CONFLICT AND COOPERATION IN WATERSHED MANAGEMENT: CASE STUDY OF METROPOLITAN BOSTON'S WATER SUPPLIES

by

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ABSTRACT

Interorganiztional conflict and cooperation in the dyadic relationship of Boston's water supply and delivery agencies is examined. Unlike other major metropolitan cities, Boston divides its water-supply system management between two agencies--the Metropolitan District Commission's Division of Watershed Management (DWM)--with jurisdiction in the watersheds--and the Massachusetts Water Resources Authority (MWRA)--responsible for the delivery system. In the five years of this institutional arrangement, observers have assumed a cooperative relationship between the two, but conflict more accurately characterizes their interaction. This question becomes important in light of the Safe Drinking Water Act amendments (SDWA) which provide guidelines by which public water suppliers shall comply with new drinking-water contaminant regulations. The SDWA assumes a single system operator and represents a performance pressure that forces the two agencies to design a functional working relationship that was not required in their enabling legislation. This thesis presents and analyzes instances of both cooperation and conflict and assesses the extent to which their magnitude effects a productive working relationship in the context of the Safe Drinking Water Act amendments.

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To my Parents

for their

Strength of Heart and Love of Life

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INTRODUCTION

The continued delivery of safe unfiltered drinking water to Boston area communities is currently being challenged by two factors. The first is recently revised federal public-health legislation, the Safe Drinking Water Act amendments (SDWA 1986). The second concerns the actual management structure of the agencies charged with ensuring watershed protection and water delivery of the drinking water supplies.

Boston and all other public water suppliers in the nation must comply with the revised SDWA. These amendments elevate drinking-water quality issues in the public consciousness in the same way that the Clean Water Act focused attention on wastewater treatment in the 1970s. The amendments are a particularly important performance measure for public water suppliers, because they institute new maximum contaminant levels that are more stringent than previous levels and increase the number of regulated contaminants to include formerly allowable chemical substances.

In addition to meeting the SDWA's water-quality standards, Boston must address issues that arise due to the organizational structure of its water supply and delivery system. Unlike similar U.S. cities with unfiltered water

supplies[1], the Massachusetts State Legislature delegates management of greater Boston's drinking-water resources to two separate agencies. A more common management model consolidates watershed management with reservoir management and water delivery, or it includes the water utility as a partner in government-initiated decision making.

Prior to 1985, Boston's water supply and delivery infrastructure was managed as a single system. This 1985 management split means that the two organizations must work not only with federal and state interests to effect the SDWA's regulations, but that they must also negotiate a working relationship with one another that integrated water suppliers need not address. While single-management organizations are not immune to internal problems, tensions and resulting discord challenge internal-management structures--not the legitimacy of the organization itself--and relationships can be established in the absence of external constraints.

SAFE DRINKING WATER ACT: CATALYST FOR INCREASED INTERACTION

The SDWA amendments, which apply to all public water suppliers, introduce new contaminant levels to be regulated in drinking water supplies and are designed to meet the following objectives:

1. Regulate contaminants (83 initially; 25 more by January 1, 1991 and every three years after 1991).

2. Monitor unregulated contaminants (53 initially).

3. Stipulate mandatory treatment techniques if water quality criteria cannot be met otherwise (filtration of surface water and mandatory disinfection of all public water systems).

4. Protect groundwater.

5. Prohibit the use of lead pipes, solder, and flux.

(Source: MWRA Safe Drinking Water Act Impact Study)

The Environmental Protection Agency drafted a set of rules to implement these safeguards of drinking-water quality. These raise serious concern for the efficacy of the DWM-MWRA organizational structure. One rule in particular, the Surface Water Treatment Rule (SWTR), highlights the unique institutional structure of the DWM and the MWRA by addressing contamination of unfiltered surface-water supplies, which characterize Boston's water sources.

The SWTR directs its requirements[2] to public water suppliers and expects them either to implement site-specific watershed management and disinfection, or to construct a water filtration facility to ensure the continued delivery of safe water supplies to system users. The former option is preventive, and the latter is corrective.

If the watershed management alternative is chosen, the DWM must comply by producing a watershed protection plan and assure its approval by the state's environmental primacy agency. In Massachusetts, this is the Department of

Environmental Protection (DEP). If this criterion is not met, the latter option, filtration, must be met by the MWRA.

The DEP and other state environmental agencies prefer to meet the amended water quality standards through watershed protection rather than filtration; but strict compliance deadlines apply for the DWM to show "ownership or control" of the watersheds.[3] If the DWM and MWRA cannot produce a plan that meets DEP watershed protection guidelines by January 1991, the SDWA mandates construction of a filtration facility.

MANAGEMENT STRUCTURE AND AGENCY REORGANIZATION

Water suppliers around the country with water supplies similar to Boston's are concerned about their ability to produce an acceptable watershed protection plan in light of the stringent new drinking-water standards. Boston must address these same issues with the additional concern of what impact its unusual dual-management structure holds for compliance. The DWM and MWRA's five-year interaction has been guided by a formal memorandum of understanding, but amendments to the federal SDWA in 1986 forced interorganizational conflict to surface between DWM and MWRA by raising issues not addressed in the memorandum.

In 1984, the Massachusetts State legislature restructured responsibility for Boston's water-supply management by creating a new division within the existing Metropolitan

District Commission (MDC). This creation was the Division of Watershed Management (DWM) and was entrusted to manage state-owned watershed lands surrounding metropolitan Boston's water-supply reservoirs. Prior to this date, the MDC operated and maintained the entire water supply and distribution systems. When the legislature created the DWM, it also created the Massachusetts Water Resources Authority (MWRA) to take over water-supply ownership and delivery functions.

The DWM's purpose is to manage state-owned watersheds--the land area that serves as a drainage route for water into the reservoirs--to ensure delivery of pure water to the MWRA supply sources. The MWRA assumed the MDC's responsibilities for providing wholesale water and sewer service to 46 communities in the greater Boston service area. The MDC's DWM manages portions of the supplies' watersheds and is responsible for the reservoirs' operating levels while the MWRA is responsible for the transmission and distribution of the water once it leaves the reservoirs.

The MWRA's and DWM's interorganizational relationship is statutorily defined to overlap in two areas--organizational goals and financing. The first overlap is DWM's mandated goal to manage the watersheds to ensure delivery of safe water to the MWRA while the MWRA is responsible for delivering safe water to end-of-system users. Financing is a second factor directly linking the DWM to the MWRA. The

enabling legislation directs the MWRA to finance 75 percent of the DWM's operations and maintenance costs. Despite the fact that MWRA monies, not the state's general funds, support most of the DWM budget, the MWRA has only advisory input into watershed policies. The MWRA relies on the DWM's protection policies for pure water to reach its reservoirs, but it has no control over the management decisions that shape policy implementation. The enabling statute's drafters designed this overlap, but offered no guidance for designing cooperation.

The institutional design of the two organizations complicates the implementation of their separate, but similar, goals and raises issues about future interaction. The MDC's DWM is a public agency, subject to competition among other state agencies and services for increasingly limited general state funds. As a public enterprise which can charge for the water it supplies and borrow from the private financial markets, the MWRA need not compete with other public agencies for state monies.

Due to the overlapping nature of their agency functions, the DWM and MWRA have chosen to draft the watershed protection plan jointly, but they are doing so without preliminary analysis of the implications their atypical relationship has on the potential for compliance with the statute's provisions and continued delivery of safe unfiltered water to system users.

CURRENT CHALLENGE FOR WATERSHED MANAGEMENT

The SWTR illustrates the importance of organizational interdependency between the DWM and the MWRA in a way that was previously unknown--it raises the question of compliance accountability. The DWM manages the watersheds, but if its policies fall short of the SWTR's requirements, the MWRA is responsible for implementing the filtration option. The amendments represent an unanticipated performance pressure that forces the two agencies to design a functional working relationship not anticipated in the originating act.

A consultant's preliminary assessment[4] of the MWRA's adherence to water-quality standards concluded that, despite current compliance, continued adherence is doubtful because of the limited public ownership of watershed land surrounding one of its reservoirs. The report encourages the DWM and MWRA to foster cooperation among the state's environmental agencies in preparation of the watershed protection plan; but this recommendation assumes a cooperative relationship currently exists between the two most directly linked participants in the planning process, the DWM and MWRA.

