory powers of the Delaware River Basin Commission. This commission may be given the authority to go as far as to allocate water to the various states, and require that all water projects planned by federal, state, or local groups conform to a management plan.

While some watershed entities are empowered to implement plans with the force of law and to allocate water resources, others are entrusted with purely advisory roles. As in the case of the Great Lakes Commission, the powers authorized to a commission under a compact may be defined narrowly. Additionally, interstate coordinating committees, because they are not Congressionally ratified, are also strictly limited in their authorities. Having only advisory capacities, these arrangements are dependent on the participants to independently implement coordination activities within their respective jurisdictions on behalf of the interstate arrangement.

If an arrangement does not have authority through regulatory and enforcement powers, it must appropriate authority by other means. A solid power base may come from strong federal, state, local, public as well as private support. A supportive constituency can be a tremendous source of political influence. Related to a supportive constituency is a clear sense of direction and purpose. A clearly defined mission strongly influences the public perception of the effort's legitimacy and can and can result in facilitating greater authority to institute change. The ability to influence change can also be rendered from within the institutional arrangement. Decisions that resolve issues of mutual concern among participants, and are presented through a unified voice, can wield substantial political clout for effecting policy changes. The above sources of authority are obtainable without necessarily possessing regulatory powers.

### **Federal-State Partnership**

The past tells us that effective water policy and water management strategies evolve from a partnership for action in which both the federal and state governments have a continuing role. The success of federally initiated programs has hinged on the support of affected states, and were therefore required to be responsive to the concerns of the states. When federally dominated programs raise suspicions by the states that their sovereignty over water allocation may potentially be weakened, the programs can lose necessary state backing. Former efforts have demonstrated that federal and state cooperation can work as long as the states are an integral part of the



decision making. Affected states must be made to feel a sense of ownership in the process, so that programs are not perceived as a loss of authority.

Past national water resources policies provided for a meeting ground of related interstate and federal water resources activities that does not exist to the same extent today. With a shift to greater state authority, and an absence of a comprehensive national policy regarding interstate water resources management, interstate initiatives are increasingly charged with strengthening cooperation around the members of both state and federal systems.

Federal-interstate compacts can provide the directive for close representation and involvement of states and federal agencies. An example is the Delaware River Basins Compact. An important aspect of having Congressional approval is its provisions for close involvement of the governor's office in each member state, and for federal representation to facilitate integration of federal projects in basin planning and management. Interstate watershed coordinating committees, in contrast, do not require legal endorsement at the federal level, and therefore may not necessarily include provisions to coordinate closely with federal agencies. As the federal government typically lends legitimacy and funding to an interstate program, the lack of federal support may be a real shortcoming of coordinating committee arrangements without provisions for federal participation.

Whether a Congressionally ratified commission, or a looser arrangement, such as an interagency coordinating committee, watershed entities have the potential to provide a sense of federal-interstate cooperation that does not necessarily result from

water resources allocation through one-time interagency agreements or statutory directives. Federal-interstate arrangements which include the creation of a watershed entity have provided an ongoing forum for information exchange and dispute avoidance by building alliances between levels of government. Federal-interstate watershed entities provide mutual benefits to states and federal government agencies; for example, they can be a tool for the states to leverage federal funds, and likewise, a means for the federal agencies to gain support for their policies programs that serve states' interests.

### **Public-Private Partnership**

In addition to the need for intergovernmental cooperation, there is the need for public-private interaction. Foster (1984) explains that what was really lacking in past New England experiences was a good way of bridging the gap between the public and private sectors. Because of the lack of a public-private partnership, the institutions were denied the feedback they so badly needed from the private sector, and the private organizations lacked the accurate information essential to a real understanding of government decision making processes.

Successful endeavors find a way of closing the public-private gap to build a supportive constituency which includes, not only government agencies at all levels, but also users of the watershed's resources, and citizen interest groups. A legitimizing and supportive constituency does not only consist of governmental agencies, but private interests, including water resources users, public interest groups,

and the general public. It should be noted that the extent of public-private partnership is not more indicative of one particular institutional arrangements over another, but is an important consideration regardless of whatever arrangement is adopted.

### **Clear Sense of Direction and Purpose, Yet Flexible Role**

Past experiences demonstrate that cooperative ventures in water resources management require a clear sense of direction and a sense of legitimacy. It must be apparent to participants that by working together something can be gained that may not otherwise be realized. If not, participants will not see the value in making the extra effort to work cooperatively. But at the same time the arrangement needs to be adaptable to address the priorities of the states and local governments. As Foster (1990) explains "The simple truth appears to be that a fixed institution, without the capacity to adapt itself to changing circumstances, is destined for eventual obsolescence." Thus, an important consideration in developing an interstate arrangement is that it be adaptable, such that new information and changing conditions in the watershed do not render it obsolete.

Congressional decisions, Supreme Court decisions, and federal-interstate compacts may be inflexible in the way they deal with issues of water allocation. Water resources are many times apportioned based on information at a specific point in time, given a particular set of circumstances. Watershed entities, administrative structures which serve to coordinate water resources management activities on a continuing basis at the watershed level, may be a more adaptable institutional

arrangement. Commissions and coordinating committees have served coordination roles between the legislative, regulatory agencies, and interest groups. By assuming roles of advising on ways of securing and maintaining a proper balance among various uses and users of the water resources, recommending policies and programs related to the development, use, and conservation of water resources, and by facilitating agreements between the parties to take particular actions, the arrangement may respond to the particular needs of the participating agencies. Watershed entities can oversee the development of management plans, and coordinate plan revisions. In this way, watershed entities invite an ongoing review of water resources management objectives and processes.

#### **Adequate Administrative Support**

Former experiences have shown that administrative matters, including a central staff and adequate funding are critical elements determining an arrangement's success or failure. Arrangements possessing a framework of permanence typically allow adequate funding and control of funds, so that long-range objectives may be pursued with a degree of confidence.

Federal-interstate compacts have the advantage of stipulating funding and staff arrangements, including federal and state budget appropriations. Compacts may give financing power to a commission, as in the Delaware River Basin Compact. Less formal interstate coordinating committees may lack the benefit of secure federal funding.

## **CHAPTER 5**

### **THE APPROACH TO A COORDINATED INTERSTATE STRATEGY**

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In accord with an efficacious institutional arrangement as an organizational framework, there are particular features of the approach that are important to devising a bi-state water resources use and allocation strategy for the Merrimack River watershed. The features of the approach will determine the capacity of the participants, government units in different jurisdictions and/or levels, and the private sector to work cooperatively toward a common goal. Features of the approach will also define the participants ability to undertake planning and management activities though the integration of the multiple programs and policies currently in play within the watershed.