Although the two organizations have exhibited cooperation by voluntarily initiating, and later revising, a Memorandum of Understanding (MOU) that details property divisions and institutional responsibilities, conflict also occurs in their interaction. It is the hypothesis of this thesis that

the relationship is conflictual, not cooperative. Prior to preparing a joint Watershed Protection Plan that can exemplify a conservationist philosophy and avoid the capital costs of a filtration facility, the relationship between the DWM and the MWRA should be examined to assess the reality of assumed cooperation and the effects of existing conflict. Conflict and uncooperative behavior may impede acceptance of a protection plan that ensures delivery of safe water to system users without the additional costs of a filtration plant.

An analysis of the DWM's and the MWRA's overlapping goals and unique funding arrangement will highlight the organizational constraints to both in their joint efforts to produce a watershed protection plan that will meet DEP guidelines. I will analyze the potential for conflict and cooperation in this relationship and assess the extent to which their magnitude affects the eventual production of an acceptable watershed protection plan. Furthermore, I will extrapolate from the lessons of this specific analysis to offer organizational recommendations on future interaction of the DWM and MWRA in fulfilling their complementary goals of watershed protection and delivery of safe drinking water.

METHODOLOGY AND CHAPTER SUMMARIES

Conflict and cooperation in the DWM and MWRA relationship are revealed through a series of interviews. Twenty-eight

personal interviews were conducted over a three-month period with staff from the DWM, MWRA, and other water utility and environmental interests. Those interviewed were chosen on the basis of the relationship of their duties to watershed management. At the DWM, the choices were evident, because the function of the division is devoted to this issue. At the MWRA, those interviewed were chosen on the bases of (1) direct and frequent interaction with DWM staff on watershed issues, (2) duties that, while not directly indicative of watershed management, include frequent contact with DWM watersheds, and (3) MWRA staff who, while not currently working on watershed-related projects, are former members of the MDC's Water Division (the predecessor to the MWRA Waterworks Division).

Personnel from both field and Boston headquarters were interviewed. In addition to the persons directly affiliated with these two organizations, selective representatives from Massachusetts and federal environmental organizations and agencies whose job descriptions and activities directly affect the two agencies were interviewed. Examples in this category include the Department of Environmental Protection (DEP) and the Environmental Protection Agency (EPA). Also interviewed were representatives from environmental interest groups (such as the Audubon Society and local watershed associations) and watershed-management staff from other water utilities.

The conclusions voiced by personnel from these peripheral organizations are not incorporated into the conflict and cooperation attributed to the DWM and MWRA. Interviews with these outside contacts are included in order to place the DWM and MWRA in a broader social context and yet not to stray from the dual-agency focus of the thesis study. External commentaries balance the internal observations of the DWM and the MWRA and are cited only where they add credence to the issues raised by DWM and MWRA staff. A list of interviewees is contained in the bibliography.

Personnel interviewed were asked a series of questions about their interaction with the other organization, including the nature of this interaction and its frequency and formalization. As clear patterns of overlap and conflict emerged in areas such as forestry management, recreation and hydropower operations, the questions focused on specific aspects of these interactions. The opinions of the MWRA and DWM personnel are attributed to their institutions and not to particular individuals. This reduces the confusion of identifying the specific affiliation of the respondent and is appropriate in this context, because the opinions of most individuals interviewed fell within boundaries of their intraorganizational structure. If there is no unanimity, this will be cited when it highlights a conflict.
Chapters 1 and 2 review Boston's water-supply management agencies and their watershed-management practices and define

the physical condition of the watersheds to offer an historical and descriptive basis for subsequent analysis. Chapter 3 explores the recent legislative and judicial events surrounding the creation of two water management agencies to illustrate political inattention to water-system needs.

Chapter 4 reviews the theoretical framework of organizations and conflict and cooperation to provide the basis for the eventual analysis of the interview results.

Chapter 5 identifies areas of conflict and cooperation between the DWM and MWRA and analyzes these results in the context of the theoretical expectations of Chapter 4. The results have been broken down into cooperative and conflictual interaction. Cooperation is best represented by a formal Memorandum of Understanding. The contents of the MOU will be introduced, and the 1985 original version will be compared to the 1989 revision and assessed for its effectiveness as a medium to address conflict.

Chapter 5 also analyzes conflict, which more accurately characterizes the interorganizational relations of this case study. Conflicts are broken down into those occurring due to structural and operational factors.

Structural conflicts are those caused by two factors: (1) the institutional differences between a public agency and a public enterprise (particularly financing capabilities), and (2) the operational constraints caused by

shared management of a system physically designed as a single delivery mechanism.

Philosophical conflicts are those which arise due to contradictory ideological interpretations of how best to define the agencies' shared goals. This category has two parts: (1) jurisdictional disputes characterized by attempts to expand (MWRA) or maintain (DWM) organizational control in the watersheds and (2) management disputes that stem from the above ideological differences.

Chapter 6 summarizes the findings of the preceding chapter and presents recommendations to guide future productive actions of the DWM and MWRA, including short- and long-term recommendations for organizational structure.

CHAPTER 1

HISTORY OF BOSTON'S WATER-SUPPLIES AGENCIES AND WATERSHED MANAGEMENT

Chapter 1 provides an historical review of Boston's water-management structures, and this review will serve as the basis for the interorganizational analysis that follows in Chapter 5. The purpose of this chapter is twofold. The initial focus will be on the management structure prior to the 1984 legislative creation of the Division of Watershed Management (DWM) and the Massachusetts Water Resources Authority (MWRA). Because the expansion of metropolitan Boston's water supplies closely parallels the formation of new water-management agencies, supply expansion serves as a backdrop for the discussion.

In the second part of this chapter, Boston's early watersheds-management efforts will be discussed and a general examination of the threats from certain land uses will be made.

WATER SUPPLY EXPANSION AND AGENCY REORGANIZATION

Early History: 17th Century to 1984. Metropolitan Boston's water supplies historically expanded to meet the

needs of a growing urban population. As supply sources were added to the system, the agencies charged with managing these supplies underwent a parallel change. A series of private and public entities managed Boston's water supplies from the mid-17th century to the present. Each new reorganization was based on the perceived need to expand existing supplies. Table 1.1 shows the progression ofsupply expansion and the accompanying changes in management agencies.

TABLE 1.1: CHANGES IN METROPOLITAN BOSTON'S SUPPLY SOURCES AND AGENCY STRUCTURE

Management Structure	Year Created	Supply Source
Waterworks Company	1652	Local waterbodies
Aqueduct Company	1796	Jamaica Pond
Cochituate Water Board	1846	Long Pond
Cochituate Water Board	1846	Sudbury Res.(*)
Metropolitan Water Board	1895	Wachusett Res.
Water Supply Commission	1926	Ware River(**)
Water Supply Commission	1926	Quabbin Reservoir

(*) The Sudbury system consisted of six small storage reservoirs with a total capacity of 13 billion gallons.

(**) The Ware River is diverted to either Quabbin or Wachusett Reservoirs

Source: (Nesson 1983; Massachusetts Water Resources Authority Long Range Planning Overview, February 1990)

Early efforts, such as the Waterworks Company and the Aqueduct Corporation, were managed by private companies; but by the early 1800s, the primitive delivery mechanisms of cisterns and wooden conduits became technologically

insufficient to meet demand increases and were abandoned in pursuit of larger supplies. By the mid-19th century, the Boston City Council selected a Water Board to oversee the construction of the Cochituate/Sudbury Reservoir system (Nesson 1983: 6). Additional development of the Sudbury River as a water-supply source occurred throughout the late 1800s to meet continuous increases in water demand. As Boston's population moved into the sensitive watersheds of these sources, these supplies became contaminated or abandoned, and newer water sources were impounded.

As Boston's population grew, additional supply sources capable of accommodating residents' needs were added to existing supplies. Incremental expansion occurred until the late 1800s when the state Board of Health recommended developing supply sources in the central part of the state to accommodate water needs (Nesson 1983). The next major expansion, Wachusett Reservoir, was preceded by a new water-management agency. Based on the Board of Health's recommendation, the state legislature created the Metropolitan Water District in 1895 to maintain and operate the water supplies of communities within a ten-mile radius of the State House.