The Merrimack River Watershed Initiative has embraced the "Watershed Protection Approach" as a strategy for environmental management and protection. Robert H. Wayland III, the director of EPA's Office of Wetlands, Oceans, and Watersheds, has outlined the administrative and programmatic features of this comprehensive approach that the department was created in 1991 to facilitate (1992). The two primary features he identifies are stakeholder involvement, and integrated, holistic strategies. What follows is a discussion of these features of the "Watershed Protection Approach", and of several past and present strategies, to serve as examples for the Merrimack River watershed.

## MULTI-STAKEHOLDER INVOLVEMENT

The most valuable role an interstate water resources use and allocation strategy can play is to determine not only what decisions or outcomes are reached, but how these decisions are made. They will need to facilitate the development of plans by focusing on such concerns as who is involved in the process; how issues are identified and framed; what information is brought to bear; how alternatives are developed and analyzed; how trade-offs are made, and what the procedures are for implementing, monitoring, enforcing and evaluating the final decisions. EPA's new "Watershed Protection Approach", which is being adopted for the Merrimack River Watershed Initiative, stresses multi-stakeholder involvement in resource protection activities. In describing the "Watershed Protection Approach" to water resources management, Wayland asserts that:

"involving stakeholders in policy formulation and program implementation decisions broadens perspective and builds trust and sensitivity. Through active participation of interested parties, decision makers learn more about a wide range of potential solutions and impacts. People with divergent views, sitting at the same table, find that honestly tackling problems together can help reduce friction and lead to better understanding of each other's needs and expectations (Wayland, 1992)."

It requires no great feat of the imagination to envisage the manifold conflicts of interest that can conceivably arise between the different uses and users of water resources in the Merrimack River watershed depicted in Chapter 2. The conflicts potentially pit not only special interest groups, one against the other, but jurisdictional and substantive conflicts among agencies of government as well. Conflicts may include a number of actors whose values and interests are incompatible. Disputants

may operate at the local, regional, state, interstate level. A conflict over a water resource might comprise actors on the same or on different levels. Different actors may act on their own or establish different kind of coalitions. However, the interests of a party in a dispute are not always easily identified. Generally conflicts are more pronounced and difficult to handle in cases where there is a sudden and unpredictable change in the demand for water. For such situations there are normally no established methods for how to solve them. The major part of settlements over water resources disputes in the U.S. occur within legal institutions, in the courts themselves or through some adversarial outside negotiation. (Bateld, 1985). Conflict has always been at the heart of the water resources management challenge.

A Council of State Governments' report notes that, "the best way to deal with conflict is to anticipate and avoid it to the greatest possible extent. Resource management planning, by process and by product, can provide a framework for coordinated, coherent decision making that can go a long way towards forestalling collisions of competing interests and authorities. It can do this by making reasonably explicit...the policies and procedures that will be used in allocation decisions, program and project development, problem solving, and internal and intergovernmental coordination." (Council, 1992).

An enhancement to the traditional processes for resolving disputes is environmental dispute resolution. Environmental dispute resolution refers collectively to a variety of approaches that allow affected parties to meet face-to-face to reach a mutually acceptable resolution of the issues in a dispute or a potentially controversial

situation. Multi-stakeholder participation is used to engage relevant interests in becoming involved in the proactive determination of management strategies, rather than a reactive process of dispute resolution. Although there are differences around the approach, all are voluntary processes that involve some form of joint problem solving and consensus-building. (McKinney, 1990).

There are several principles which guide the process of making decisions through a dispute resolution process: 1) all the parties affected by, or interested in, a given issue are represented in the process; 2) whenever necessary, an effort is made to assist parties in acquiring the expertise, information, and skills necessary for their full and equal participation in the process; 3) the best available scientific and technical expertise is used to create a jointly acceptable data base and framework for analyzing the issues and their potential impacts; 4) an external third party or mediator is often used to assist the parties in reaching a negotiated settlement; 5) decisions are made, or are largely influenced, by the parties as they work toward mutually acceptable solutions; 6) if the parties are successful in reaching a consensus solution, it is written down and includes provisions for implementation, monitoring, enforcement, and evaluation. This approach is intended to allow individuals and groups affected by water management decisions to participate directly in the development of policies, programs, and management decisions. Its premise is that if interested parties are provided with an opportunity to be involved in the formulation of plans and policies, they are more likely going to support those decisions and be engaged in implementing them.



The Institute for Environmental Negotiation at the University of Virginia has developed and applied environmental dispute resolution and consensus building through the use of roundtables as a major component of its work on water resources policy with the State of Virginia (Collins, 1990). Collins describes roundtables as "ad hoc groups formed to allow interested parties in conflict on matters of public policy importance to study, discuss, and negotiate among themselves in search of a consensus for action."

The roundtables are assisted by a neutral mediator who, through a process called "conflict assessment," identifies the major stakeholders, and the organizations and/or individuals who might speak for that interest. Participants are parties who recognize that they have diverse interests, but also that their individual interest may be served by finding an mutually acceptable collective agreement. All parties recognize that a roundtable is a process that protects their interests even as it explores issues. They are assured that there is a basis for terminating their involvement, or the process itself, if there is no hope for a productive outcome. Collins states that "Demystified, a roundtable is nothing but a group of people with different interests and concerns looking for some common ground" (1990). The goals of the roundtable are to provide a public report that will influence public opinion, and to encourage public action consistent with their consensus. Many times this action takes the form of proposing legislation.

Another illustration of consensus building is an effort by the Metropolitan Water roundtable, in Boulder Colorado, staffed by Accord Associates, Center for

Environmental Problem Solving, and chaired by the State Governor. As in the State of Virginia, the roundtable does not have power to make decisions on what projects or water conservation measures should or should not be undertaken, but, as stated by Hobbs "A roundtable's function is to examine issues and fashion possible means for conflict resolution through consensus of affected interests, and then to make recommendations to those empowered to make decisions." (Bateld, 1985).