The last two major supply-system expansions, the Quabbin Reservoir (1939) and the Ware River Diversion (1931) were designed and constructed by yet another water-management entity, the Water Supply Commission. Although the state

legislature, in 1919, centralized water, sewer, and park management into the Metropolitan District Commission (MDC Annual Report 1919), it relied on the Water Supply Commission to oversee construction projects. Since the completion of Quabbin Reservoir in 1946, no major water supplies have been added to Boston's system. Table 1.2 shows the supply sources and their capacities.

TABLE 1.2: METROPOLITAN BOSTON'S CURRENT WATER SUPPLY SOURCES

Source	Status	Year Filled or Diverted	Maximum Depth (ft.)	Capacity (Mil.Gal.)
Sudbury Reservoir	Standby	1878	65	7(*)
Wachusett Reservoir	Active	1908	129	65
Ware River	Active	1931	--	--
Quabbin Reservoir	Active	1946	150	412

(*) Sudbury Reservoir supplies are on standby only
Source: MWRA, Long-Range Planning Overview, 1990.

Throughout the periods of supply expansion, no water sources were designed to include filtration. During early efforts, such as the Cochituate system, filtration was still an experimental technology. Water engineers were unwilling to gamble the success of the system's water quality on a fledgling technology (Nesson 1988: 12). In later expansion efforts, engineers opted for unfiltered supplies even though the technology was practicable. Wachusett's pure water was chosen over the alternative of filtering industrially-polluted water from the Merrimack River. Water engineers opted for Wachusett's unfiltered source because it was preferable to obtain water from pure sources that did

notrequire constant supervision (Nesson 1983: 20).

In addition to professional preference for unfiltered water, engineers were conscious of consumers' preference for unfiltered supplies. Unlike today, where alternative water sources are scarce, consumers at that time could substitute filtered supplies with unfiltered water sources. This consumer preference continued when Quabbin Reservoir was added to the system, resulting in a completely unfiltered supply source for today's water consumers.

WATERSHED MANAGEMENT HISTORY

As the supply system expanded throughout the late 19th and early 20th centuries, the water entity responsible for constructing impoundments also managed watershed lands. When each new reservoir was constructed or river diverted, the water management agency exercised eminent domain power to purchase lands necessary to ensure protection of the water supplies. The Metropolitan Water Act of June 1895 granted broad taking powers to the Water Board during construction of Sudbury and Wachusett watersheds.

The Wachusett Reservoir's Nashua River impoundment in 1908 was the first incidence of the relocation of towns for reservoir construction.[5] By 1930, the legislature approved construction of Quabbin Reservoir to meet increased demand for water. This time, the construction necessitated the destruction of four towns and the relocation of their

residents.[6]

Despite these broad powers, the Water Board was conscious of the potential for opposition to outright takings without initial negotiation with landowners.

> The Board has deemed it wise to exercise as little as possible its power under the statute of arbitrarily taking lands and other valuable rights and divesting people of their ownership, and has pursued the policy of acquiring the necessary lands and rights by mutual agreements with the landholders.[7]

In addition to paying property owners for land, the Water Board also released payments for damages to businesses, loss of employment, and depreciation of real estate that occurred during reservoir construction.[8] The Board effected eminent domain proceedings as required for construction needs; the watersheds adjacent to reservoir sites were purchased as construction progressed. In some instances, construction work proceeded on private property prior to the completion of sale negotiations.[9] When Wachusett was completed in 1908, the Water Board had purchased almost 12 million acres for the Sudbury and Wachusett Reservoirs at a cost of approximately three million dollars.[10]

To protect watershed lands from intensive development is important because, in addition to transporting clean water to reservoirs, the watersheds' natural drainage patterns are vehicles for contaminants. Intensive residential, commercial, and industrial activities adjacent to a reservoir pose significant risks to the quality of water

which is eventually delivered to Boston. Leaching from landfills, leaking underground storage tanks, and on-site septic systems present a few of the sources of potential dangers which threaten reservoir water quality.[11]

The early designers of Boston's water-supply system recognized the importance of protecting sensitive watershed lands. The fact that only seven percent of the Wachusett watershed was purchased at the time of construction in 1908 does not mean that the water planners were ignorant of watershed protection needs; nor does the 47 percent purchased at Quabbin in the 1930s reflect a new watershed preservation ethic. Rather, it represents the belief that these distant rural areas would never be urbanized to an extent that could threaten the water quality of the reservoirs.[12]

During the MDC's tenure, the definition of watershed management grew to include water quality monitoring, forestry, wildlife management, and recreational issues. Early watershed management consisted of sanitary inspections at the reservoir construction sites. The Water Board exhibited concern for the health of the construction laborers. A lack of sanitary facilities posed a severe threat. Several cases of typhoid occurred during construction of Wachusett, and the Water Board reacted by installing latrines, using disinfectants, and a regular monitoring of the sites to prevent further outbreak. In

addition, the Board assigned a medical inspector to the work sites.[13]

Once the reservoirs were activated, the early concern for the health of the workers expanded to include additional land acquisition and sanitary monitoring. Additional lands were purchased in sensitive tributary areas that fed the supplies. Management focused on installing septic systems, filtration beds, and drainage sewers in the watersheds to serve the remaining population. In addition, engineering crews drained swamps to avoid excessive growth of organic matter.[14]

Despite the Board's success in maintaining high water quality in the reservoirs (93 percent satisfactory inspections in 1908 and 98 percent in 1918), unanticipated land uses highlighted an increase in water-quality problems. By 1911, the Board's annual reports cited factory discharges into the Wachusett watershed's Nashua River and agricultural and farm-animal waste drainage as causes of typhoid outbreaks in the watersheds.[15]

During the MDC's management tenure, tributary monitoring and sanitary surveys continued. The MDC also initiated forestry management to increase reservoir yield by thinning high-density forests to reduce vegetative coverage. This resulted in less water absorption by plant root systems and reduced transpiration loss, thus, allowing increased water runoff into the reservoirs.[16]

From the 1930s to the 1960s, forestry management consisted of red pine plantings to replace the vegetation originally removed during reservoir construction. The fast growth pines proved problematic in later years due to their high water consumption.[17] In the following two decades, forestry practices involved selective clearing and reduced forestry stocking to ensure a diversified habitat for wildlife, reduce erosion, and to increase reservoir water yield.[18] In addition, the MDC asserted that selective cutting would increase the recreational value of the watersheds by providing scenic views.

In 1986, the MDC proposed expanding forestry management as a watershed management technique by increasing lumber harvesting by 100 percent of its historical level. This proposal is shown below in Table 1.3. The MDC estimated that increased forestry management would increase system yield by four billion gallons per year (11 million gallons per day).[19]

Table 1.3: PROPOSED MDC FORESTRY MANAGEMENT PRACTICE - 1986

	1986 Yield (Acres)		Proposed Increase	Percent Increase
Watersheds	Softwood	Hardwood	in Cutting	in Cutting
Quabbin	257	679		
Ware River	63	171		
Wachusett	21	61		
Total	341	911	2500	100%

Source: MDC, Water Supply Study and EIR 2020, 1986.

In addition to a forestry focus, the definition of watershed management expanded to include recreational issues. Since the reservoirs were first constructed, local residents have used them for recreational pursuits.[20] As populations in the watershed communities grew, the reservoirs and adjacent watersheds became increasingly popular recreational areas.

Water supplies for metropolitan Boston and accompanying management agencies underwent continuous growth and change since the early recognition of the need for a centralized delivery system. As supply sources expanded under increasingly centralized management, those who planned and constructed system expansion chose to avoid filtration of already contaminated supplies and relied instead on purchasing sensitive adjacent reservoir lands and watershed protection of pure sources.

From the early purchases in Sudbury to later acquisitions at Quabbin, a single agency has monitored these lands to ensure eventual delivery of safe drinking water to Boston's communities. This arrangement changed in 1985 when the legislature decentralized management into two agencies--the Division of Watershed Management and the Massachusetts Water Resources Authority. These new management agencies face the challenge of continuing to provide unfiltered drinking water in accord with the more stringent SDWA standards.
Adapting to a decentralized system and complying with water-

quality standards are complicated by increasing recreational and development pressures in watershed lands. The next chapter illustrates the effects of these pressures by providing a detailed description of Boston's water-supply watersheds.