The International Joint Commission is an example of a permanent entity, instituted by the Boundary Waters Treaty<sup>59</sup> of 1909 between the United States and His Majesty the King, that has dispute resolution and consensus building as one of its primary roles. The purpose, stated in the preamble, was "to prevent disputes regarding the use of boundary waters and to settle all questions which are now pending between the United States and the Dominion of Canada involving the rights, obligations, or interests of either in relation to the other or to the inhabitants of the other, along their common frontier, and to make provision for the adjustments and settlement of all such questions as may...arise". Article IX of the Treaty, allows for any matters of difference arising between the parties, pertinent to the purpose stated in the Treaty, to be referred to the International Joint Commission for it to examine and report upon as appropriate. The Commission's reports are advisory only, but have taken up the bulk of the Commission's work load.

The importance of consulting all interested parties, the IJC staff believes, is that it has been probably the principal mechanism by which the Commission has been

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<sup>59</sup> 36 Stat. 2448

able and, indeed obliged, to take account of a full range of impacts of resource development decisions. Impacts include, not only environmental ones, but economic and social costs as well. In this way, both long-term and short-term economic and environmental goals can be more wholly achieved. (Thornburn, 1990).

In summary, multi-stakeholder participation is a decision making process which strives to accommodate the interests of affected parties, and allow for the resolution of competing opinions through full participation of interested groups. Multi-stakeholder participation has been used as an opportunity for the development and implementation of options in situations where the existing institutional arrangements for management are fragmented, complex and problematic (Smith, 1990). It has facilitated bringing people together in addressing common problems across the usual political boundary, agency, level of government, topical, environmental media, disciplinary, business-government, and other institutional barriers. The usual "experts" on river basin management are engineers or lawyers - multi-stakeholder participation may be an opportunity to give the politicians other bases than technical or legislative facts for their decisions on how to formulate the public water policy, and to avoid the plan-announce-defend syndrome (Thornburn, 1990). By employing the principles and techniques of environmental dispute resolution, it is said that water resources planning can become a decision making process to proactively resolve water resources issues before they become too controversial and the affected parties too polarized (McKinney, 1990).

Although a multi-stakeholder approach offers advantages over traditional

decision making processes, observers and analysts have noted several concerns, and conditions for this approach. First, there may be a problem of representation of all the pertinent interested parties (McKinney, 1990). For instance, discussions can become unwieldy if there are too many participants. Therefore each interest may need to be represented by a spokesperson. Although, it is quite possible that a major interest is not sufficiently organized so that a representative can be selected (Pritzker, 1990). A second problem may be the issue of unequal political power or bargaining ability (McKinney, 1990). One party may have power through political influence, access to information, or bargaining strength to dictate the results of the process (Pritzker, 1990). Finally, parties are not likely to grapple with issues that are only emerging and are neither well defined nor imminent for decision (Pritzker, 1990). Thus, the matter must be sufficiently developed so the participants can focus on relatively well crystallized issues.

## **INTEGRATED APPROACH**

It is becoming increasingly clear that water resources use and allocation in the Merrimack River watershed calls for an integrated approach to effectively respond to present and future threats to the integrity of the watershed's resources. Wayland describes EPA's new "Watershed Protection Approach" as a movement to focus efforts within naturally defined geographic areas or watersheds. "Within a particular watershed, the approach involves evaluating the condition of the natural resources and the range of environmental threats, enlisting the active participation of public and

private stakeholders, and formulating and executing integrated, holistic strategies for restoring or protecting the resources." (Wayland, 1992) Two significant attributes of integrated strategies are, first, an emphasis on natural ecological boundaries rather than the arbitrary jurisdiction of a political unit, and second, its ecologically-holistic orientation toward resource protection and management. Thus, on the whole, integrated strategy can be seen as both holistic in scope and in content.

The watershed, which provides a coherent hydrological unit relevant to water resources use and allocation, is not always coincident with the political/administrative regions within which societies function. Since governmental bodies do not normally seek to act beyond their legally defined jurisdictions, this becomes an impediment to coordinated planning and management of water and land resources.

In the watershed protection approach, the ecosystem, and accordingly the study area, is generally identified as the drainage area of the watershed. In this way, problems are not solved once they are removed from one jurisdiction (e.g. the town, or state) and transferred to another, but once they are reconciled for the watershed in its entirety. This necessitates that the multiple governing agencies within the watershed region work together in a coordinated fashion, such that the actions of one jurisdiction to manage and protect their water resources does not adversely effect the neighboring jurisdiction's ability to do the same.

To achieve coordinated action, policy makers at all levels of government, on both sides of the border, need information about the effects of their decisions on the watershed as a whole, not only within their own jurisdictions. Policy makers also

need the political support to take ecosystem effects beyond their borders into account. Institutional arrangements in which multiple jurisdictions have worked together within a naturally occurring watershed boundary, beyond their individual political boundaries, have been described in Chapter 4.

Within the watershed ecosystem, all biological, physical, and chemical matter exists in a complex relationship of interdependence. Similarly, the "Watershed Protection Approach" recognizes that all elements of the system must be planned for in unison. In other words, multiple aspects of water resources management, including water quality and water quantity, surface water and ground water, must be considered together. In addition water resources concerns must be considered jointly with other environmental concerns such as land use, population growth, industrial development, and solid waste disposal in order to develop an ecologically sound and sustainable socio-physical system.

For example, the problem of water quantity is closely linked to water quality since as more water is removed from the river for use, less water remains for dilution purposes. Up to 1972, the federal pollution control agency preceding the EPA was dedicated to the integration of water quality with programs of water quantity. Since that time and until the present, the EPA has not significantly attempted to link these two elements, without which effective water resources management cannot be realized (Dworsky, 1992). As the states intensify their programs to allocate quantities of water it will be absolutely essential to again consider water quality requirements in relation to the allocated supplies and resulting stream flows.

Similarly, water quantity and land use issues are integrally tied. Changes in land use cause changes in demands for water. For instance, a proposed new use of land may impact upon water management by leading to a demand for water, by interfering with surface or sub-surface drainage and/or by given rise to pollution. Vice versa, a change in water management may impact upon land use, either directly through the required structures, or indirectly through consequential environmental and ecological changes (Sinnott, 1885).

Despite the apparent flaws in the present fragmented nature of present water planning and management programs, and the growing interest in, and endorsement of an integrated ecosystem approach, implementation of an integrated approach remains formidable. An integrated approach demands a conceptual transformation from one mind set to another, something not easily achieved without an attendant education process. Political endorsement of the concept will not necessarily guarantee its successful implementation. There are several potential obstacles to implementing an integrated approach.