CHAPTER 2

BOSTON'S WATER-SUPPLY WATERSHEDS

This chapter will feature descriptions of the watersheds managed by the Division of Watershed Management (DWM) and a discussion of the interdependencies between watershed management practices and water supply quality. Population profiles of the communities having land within the watershed will be presented to illustrate the land use pressures of both recreation and residential development in sensitive areas.

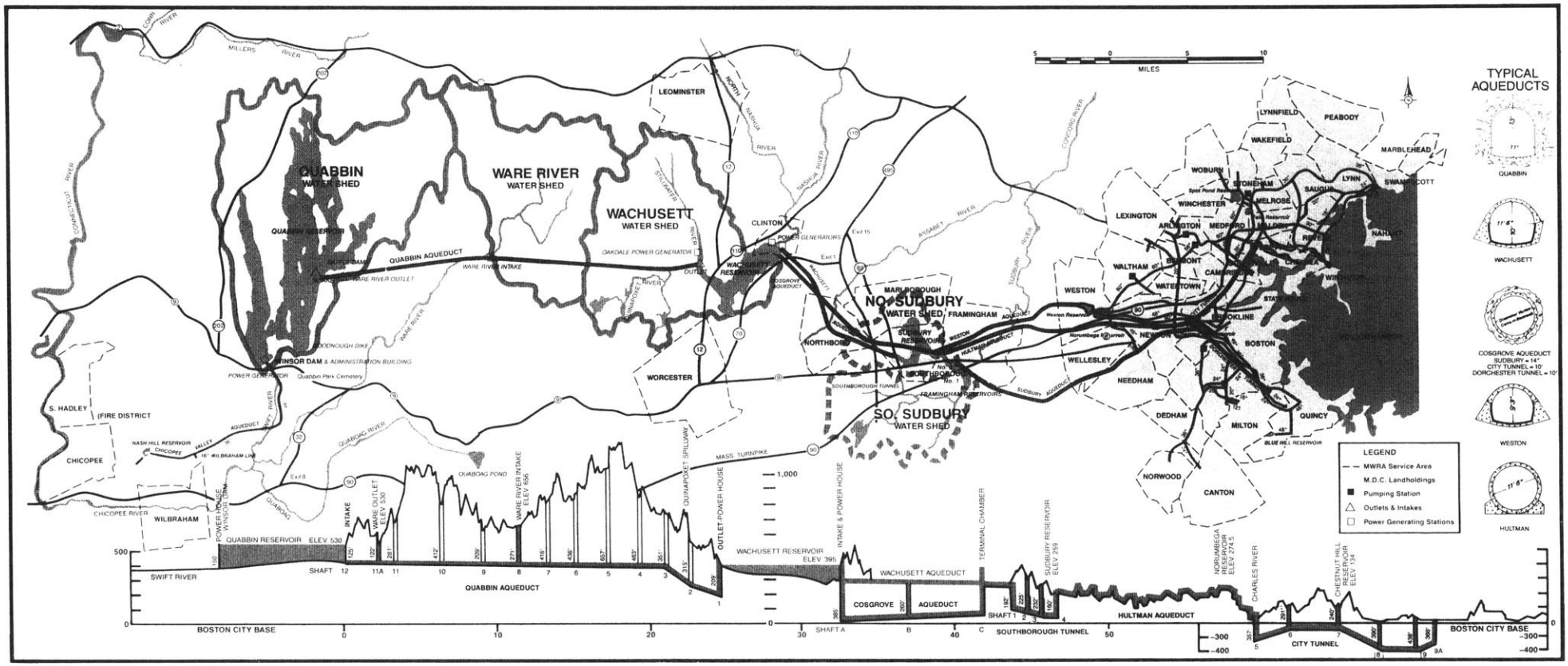
LAND MANAGEMENT JURISDICTION

The watersheds serving metropolitan Boston's water supplies drain into two surface reservoirs (Quabbin and Wachusett) and one river (Ware). The DWM manages, under state ownership, different percents of four watersheds that drain into the water supply reservoirs: Quabbin, Ware River, Wachusett, and Sudbury watersheds. (Refer to Figure 2.1 for a system-wide view of the four watersheds).

Quabbin, Wachusett, and Sudbury watersheds drain into unfiltered surface reservoirs, and the Ware watershed contributes to flows in both Quabbin and Wachusett

FIGURE 2.1:

BOSTON'S WATER SUPPLY AND DISTRIBUTION SYSTEMS



Reservoirs. All water supplies are active except for the Sudbury Reservoir, which is on standby for emergency use only (See Table 1.2 in Chapter 1 for MWRA supply sources.) Table 2.1 presents the total acreage for each watershed compared to the land and water areas under MDC or MWRA management.

TABLE 2.1: MDC DIVISION OF WATERSHED MANAGEMENT: ACREAGE OWNERSHIP

		Acreage DWM Ownership		Percent DWM Ownership		
	Total					
Watershed	Watershed	Water	Land	Land	Water	Combined
Quabbin	119,400	25,000	56,000	47	21	68
Ware River	62,720	(*)	20,000	32	(*)	32
Wachusett	73,000	4,200	5,800	8	6	14
Sudbury	48,000	1,830	1,670	3	4	7
Total	303,120	31,000	83,470			

(*) Ware River has no reservoir associated with it; its waters are diverted into either Quabbin or Wachusett Reservoirs.

Source: Metropolitan District Commission Division of Watershed Management, Mission Statement and Operational Summary, January 18, 1989

These figures show that the level of watershed protection, as measured by percents of state-owned land, varies considerably among the watersheds.

Quabbin Watershed. Quabbin watershed, comprised of 119,400 acres, is the largest of the DWM's four watersheds. The DWM maintains control of 47 percent of this total, which makes Quabbin Reservoir Boston's best protected water supply. The 63,400[21] acres of land not owned by the state

are held by private property owners in ten surrounding towns, but the number of property owners whose residences directly affect the Quabbin watershed includes only 6,984 persons. Table 2.2 below shows the population profile of these towns.

TABLE 2.2: QUABBIN WATERSHED: COMMUNITY POPULATIONS

Town	1970	1980	1985	1990	Percent Change 70-90
Belchertown	4,936	8,339	7,863	9,010	83
Barre	3,825	4,102	4,020	9,390	145
Hardwick	2,379	2,272	2,190	2,300	(03)
New Salem	474	688	770	790	67
Orange	6,104	6,844	6,341	7,400	21
Pelham	937	1,112	1,136	1,250	33
Petersham	1,014	1,024	82	1,100	08
Shutesbury	489	1,049	1,126	1,260	158
Ware	8,187	8,953	8,669	8,960	09
Wendell	405	694	780	870	115
Subbasin Total	29,750	39,077	33,877	37,330	25

Source:
1970 = US Census Figures
1980 = US Census Figures
1985 = Massachusetts State Government, 1985 Census
1990 = Massachusetts Department of Public Health Estimate

Despite the limited number of residences that directly affect this area, the Quabbin watershed represents the greatest visitor usage of any of the four under discussion. As the largest remaining open space in southern New England, Quabbin watershed each year hosts over 700,000 visitors who hike, picnic, fish, and sight see. In addition, the

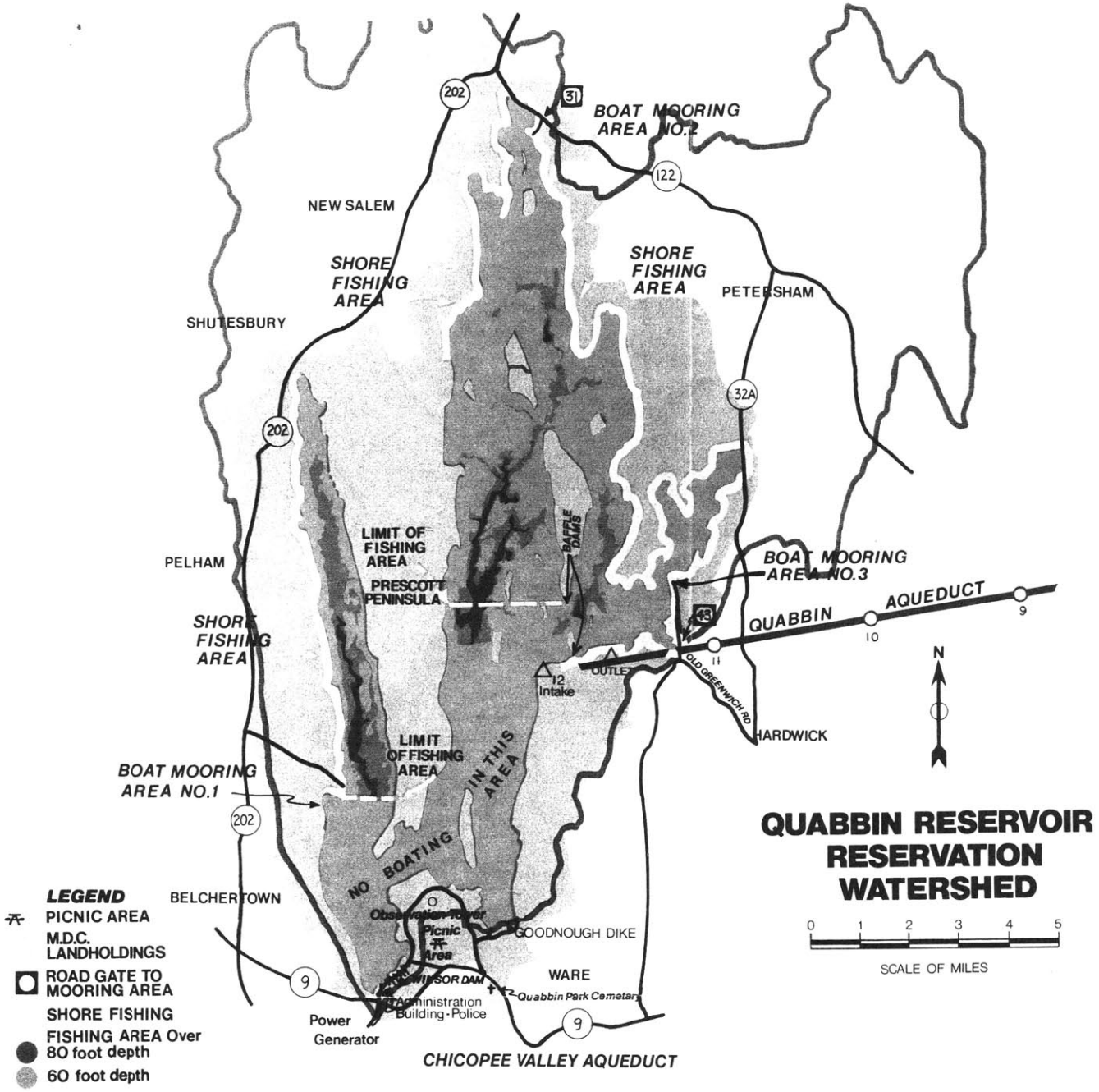
watershed serves as an educational research facility. Quabbin watershed is further divided into three regions, each with varying levels of visitor access; (1) Quabbin Park, (2) Quabbin Reservation, and (3) North Quabbin Reservation. Quabbin Park's 3,100 acres at the southern tip of the reservoir are the watershed's most popular and frequently visited location, hosting about 600,000 visits each year.[22] A visitors' center is located in this area and is open year round to provide interpretive displays and visitor information. The DWM seeks to make this portion of the park an intensive use area, because its proximity to the MDC Administration area and the Police offers the greatest potential for visitor oversight.

Quabbin Reservation consists of 53,000 acres that drain primarily into the Quabbin Reservoir. Unlike Quabbin Park, this area is primarily reserved for water resources protection.[23] Management activities here include forest and wildlife resources and environmental research. Human activity in this area is limited by restricting access to Prescott Peninsula and Mount Zion Island. Despite these restrictions, fishing is allowed from gas-powered boats from three boat ramp access points, as well as from the shoreline (Refer to Figure 2.2 for these locations).

North Quabbin Reservation consists of 7,500 acres not covered by the same statute as the Quabbin reservation due to the fragmented nature of land holdings in this area. It

FIGURE 2.2:

QUABBIN RESERVOIR RESERVATION WATERSHED



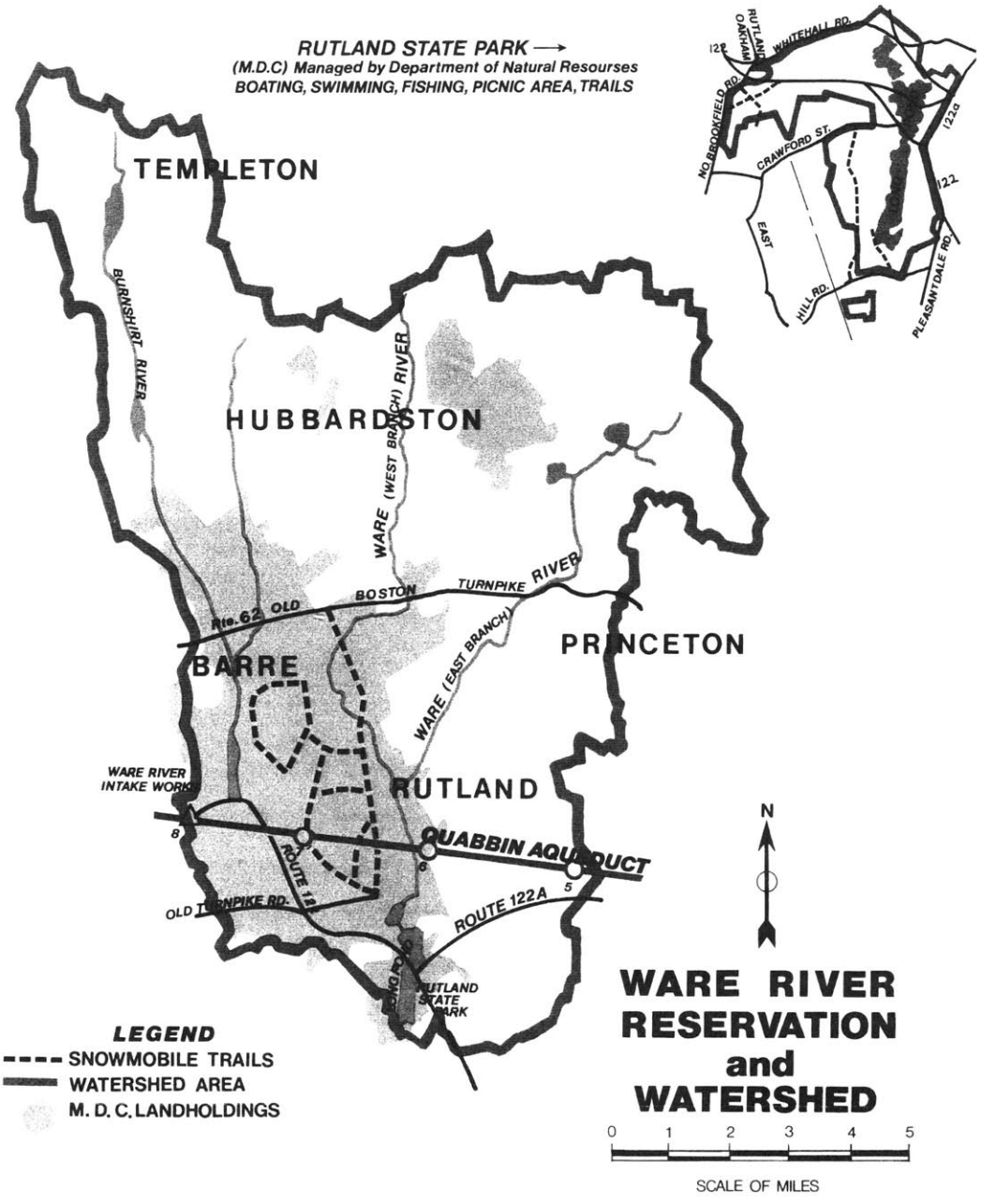
consists of approximately 50 separate land parcels that are further decentralized by interim private and public land holdings. Most of these holdings are in the towns of Shutesbury, New Salem, and Pelham. The DWM identifies this area as a management difficulty due to the fragmented ownership but acknowledges that poor access to these holdings reduces this concern.