First, government bodies do not typically act beyond their legally defined jurisdiction. There are at least two dimensions to intergovernmental coordination. First horizontal coordination among agencies at the same level of government, and second vertical coordination among agencies at different levels of government. Government agencies need political sanction and support to consider effects of their actions on other jurisdictions. Second, disciplines associated with the physical, biological, and social sciences, including natural resources, economics, land-use

planning, sociology, and engineering are typically compartmentalized within rigid institutional structures. Participants will need the political sanction and support to take part in cooperatively devising and implementing multi-disciplinary strategies. Finally, integrated approaches require large quantities of data, and the participation of many individuals coordinating across large physical distances. It is clear that an integrated approach to water resources management is not an inexpensive proposition. Securing funds to implement an integrated approach can be troublesome for a number of reasons. This is an era of budget deficits and cutbacks at all levels of government. It is difficult to find monies to allocate for natural resource programs already in place, much less a new approach. Additionally, the integrated approach, like other environmental protection activities, is a long-term endeavor, requiring a commitment of large sums of money upfront for benefits which accrue in the future. The political process, in contrast, is oriented toward funding programs which will produce immediate and visible benefits. Further, the logistics of allocating funding responsibilities among the various participants is difficult when governmental agencies are more disposed toward arguing for funds to support their internal programs.

In summary, a decision making environment consisting of complex, controversial issues requiring long timelines and large investments in the context of an uncertain future is among the most challenging imaginable. To cope effectively, all participants will need sustained commitment, openness, and flexibility. In addition, the participants must have access to reliable information regarding alternatives on an ongoing basis. It is, therefore, necessary to invest in work that improves the knowledge base and enhances understanding of the system as a whole.



## **CHAPTER 6**

### **KEY FUNCTIONS OF AN INTERSTATE WATER RESOURCES USE AND ALLOCATION STRATEGY**

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One can foresee many important functions of a water resources use and allocation strategy. A program for data collection, water conservation, and drought management in the Merrimack River watershed must recognize that the water resources of the Merrimack River watershed are part of a single ecosystem which must be carefully managed to preserve its quality and benefits for all residents and resources, including neighboring jurisdictions. Because these functions are most effectively developed and implemented at the watershed level, they are important features of a water resources use and allocation strategy.

#### **DATA COORDINATION, COLLECTION, AND DISSEMINATION**

Accurate information must be the basis for the development of solutions for the wise management and protection of water resources. Complex management decisions require scientifically valid information. Geographic Information Systems technology and related databases have become a powerful tool for storing, analyzing, and accessing information describing ecosystems. Today, the multiple jurisdictions within the Merrimack River watershed each maintain independent water use databases. Databases created by both federal and state agencies for water user identification have been used to analyze water requirements and to project future demands. This data provides detailed information on water used for municipal,

industrial, and agricultural purposes, and instream requirements for waste assimilation, energy generation, recreation, and fish and wildlife habitat. Although data is collected by various agencies of the government, it is neither readily available, nor have the consistency and uniformity to serve watershed-wide needs. Lack of complete and consistent information on the Merrimack River watershed will make it difficult for federal and state agencies to manage the water resources to ensure that the divergent interests and uses of the river are balanced and to make sound management decisions into the future.

Like in the Merrimack River watershed, the Great Lakes jurisdictions maintained independent water use data collection storage and retrieval systems that were not useful in serving regional needs (Great Lakes Commission, 1985).

Currently, the Great Lakes Charter commits the states and provinces to pursue a common base of data and information regarding the use and management of water resources in the Basin, and specifies that the data will be in comparable form. The Great Lakes Commission, in 1987, established the Great Lakes Regional Water Use Data Base Repository. The database catalogs water withdrawal and consumption in nine active categories of use, for ten jurisdictions, and six sub-basins by three types of withdrawals. Reports of the database aggregate information in a variety of ways.

As the database system continues to be used and refined, it will assist regional water resources planning management efforts by: 1) providing the jurisdictions and federal agencies with better data to support the development of a water budget for the Great Lakes Basin; 2) establishing a more complete and accurate base of data on

water uses to assist the Great Lakes states and provinces in projecting future water demands and in developing overall demand management and water conservation activities; 3) supporting policy activities related to regional decisions on diversions and consumptive uses of Great Lakes water; and 4) creating a statistical foundation for future research activities on Great Lakes levels, flows and water uses and their relationships. (Crane, 1990).

## **WATER CONSERVATION**

Two major approaches to water resources management are to increase the useable supply, and to decrease unnecessary loss and waste. Water resources management is in the process of shifting from the former to the latter. No longer is the development of new supplies the only major function of management. New uses of water are still being developed, however, it is now clear that old uses can often be met with less waste of water so that the available supply can be made to go further. Most water resources experts believe that any effective plan for water use and allocation should include demand management and conservation (Miller, 1990).

Water conservation measures reduce the total amount of water used by a community. Ordinances requiring water-efficient plumbing fixtures, a leak detection program, and a pricing system that charges more for water as consumption increases, are examples of water conservation measures. Water demand does not have to be inflexible, instead, efforts to modify demand, to make them equal to supply, are viable alternatives to increase supply. The possibility of meeting present and future

water needs by adjusting our levels of water use may be among the most realistic of our solutions to water use and allocation problems.

In the past, local and federal pricing practices have failed to provide incentives to use water efficiently and conservatively. Federal projects to construct, operate, and maintain water supply systems often have resulted in heavy subsidies to local users, so that they have virtually no incentives to conserve. But now requirements of the Federal Safe Drinking Water Act of 1974, amended 1986, such as corrosion control, surface water filtration, disinfection, and testing for 139 synthetic organic and inorganic compounds, will make finding new sources of safe drinking water more difficult and more expensive to treat (Garrigan, 1989). Water conservation will need to be practiced in order to minimize cost to both the supplier and the consumer. Furthermore, water conservation can provide higher streamflows for fish and wildlife habitat, water quality, power generation, and recreation. Conservation may allay potential conflicts between keeping the ecosystems alive and satisfying human needs for water. Successful water conservation initiatives will result in reducing the necessity for water withdrawals, enabling more water to remain in the natural environment.

In 1980 the Massachusetts Department on Environmental Management, Division of Water Resources noted that almost one third of Massachusetts communities could be facing water supply deficits in the 1990s (Garrigan, 1990). The safe yield of the Quabbin/Wachusett reservoir system serves 46 communities in the state including the greater Boston area. In 1988, the average daily demand for

water was 324 MGD, 24 MGD over the safe yield. Instead of developing new sources of water supply, the Board of Directors committed the MWRA to an aggressive five year strategy of water conservation and demand management. They have currently recovered the loss of some 30 MGD through a strategy that includes an intensive leak detection and repair program, inspection of meters and other measures such as public education and domestic device retrofit programs. The MWRA Board has decided that the potential for additional conservation is so great that they have postponed decisions about investing in any new sources of water supply for at least five more years.