Ware River Watershed. The DWM manages 20,000 acres of the Ware River's more than 60,000 acres of watershed land. The Ware watershed is unique among the DWM's watersheds in that its drainage does not flow into a supply reservoir, thus posing unique management needs. (Figure 2.3 illustrates this concern). The Ware River watershed contains six major tributaries that branch from the main river, and greater than half the area of these tributaries is under DWM ownership; the remainder are private property holdings in surrounding towns. Although the communities are predominantly rural, development pressure exists that could threaten the water quality of supplies eventually delivered to Boston.

In addition, even the watershed land managed by the DWM is not subject to Quabbin's strict human access guidelines, partly due to staffing shortages that prevent proper monitoring of human access to the watershed. The Ware River watershed is open to the public 24 hours per day, 365 days per year. Such unlimited access coupled with the limited

FIGURE 2.3:

WARE RIVER RESERVATION AND WATERSHED



staff to enforce existing guidelines results in documented cases of illegal dumping and negative impacts of human use.

TABLE 2.3: WARE RIVER WATERSHED: COMMUNITY POPULATIONS

Town	1970	1980	1985	1990	Percent Change 70-90
Hubbardston	1,437	1,797	1,876	2,050	43
Oakham	730	994	1,212	1,120	53
Phillipston	872	953	1,101	1,100	26
Rutland	3,198	4,334	4,291	5,104	60
Templeton	5,863	6,070	5,941	6,410	09
Subbasin Total	7,918	10,503	11,160	12,124	53

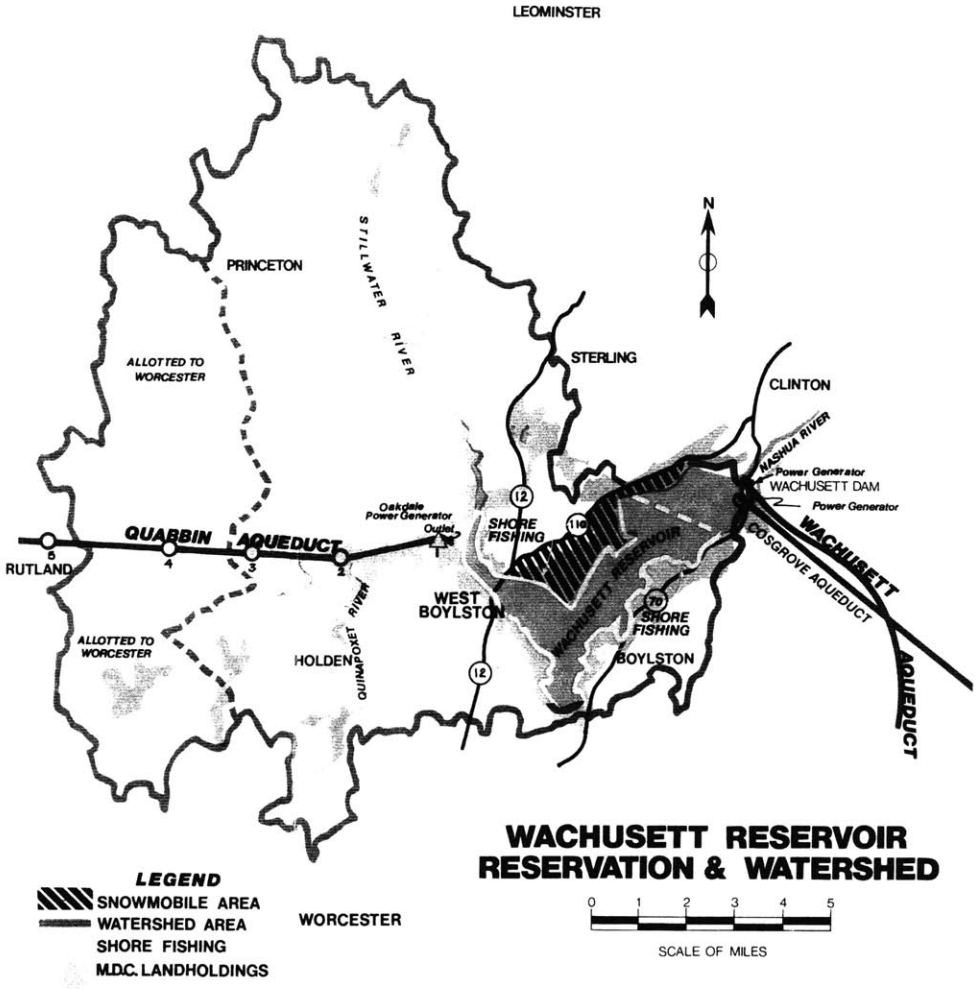
Source:
1970 = US Census Figures
1980 = US Census Figures
1985 = Massachusetts State Government, 1985 Census
1990 = Massachusetts Department of Public Health Estimate

Wachusett Watershed. The DWM owns 7 percent of the total 73,000 acres of Wachusett watershed; the remaining 93 percent is private property holdings. Of the three current supply sources, the Wachusett is the most at risk regarding contamination, because less watershed land is state owned there than in the Quabbin or Ware River watersheds. (See Figure 2.4).

Increased development pressure in central Massachusetts is threatening Wachusett Reservoir's water quality. The watershed is characterized by intensive residential development pressures in the surrounding towns of Boylston, Clinton, West Boylston, Holden, Sterling, and Princeton. At

FIGURE 2.4:

WACHUSETT RESERVOIR RESERVATION AND WATERSHED



first glance the population increases appear less troublesome in Wachusett than in other watersheds; but when combined with the limited state control of Wachusett watershed lands, the increases in the past twenty years are more problematic due to greater potential for development. (Refer to Table 2.4 for Wachusett's population figures).

TABLE 2.4: WACHUSETT WATERSHED: COMMUNITY POPULATIONS

Town	1970	1980	1985	1990	Percent Change 70-90
Boylston	2,774	3,470	3,594	4,030	45
Clinton	13,383	12,771	12,689	13,880	04
Holden	12,564	13,336	13,187	14,390	15
Sterling	4,247	5,440	5,956	6,190	46
W. Boylston	6,369	6,204	6,112	6,300	(01)
Princeton	3,198	4,334	4,291	5,104	60
Subbasin Total	42,535	45,555	45,829	49,894	17

Source:
1970 = US Census Figures
1980 = US Census Figures
1985 = Massachusetts State Government, 1985 Census
1990 = Massachusetts Department of Public Health Estimate

Private land holdings in Wachusett watershed are more developed than those of either Quabbin or Ware River watersheds. Although the amount of state-owned watershed land in Quabbin is almost ten times greater than that in Wachusett, and Quabbin's reservoir capacity is six times larger than that of Wachusett Reservoir, the Wachusett watershed's population exceeds Quabbin's by 34 percent. In addition, the Wachusett Reservoir is traversed by heavily

travelled roadways and within ten miles of a major transportation link, Route 495.