Legislation passed by Massachusetts in recent years, requires communities requesting grant money or state approvals to have a local water resources management plan "approved" by the WRC, consists of the completion of a "Water Conservation Plan". In addition, all applicants for a water withdrawal permit must submit a "Water Conservation Plan" with the permit application. If the State determines that the applicant's plan meets the requirements for minimum conservation efforts for the applicant's type of use, the plan will be attached as a condition of the permit. If the State determines that the applicant's plan does not meet its minimum requirements, the permit will include additional water conservation requirements that the applicants must fulfill as a condition of the permit. The "Water Conservation Plan" asks a public water supplier to identify actions they can take in several areas: meter installation and maintenance, leak detection, full-cost water pricing, public information and education and employee awareness, drought and emergency

procedures, efficient water fixtures, water resources protection. Currently New Hampshire has no state water conservation program.

A watershed-wide approach to water conservation can facilitate the exchange of innovative ideas and techniques for activities, such as the development of assistance programs, and public education materials that might otherwise be addressed independently by each state. Thereby limited governmental resources can be saved and duplication of efforts among government agencies can be reduced. Given that the water resources of the watershed are hydrologically interrelated, and the uses of water resources are interdependent, it makes sense that users within the watershed should share equally in the responsibility for conservation.

Effective conservation will require not only the usual conservation measures by the supplier, such as leak detection and metering, but also a concerted effort to reach beyond the water supplier. This includes adopting town water protection by-laws, charging the full cost of providing water, educating the public to change their habits, and providing incentives for industries to recycle or reuse water.

## **DROUGHT MANAGEMENT**

Drought analysts and historians have documented that governments have typically taken a reactive, crisis management approach to the problems of drought (Wilhite, 1987). Once the rain comes and they return to "business as usual" without taking the time to review response efforts or evaluate ways to improve future planning and response activities (Crane, 1990).

Although traditionally a major concern in the Great Plains and western portions of North America, drought is now becoming a serious concern east of the Mississippi River. Several eastern states have replaced a traditional common law riparian rights system of water allocation with a permit-based system primarily because of the inability of riparian system to effectively manage water in times of scarcity. (Crane, 1990).

Increased awareness of drought in the U.S. has led to increased drought planning activities at the state level (Crane, 1990). Drought planning enables public officials and others affected by drought to plan in advance for future drought events, and to act decisively and effectively when they occur. Policy makers have recognized that the economic and environmental costs due to drought are inevitable, and that limited resources will be saved in the future if important drought management is performed in advance. For instance, by notifying water users in advance how they will be treated during a water shortage, agencies encourage low-priority users to mitigate the damages of a water reduction by constructing storage facilities or making other arrangements for obtaining water during drought conditions.

It is the policy of Massachusetts under the Water Management Act to work with public water suppliers to develop specific and practicable contingency plans and water supply emergency responses, and to offer technical and financial assistance programs. In New Hampshire, the Water Resources Division has developed a drought management plan to deal with water shortages. The plan establishes the administrative framework for anticipating drought conditions and coordinating

response. It includes monitoring hydrologic conditions, identifying water conservation options, and identifying the appropriate responsibilities and the roles of participants for four different levels of drought conditions.

Drought experts generally agree that drought management at the watershed level makes it easier to coordinate monitoring and assistance activities. Use of watersheds as drought management areas makes sense for two reasons: they directly relate to the hydrologic characteristics of the area, rather than to political boundaries; and they allow state and local governments to focus resources and media attention on specific regions with the greatest need. Watershed approaches to drought management in North America are relatively new. The Delaware River Basin Commission provides a good example of drought planning at the watershed level. The Commission developed a drought contingency plan for the watershed in 1985 in response to water shortages during the 1980-81 drought and direction from a January 1983 agreement between the Governors and the Mayor of New York City on interstate water management. The plan includes a strong emphasis on local drought planning and management, by requiring all municipal and public water suppliers to develop water rationing plans and locate alternative supplies for water. Technical assistance is supplied by appropriate state agencies. (Delaware River Basin Commission, 1991).

The Great Lakes Commission established drought management as a priority issue in November, 1988, in response to the impacts of that year's drought on various sectors of the Great Lakes economy and environment. The first action taken by the



Great Lakes Commission in the area of drought management was to create a Drought Management and Great Lakes Water Levels Task Force. Members of the Task Force represent the states and provinces bordering the Great Lakes, and several federal agencies. The primary policy focus of the Task Force is to recommend a set of guidelines which employs a regional approach in addressing future drought events. Development of a planning process applicable at the local level is emphasized. The Task Force was charged with developing distinct products including a guidebook to assist government officials in planning for and respond to drought, and a series of recommendations for drought planning at the all levels of government.

Activities in the Potomac watershed are another example of watershed-wide drought management. In the late 1970s, when water supply systems in the Potomac basin were undergoing significant changes, it became apparent that the users of the river had to reach some watershed-wide agreements regarding the allocation of the river for water supply during drought. The first agreement, among three of the states and the federal government, and water suppliers was the Potomac River Low Flow Allocation Agreement. Signed in early 1978, this basic agreement outlined procedures to be followed during a severe drought. Shortly thereafter, the same jurisdictions and water suppliers asked the Interstate Commission on the Potomac River Basin to form a special section called CO-OP, the Section for Cooperative Water Supply Operations on the Potomac. Its purpose is to analyze the risks of drought, examine ways to predict flows in the river using sophisticated techniques, and develop methods of coordinating the timing and volume of reservoir releases and river withdrawals in

the region. CO-OP is continuing to refine its techniques while its recommendations already are being used for setting release and withdrawal schedules. These schedules are designed to maximize water supply reliability while meeting water quality, flow, recreation, and flood control requirements. The region's solution to water supply is unique in that the utilities, and the U.S. Army Corps of Engineers Washington Aqueduct Division for the District and a small part of Virginia have sacrificed some of their independence to work together efficiently and minimize the risk of a water shortage for all. Ordinarily, the utilities operate quite independently of each other. However, in order to make best use of these resources in time of drought, their use is coordinated. The effect of the cooperative operation is to minimize the maximum risk that any one of the utilities faces.

The goal of a watershed drought management program is the establishment of a efficient, coordinated network for responding to the many potential impacts of drought. Such impacts include inadequate public water supplies, restricted recreation, reduced hydropower production, and damage to fish and wildlife habitats.

An effective drought management program may involve several key elements. A standing drought task force, including policy makers at the federal, state, and local levels, can coordinate drought planning and response activities within the watershed. A role of this task force could be manifold. Coordinating monitoring of hydrologic and climatological factors in conjunction with effective data dissemination and analysis is crucial. A drought management program may include the development, and periodic update, of contingency plans by appropriate agencies at all levels of

government as well as by public water suppliers. Drought trigger levels are critical components of these plans because they provide guidance for government officials and the general public alike in declaring and responding to drought conditions as they develop (Crane, 1990).

A critical element of a drought management program is to initiate and coordinate drought management efforts of local governments. Municipal and county entities can provide critical services to local citizens in areas such as dissemination of information on drought conditions, promotion of water conservation and other educational programs, coordination of emergency services for alternative water supply assistance, and formal adoption and periodic review of drought management efforts through passage of local ordinances.

Lastly, when drought occurs, a drought management program may include a thorough evaluation of actions taken in response to the drought, and incorporate into contingency plans recommendations for improving actions. Because key water management personnel may change from year to year, drought management programs may serve as an "institutional memory".



## **CHAPTER 7 RECOMMENDATIONS**

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### **WHY COORDINATE?**

Put simply, the Merrimack River watershed states of Massachusetts and New Hampshire cannot afford to take one of their most vital natural resource for granted. The states have recently taken a number of autonomous, yet nonetheless significant steps toward monitoring and controlling the use of shared water resources, though much remains to be done. Three primary reasons why interstate coordination is necessary follow.

#### **Need to Balance Multiple Uses of Water Resources**

The Merrimack River watershed is a multiple-use water resource. The water resource provides energy for power production water for domestic, industrial, commercial and agricultural purposes, dilution for wastewater discharges and an aquatic environment which supports many forms of wildlife and recreation. To date, no single use of the river precludes others, yet as a multiple-use river, the capacity of the Merrimack River to support numerous and competing uses is ultimately limited. Each instream and out-of-stream water user has their own specific, and sometimes overlapping water quantity and quality requirements. Yet without careful management and protection of the resource, satisfying the future water resources needs for one particular water use category has the potential to pose significant hardships for the others. For example, one large withdrawal or the cumulative impact

of a number of smaller withdrawals has the potential to create serious problems related to the quantity and, consequently, the quality of water available for other uses.

### **Inconsistencies Between States' Policies and Programs**

Each water user in the Merrimack River watershed seeks to protect their individual interest, and must rely on the State to exercise proper judgement in managing and protecting the water needs of the multiple interests. Federal, state, and local courts, administrators, and legislatures have the formidable charge of striking a delicate balance between the many water needs, while protecting the watershed ecosystem if we are to ensure the continuation of the multiple-use capabilities of the Merrimack River.

Current strategies for protecting and managing the water resources of the Merrimack River watershed are inconsistent across the New Hampshire-Massachusetts state border. Primary inconsistencies between the states' strategies for use and allocation of the water resources center around: 1) differing approaches with respect to the states' methodologies for water resources planning, including data collection and instream flow protection; and, 2) the differing roles adopted by the states to regulate water use. These inconsistencies, coupled with a lack of coordination across state boundaries, result in uncertainties with respect to the ability of the watershed to meet future water supply demands within both states (and potentially outside the watershed region) while simultaneously maintaining sufficient instream flows and water quality within the entire bi-state region.

## **Lack of Mechanism for Interstate Coordination**

The two states with jurisdiction in the Merrimack River watershed are not legally free, under the common law, to act as sovereigns when their actions have interstate implications. Yet, given the divided political jurisdictions within the watershed, there is currently no mechanism for advancing water resources strategies that consistently and efficiently assure that one state's actions will not adversely effect the other, and that multiple uses and users of the watershed's resources will be equitably balanced.

Massachusetts state agencies are presently reassessing their procedures for river basin planning and determining protected instream flow values. New Hampshire is evaluating procedures for permitting water withdrawals, as an alternative to the riparian rights doctrine, and developing a methodology for determining protected instream flow values for designated river segments under the Rivers Management and Protection Program. Given that both states are in the process of reassessing their procedures for planning for and allocating water resources, this may present a unique opportunity to coordinate these procedures as they converge on the Merrimack River watershed.

Together, the EPA's Merrimack River Initiative and MRWC's Water For All Program present opportunities to explore a strategic framework for inter-jurisdictional management of water resources which embodies a "Watershed Protection Approach". A "Watershed Protection Approach" recognizes that environmental and development issues transcend political boundaries and that common interests can only be articulated through inter-jurisdictional cooperation. An integrated process for environmental

decision making, and a more holistic approach to water resources use and allocation, necessitates interstate coordination.

## HOW TO COORDINATE

To follow are recommendations, including an institutional framework, an approach, and specific functions, for a coordinated interstate approach to water resources use and allocation for the Merrimack River watershed.

**Figure 12**  
**SUMMARY OF RECOMMENDATIONS**

	<b>Recommendations</b>
<b>Institutional Arrangement</b>	<p>Short-term: interstate coordinating committee under the Merrimack River Initiative</p> <p>Long-term: watershed commission formed by interstate compact</p>
<b>Authority</b>	The commission should not have regulatory authority, but instead should focus on strengthening existing laws and programs, utilizing the review and enforcement capabilities of federal, state, and local agencies.
<b>Approach</b>	<p>"Watershed Protection Approach" which recognizes that:</p> <ul style="list-style-type: none"> <li>- all stakeholders should be represented in the process;</li> <li>- water resources are more effectively managed on a hydrologic basis rather than a geopolitical basis; and</li> <li>- an ecologically-holistic orientation toward resource protection and management is needed.</li> </ul>
<b>Key Functions</b>	<p>Roles of interstate coordination and policy effectuation, as opposed to assuming functions already in place within the state, regional, and local agencies.</p> <p>A major role should be the promotion of consistency of purpose among federal, state, and local agencies, policies and programs by:</p> <ul style="list-style-type: none"> <li>- facilitating information exchange between federal, state and local agencies, private interest groups and the general public;</li> <li>- supporting agreements between states toward interstate water resources use and allocation.</li> <li>- coordinating the development of new water resources use and allocation programs among all levels of government, including data collection, water conservation, and drought management.</li> </ul>



## **Institutional Arrangement**

*Recommendation: The Management Committee currently being formed as part of EPA's Merrimack River Initiative, should serve, in the short-term, as the coordinating committee to develop and administer an interstate water resources use and allocation strategy for the Merrimack River watershed.*

*A long-term objective of the coordinating committee should be to develop a federal-interstate compact. The federal-interstate compact for the Merrimack River watershed should provide the directive for close representation and involvement of the federal, state, and local government, as well as private interests, through the establishment of a permanent watershed commission.*

EPA - Region 1 is currently establishing a decision making framework, which includes a Management Committee as well as several topical subcommittees for carrying out the objectives of the Merrimack River Watershed Initiative. The Initiative provides a window of opportunity to begin to explore possibilities for coordination because of funding and attention currently being directed at Merrimack River watershed.