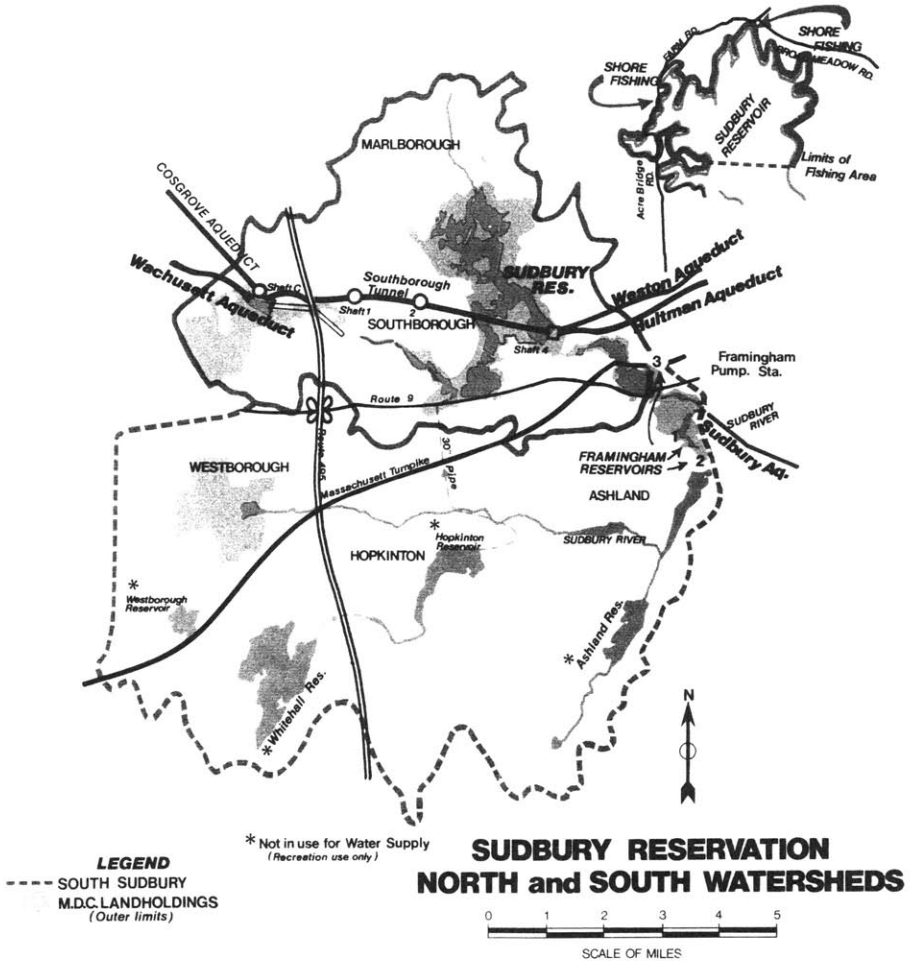
Recreational access to the watershed is discouraged, but the greater issue at Wachusett is the use of watershed land not managed by the DWM. The fact that Wachusett Reservoir and watershed provide the only extensive open space for the watershed communities results in its use as a recreational resource. In addition, shoreline fishing is allowed which brings users to the water's edge and has resulted in illegal boating and swimming in the reservoir.

Sudbury Watershed. The Sudbury watershed represents the least amount of DWM ownership, with only four percent of a total 48,000 watershed acres controlled by the DWM (See Figure 2.5). The water supplies associated with this watershed[24] had been active since the 1870s, but were removed from service in the early 1970s due to water-quality contamination. Pollution from adjacent residential, commercial, and industrial development resulted in consistent failure to meet federal drinking water standards.[25] Currently, the supplies are on standby, which means that it can be reactivated for emergency use; but the resources needed to bring the supplies up to current federal water quality standards would preclude watershed management.

A treatment facility would be required due to the advanced degradation of the source and the population

FIGURE 2.5:

SUDBURY RESERVATION: NORTH AND SOUTH WATERSHEDS



intensity in the watershed.[26] Sudbury's watershed populations are listed in Table 2.5.

TABLE 2.5. SUDBURY WATERSHED: COMMUNITY POPULATIONS

Town	1970	1980	1985	1990	Percent Change 70-90
Ashland	8,882	9,165	10,531	9,960	12
Framingham	64,048	65,113	61,241	63,900	(.02)
Hopkington	5,981	7,114	7,711	8,230	27
Marlborough	27,936	30,617	34,294	33,060	15
Southborough	5,798	6,193	6,334	6,800	15
Westborough	12,594	13,619	13,549	14,811	15
Subbasin Totals	125,239	131,821	133,660	136,761	08

Source:
1970 = US Census Figures
1980 = US Census Figures
1985 = Massachusetts State Government, 1985 Census
1990 = Massachusetts Department of Public Health Estimate

This chapter introduced the separate watersheds for Boston's water supplies and showed the potential for protection, as measured by percent of state-controlled land, for each of the four. Quabbin watershed is one of the best-protected unfiltered supplies in the Boston system, as well as in the nation, but threats to water quality are evident in the other three. Development potential and its accompanying water-quality threats are not pressing issues in Ware River and Sudbury. In Ware River, a large percent of land is state-owned and in Sudbury, the existing level of development has caused water-quality problems resulting in the closure of that system as a viable unfiltered supply. Wachusett watershed is the most susceptible to water-quality

degradation and, thus, is the target of watershed management efforts.

Despite the urgency to produce an acceptable management plan, progress is impeded by several factors. Political inaction results in an ill-defined management structure that undermines intentions to comply with the SDWA amendments without constructing a filtration facility.

The following chapter details the political basis for creating and retaining a dual-management system, and outlines the specific responsibilities of the DWM and the MWRA in the context of the watersheds.

CHAPTER 3

MANAGING THE WATER SUPPLIES: CATALYST FOR CHANGE AND MANDATE FOR OPERATIONS

The DWM's and MWRA's split responsibility for water-supply protection is unique in Boston's water-agency history. Throughout the reorganizations of the 19th and 20th centuries, the legislature continually centralized management; but the action taken in 1984 reversed that trend.

In the first part of this chapter an examination of the events leading up to the most recent organizational designs (the DWM and the MWRA) will be made. The contributing political and legal reasons for the separation of watershed management into a division separate from the water supplier will follow.

This separation of watershed management into a new MDC division was totally unexpected, for the 1984 political debates focused on issues relative to preventing continued wastewater pollution of Boston Harbor, limiting water supply expansions, and encouraging water conservation. The debates did not focus on watershed management.

The second part of this chapter details the operational jurisdictions of the DWM and the MWRA and explores their interaction in terms of watershed management. Their shared enabling legislation is introduced to show the bureaucratic overlaps in their operational mandates.

RECENT HISTORY: 1970 TO 1984

From 1919 to the reorganization in 1984, the MDC managed the Boston area's water supply functions (which includes both watersheds and reservoirs), but it proved increasingly unable to maintain and improve the system due to consistent legislative underfunding for systems' upgrade and maintenance. Table 3.1 shows that, from 1970 to 1984, the legislature successively reduced allocations for the MDC Water Division.

TABLE 3.1: MDC'S FORMER WATER DIVISION: FUNDING REQUESTS AND APPROPRIATIONS, FISCAL YEARS 1970-1985 (1989 DOLLARS(*) IN THOUSANDS)

Year	Agency Request	EOEA Sct'y Recommend.	Governor's Recommend.	Legislative Allocation	Percent Yearly Change
1970	24,225	18,210	18,177	(+)	
1971	23,718	20,402	20,118	20,128	
1972	23,950	20,395	19,886	19,859	(1)
1973	25,018	20,590	20,342	20,355	2
1974	19,851	19,851	20,068	20,095	(1)
1975	19,341	18,559	18,855	18,873	(6)
1976	14,395	14,395	14,395	17,425	(8)
1977	18,696	18,696	17,557	18,424	(6)
1978	16,713	15,594	15,594	18,840	(2)
1979	19,061	17,375	16,352	15,816	(16)
1980	18,819	14,695	16,695	14,132	(11)
1981	16,127	14,831	14,831	14,588	3
1982	16,091	15,145	15,145	15,063	3
1983	16,222	15,787	15,787	15,720	4
1984	17,853	17,606	17,606	(+)	
1985	19,173	9,010	9,010	(+)	

(*) CPI 1989 = 100
(+) Figures not readily available for these years
Source: Massachusetts House 1 Budget Requests 1970-1984.

As a government agency, the MDC's budget requires approval by the legislature, but the agency never received adequate funds to operate and maintain the water system, let alone finance needed capital improvements.[27] In the ten-year period between 1973 and 1983, the legislature reduced MDC Water Division funding in constant dollars by 23 percent.