A compact is a legal tool that states that members agree that coordination among jurisdictions for monitoring, planning, and conservation activities within the watershed will be implemented. The compact will be a major step in establishing a binding framework for the development of an interstate water resource allocation program. Most importantly, it is an expression of the participants' concern and shared stewardship of the watershed.

An interstate compact is an important means for participants to proactively avoid future disputes related to water resource use and allocation. Given that interstate conflict over water use and allocation may potentially result in a less mutually agreeable apportionment between states by Congressional Act or Supreme

Court decision, some form of interstate coordination is in the best interest of both states. Furthermore, a federal-interstate compact and the formation of a watershed commission will provide the necessary permanent structure to make watershed-wide decisions and see to it that these decisions are backed with the adequate authority and funding to be implemented.

As conceived, the commission's functions would not be a substitute for federal, state, and local efforts, but a supplement to them. The commission should assist existing agencies of government and concerned citizen groups in dealing with problems that cannot be proactively resolved within the framework of a single municipality or state. The creation of a commission has the potential to provide a sense of federal-interstate cooperation that does not necessarily result from water resources allocation through one-time interagency agreements or statutory directives. The compact should also stipulate funding and staff arrangements, including federal and state budget appropriations. In addition, the commission should propose and promote federal legislation and appropriation as a means of obtaining further recognition and financial support for interstate efforts.

### **Authority**

*Recommendation: The commission should not have regulatory authority, but instead should focus on strengthening existing laws and programs, utilizing the review and enforcement capabilities of federal, state, and local agencies.*

It is generally assumed by resource managers that no regulatory regime is complete without the "teeth" of an enforcement mechanism. Although effective enforcement is definitely a good thing, achieving this goal may be impossible in the

interstate context. In the case of the Merrimack River watershed, developing another governmental layer of review and approval would most likely be considered unacceptable; it is highly unlikely that the state governments would agree to create and concede authority to an interstate body with the power to regulate and enforce.

Without regulatory authority, the commission will need to develop authority through other means. The successful operation of the interstate entity will depend upon the willingness of the participants to rely on it as a source of advice and to independently implement the commission's recommendations. The willingness of the participants to depend on an interstate entity as a mechanism for decision making presumes a desire for cooperative relations, and a realization of interdependence between the participants. A watershed entity cannot manufacture cooperation, it can only facilitate it. Therefore the creation of a commission should be founded on a clear vision of why such an entity is necessary, and what problems or issues it seeks to resolve. A clear definition of the mission will usually help to create a basic understanding of the program's purpose. In addition to a strong sense of direction and purpose, the success of the commission will depend on its ability to develop a strong power base through political and public support. By gaining wide acceptance and forging strong collective positions on issues of mutual concern within the watershed, through building consensus among participating agencies, organizations, and interest groups, the commission will wield substantial political clout for effecting policy changes.

## Approach

*Recommendation: The commission should adopt the "Watershed Protection Approach" currently being embraced by EPA's Merrimack River Initiative. This approach recognizes that:*

- 1) all stakeholders should be represented in the process;*
- 2) water resources are more effectively managed on a hydrologic basis rather than a geopolitical basis; and*
- 3) an ecologically-holistic orientation toward resource protection and management is needed.*

**Multi-stakeholder Approach:** A federal-interstate compact should stipulate the members of the commission to be representative of those engaged in the administration of water resources policy in pertinent local, regional, state and federal agencies, as well as private interests, including water resources users, public interest groups, and the general public. A multi-stakeholder approach will assist the commission in gaining wide acceptance, resolving conflict, and avoiding disputes by building consensus within all levels of government, as well as among users of the resources.

A multi-stakeholder approach will promote a partnership between all levels of government. Many decisions and actions that effect water resources use are made at the local level. Engaging local government in the decision making process will advance an understanding among the 200 municipalities within the watershed region regarding the effects of their individual decisions on the watershed as a whole. The commission will offer needed political support for the local agencies to work together with others in a coordinated fashion. The state agency representatives must be an integral part of the decision making, so that they and are made to feel a sense of

ownership in the process, and so that the program is not perceived as a loss of state sovereignty with respect to the control of water resources use and allocation. Federal representatives will lend legitimacy and potential funding to the interstate program.

A multi-stakeholder approach will also advance a partnership between the public and the private sectors. A legitimizing and supportive constituency for interstate coordination will consist not only of governmental agencies, but private interests, including water resources users, public interest groups, and the general public. Partnership between the government agencies and private entities will assist the government in securing the feedback they so badly need from the private sector, and assist private entities in obtaining accurate information essential to a real understanding of government decision making.

Multi-stakeholder participation will engage groups which will be affected by water management decisions in becoming involved in the proactive determination of policies and programs, rather than in a reactive process of dispute resolution. If interested parties are provided with an opportunity to be involved in the formulation of plans and policies, they will more likely support those decisions and be engaged in implementing them. Furthermore, by consulting all interested parties, the interstate water resources use and allocation strategy will more likely to take account of the full range of impacts of resource development decisions, whether they be economic and social costs or environmental.

A multi-stakeholder approach will have to overcome several potential difficulties. The process must include representation of all the pertinent interested parties, including those that are not sufficiently organized so that a representative can

be easily selected. The process needs to confront the potential issues of unequal access to information, political power, and bargaining ability between participants. Finally, issues to be discussed must be sufficiently developed so that participants can focus on relatively well crystallized questions, otherwise the participants are not likely to grapple with the issues at hand.

**Integrated Approach:** Water resources use and allocation calls for an integrated approach. An integrated approach recognizes that: water resources are more effectively managed on a hydrologic basis rather than a geopolitical basis; and ecologically-holistic orientation toward resource protection and management is needed.

Integrated water management strategies include the entire ecosystem, identified as the drainage area of the watershed, in the study area. In this way problems are not simply transferred from one jurisdiction to another, but are reconciled for the watershed in its entirety. Furthermore, integrated water resources use and allocation strategies recognize that within the watershed ecosystem all biological, physical, and chemical matter exist in a complex relationship of interdependence, and that all elements of the system must be planned for in unison. In other words, multiple aspects of water resources management, including water quality and water quantity, surface water and ground water, are be considered together. In addition water resources concerns are considered together with other environmental concerns such as land use, population growth, industrial development, and solid waste disposal in order to develop an ecologically sound and sustainable socio-physical system.

A shift to an integrated approach to water resources management will require a conceptual transformation from one mind set to another. Government bodies will have to consider the implications of their activities on others beyond their legally defined jurisdictions. An integrated approach will mean that a much broader, multi-disciplinary approach must be applied. It should be expected that it will become more difficult to reconcile competing scientific views than in former years, when studies revolved primarily around the engineering aspects of the proposed project. Overcoming these obstacles will require, not only political endorsement, but an educational process as well.

### **Key Functions**

*Recommendation: The watershed commission should assume roles of interstate coordination and policy effectuation, as opposed to assuming functions already in place within the state, regional, and local agencies.*

*A major role for the commission should be the promotion of consistency of purpose among federal, state, and local agencies, policies and programs by:*

- 1) Facilitating information exchange between federal, state and local agencies, private interest groups and the general public;*
- 2) Supporting agreements between states toward interstate water resources use and allocation.*
- 3) Coordinating the development of new water resource use and allocation programs among all levels of government, including data collection, water conservation, and drought management.*

Such generalized functions for the commission as information exchange, regional coordination, and regional policy effectuation are preferable to roles of an operating or managing agency. In general, the approach should aim to provide its constituents with something over and above what they can supply themselves -

technical specialists, data, funds, the capacity to mediate, the ability to influence decisions.

In addition, the commission's role should be adaptable to address the priorities of the states and local governments. As Foster explains, "It should be built around specific, timely problems or issues, yet contain the capacity to expand or contract to meet needs as they occur." Furthermore, if the interstate effort is able to focus on important issues and can demonstrate measurable success and progress it will be more attractive to sources of funding.

As indicated above, the watershed is an ecosystem - actions taken in one jurisdiction affect others. Therefore, a water resources use and allocation strategy for the Merrimack River watershed should include programs for data collection, water conservation, and drought management. These functions require a watershed view of the system and are, therefore, most effectively developed and implemented at the watershed level.

**Data Coordination, Collection and Dissemination:** A primary function of the commission should be the collection, analysis, and dissemination of basic planning data in a uniform, watershed-wide basis. In light of such data, the various levels, units, and agencies of government, and private interests, within the watershed can better make decisions.

The collection of hydrologic and water use data is vital for various water management functions. Complete and consistent data at the watershed level is needed: 1) to project future water demands, in developing overall demand management and water conservation, and drought management activities; 2) to support



policy activities related to decisions on intra- and interbasin transfers of water; 3) and to create a statistical foundation for future research activities on flows and water uses and their relationships.

Data collection is currently performed by various local, state, and federal agencies, with little coordination between agencies. The commission should work toward a more effective system for the compilation, exchange, and use of water resources data on a watershed-wide basis. A coordinated watershed-wide database would provide decision makers, both public and private, with a baseline of information to support water resources use and allocation efforts.

There are several ways in which data collection and use regarding water resources should be coordinated. First, the two states should coordinate their respective water use data efforts, as to secure a complete picture, and to create a basis from which to conduct further analysis at the watershed level. An important component would be to design a water use inventory such that water uses are disaggregated onto similar categories such as domestic, commercial, industrial use. Second, to the extent possible, streamflow requirements need to be assessed for each individual use within the entire watershed. Therefore, once the information is compiled, protected instream flows for the river and its tributaries can be determined and an evaluation of how to meet the various water uses can be undertaken. Ultimately, a complete analysis of the river and its tributaries should be conducted to determine the capacity of the watershed to meet the existing and projected needs for water.

The data and information gathering function of the commission will be significant because it will allow the participants to at least agree upon a common technical base for decision making, and will build the capacity for joint problem solving and to avoid disputes stemming from differing information. It will be much easier to make the hard judgements, trade-offs and political decisions when a common information base is there to back up decisions.

**Water Conservation:** A water resources use and allocation strategy for the Merrimack River watershed should include a coordinated program for water demand management and conservation. A watershed-wide water conservation effort can facilitate the exchange of innovative ideas and techniques for activities, such as the development of assistance programs, and public education materials, that might otherwise be addressed independently by each state, thereby saving limited governmental resources and reducing duplication of effort. A water conservation programs should include: 1) promoting conservation measures by suppliers, such as leak detection and metering; 2) encouraging towns to adopt water protection by-laws and to charge the full cost of providing water; 3) educating the public to change their habits; and, 4) providing incentives, and assisting industries with recycling or reuse of water. Currently neither of the states or the federal government have an office or personnel dedicated to water conservation. Federal technical and financial assistance should be made available to states to promote the development of water conservation technical assistance programs.

**Drought Management:** The commission should have as a primary component of a water resources use and allocation strategy the development of a coordinating regional approach to drought management. The goal of a watershed drought management program should be the establishment of efficient, coordinated network for responding to the many potential impacts of drought. Effective drought management programs have several key elements. Policy makers at the federal, state, and local levels, agencies will need to coordinate planning and response activities, including: 1) monitoring of hydrologic and climatological factors, data analysis and dissemination; 2) development of contingency plans by appropriate agencies at all levels of government as well as by public water suppliers; and, 3) evaluation of actions taken in response to the drought so that improvements can be incorporate into contingency plans.

A watershed-wide approach to drought planning is needed to properly manage and protect the Merrimack River watershed's significant water resources that are shared by many jurisdictions. Drought management strategies should be developed while the states have the time to properly consider alternatives. To wait until a natural or man-made crisis results in a severe water shortage, and to try to develop new bi-state water allocation strategy during such a crisis, may be to destroy the options currently available to the states.

The commission should serve as a central point of coordinated planning and response to include all involved state and federal agencies as well as local authorities. The commission should encourage the development of bilateral water management

agreements to facilitate a coordinated response to drought conditions and a plan for water distribution and emergency allocation among water suppliers of the multi-state region.

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