In addition to decreasing legislative appropriations, the MDC's ability to fund operations and maintenance became even more problematic in 1981 with the passage of voter initiative Proposition 2 1/2. Prior to 1981, the MDC Water

Division could recoup its costs via user fees from member communities. The agency assessed the costs of its operations and debt service on the member cities, towns, and other public bodies in its jurisdiction; but the passage of the initiative constrained the MDC's (and other state agencies') ability to collect on certain kinds of revenues. Proposition 2 1/2 specifically limits any increases in the charges and fees assessed by MDC on the towns to the sum of:

1. 2.5% of the total charges and fees imposed in the preceding fiscal year and
2. any increase in charges for services customarily provided locally, or services obtained by the city or town at its option.[28]

In effect, the initiative placed a cap on the funds that the MDC could raise to finance its multi-purpose operations for water, sewer, and parks.

After 1981, a decreasing proportion of the new limited assessments were allocated to the water division, because the 2 1/2 percent cap applied to the three MDC divisions: Water, Sewer, and Parks. Of the three divisions, Parks consistently received the lion's share of MDC's total budget. Legislators were more concerned with funding the Parks Division, because it was a visible sign of political action in a community and could return votes on election day. Between 1970 and 1984, legislators consistently allocated at least twice as much money to the MDC Parks

Division as they did to the combined Water and Sewer Divisions.

In addition to receiving a decrease in monies for operations, the MDC was forced to rely on general tax revenues (not just assessments on user communities) to fund its operations and maintenance costs. A combination of system age and political unwillingness to finance maintenance and upgrades resulted in an antiquated infrastructure and harbor pollution.

CATAYLYST FOR CHANGE

The impetus for changing the management structure was based on wastewater pollution, not water-quality degradation. A court suit filed by a member community charged the MDC with violating the state and federal Clean Water Acts.[29] The presiding state judge, Judge Paul Garrity, appointed a special court master to explore ways to address compliance with the Clean Water Act, and the special master recommended that a quasi-public authority be created to take over the MDC's water and sewer management duties.

Prior to legislative response to the crisis, the Bank of Boston published a report recommending an authority management structure and cited the problems inherent in the MDC's ability to upgrade and maintain the water and sewer systems, including the property-tax initiative and MDC reliance on legislative appropriations. (Refer to Appendix

A for the Bank of Boston's bases for recommending a public enterprise to manage the water and sewer systems.)

In April 1984, Governor Dukakis submitted a proposal to the legislature[30] to create a public enterprise to address harbor pollution. In recognition of the financial restrictions faced by the MDC, he adopted the court master's recommendation of an authority independent from legislative budget allocations and capable of raising revenues in the private market.

From April through December 1984, the legislature debated the proposal. The Governor's bill was unopposed until October when the Senate President rejected the formation of an authority including both the water and sewerage systems under a single public enterprise structure.[31] Although this provision of the original bill was eventually restored in the final legislation, a November 1984 revision by the Ways and Means staff separated the watershed management function from the rest of the water system.

Judge Garrity was prepared to take over MDC sewer-service operation unless the legislature approved the recommended restructuring. The legislation was finalized in a three-day marathon conference committee and resulted in the creation of the Massachusetts Water Resources Authority and the Division of Watershed Management.

The conference committee process avoided a court takeover to clean up the harbor, but no record of public

debate is extant to justify creating a new division within the MDC to oversee watershed management. Several reasons exist for creating a separate division to manage watershed lands, including:

1. Accountability: Concern that the authority, as a single-purpose water-delivery agency, would not manage the watersheds in the best interests of the Commonwealth.

2. Legislative Special Use: A guarantee that both the legislators whose districts are adjacent to MDC watersheds and certain special interests of such districts would retain unauthorized special uses.[32]

A former committee staff person[33] who was privy to the closed conference sessions states that he drafted this organizational arrangement to preserve public control over state-owned property. His actions were motivated by the fear that an authority would not be an appropriate steward of public lands and would lack accountability to the commonwealth in its management practices. This concern was shared by the Water Supply Citizens Advisory Committee which expressed concern that a public authority lacked legislative oversight and could possibly sell watershed lands to finance a filtration plant to increase water sales.

In addition to altruistic concern over public accountability in land management, state legislators regard the watersheds as havens for special-use privileges and respond to recreational interests at the expense of water-quality protection. Despite the DWM's stated goal of passive use of the watersheds, state legislators have used

the state-controlled watersheds for private social functions, such as wedding receptions. These special privileges divert limited staff from legitimate duties and place an unnecessary strain on DWM decreasing finances.

Due to the harbor problems and the water supply-expansion focus, responsibility for watershed management received little attention during the drafting process. At the time of passage, the debate centered on sewerage (Boston Harbor) and water expansion (river diversion) issues.[34] The court process guided the sewerage needs and a citizens' advisory committee responded to attempts to expand supply sources by stressing options (such as conservation and limitations on supply expansion) that could reduce the likelihood of new source construction. These concerns were incorporated into the enabling legislation (Ch. 372, Sec. 108 (d) and (e)), but no similar political debate for watershed management occurred outside the committee.[35]

This inattention effectively resulted in an organizational relationship designed by default; watershed management was retained in a state agency due to the concern for continued state management of lands and the political attempts to maintain special-use privileges. The intricate links between the DWM and the MWRA were not, however, given the same detailed attention as were capital funding for sewerage or additional supply-source issues. The enabling act's emphasis on sewerage issues and water-supply expansion

set the stage for potential conflict over watershed management. The following section details the DWM's and MWRA's organizational responsibilities that resulted from the lack of legislative debate on watershed management.

MANDATE FOR OPERATIONS: INTERACTION OF THE DWM AND MWRA

The DWM and the MWRA are linked most directly by their shared enabling legislation (MGLA, Ch. 372, Sec. 104-120), but this document provides minimal insight into how to translate legal language into effective operations. Watershed management was mandated without guidance as to how to accommodate the split responsibilities between the two agencies.

An examination of the operational mandate of both entities and the identification of the most prevalent interactions between them reveals that the two organizations are linked most explicitly by their shared enabling legislation--legislation that outlines such items as agency goals and financing mechanisms.

Division of Watershed Management

Creation and Mandate. The enabling legislation defines the new division's purpose and mandates it to

> construct, maintain, and operate a system of watersheds, reservoirs, water rights and rights in sources of supply in order to provide a sufficient supply of pure water to the Massachusetts Water Resources Authority...and...the availability of pure water for future generations (MGLA. 372, Sec. 105).

The enabling act also defines the structure and responsibilities of the new DWM.

> The ownership of the system real property[36] as it relates to the watershed system shall remain in the commonwealth and the watershed management division of the metropolitan district commission shall manage all properties provided for by this act (MGLA, Ch. 372, Sec. 1-4).

In addition, the act directs the MDC commissioner to establish two watershed advisory committees (one specifically for Quabbin and Ware, and one for the watershed system) to "...advise the division on its policies and regulations regarding fishing, boating, and recreational activities and other environmental and wildlife matters..."(MGLA Ch. 372, Sec. 114-115). The MDC commissioner must also produce, at least once every five years, a watershed management plan for the MWRA's supply sources (MGLA Ch. 372, Sec. 114-115).

Operating Responsibilities. The DWM is one of four divisions in the Metropolitan District Commission.[37] Its headquarters is sited in Boston, but the DWM also maintains field offices in Clinton (for the Wachusett and Sudbury watersheds) and in Belchertown (for the Quabbin and Ware River watersheds). A DWM Forestry headquarters is located in the northwestern section of the Quabbin watershed.[38]

The Division's stewardship includes 380 miles of property boundaries, 419 miles of roads and fire lanes, 14 bridges, and six water supply dams. The DWM holds exclusive rights

to the hydroelectricity generated or sold from the operation of five hydroelectric power stations (MGLA Ch. 372, Sec. 107) In addition, it owns 65 facilities and owns and operates an 8.3 mile trunk and relief trunk sewer line in the Wachusett watershed towns of Rutland and Holden.[39] The DWM is responsible for operating levels in the supply reservoirs and for monitoring water quality in the watersheds.

To implement its mandate, the DWM adopted six on-going programs including Sanitary Management and Water Quality Monitoring, Facilities Engineering and Rehabilitation, Land Management and Environmental Protection, Surveillance and Enforcement, Public Education and Quabbin Visitor Center Operation, and Administration.[40] The DWM's operational goals include:

(1) maintaining availability of pure drinking water for future generations

(2) effectively managing its natural and structural resources

(3) establishing an effective interorganizational network among government agencies to implement its programs

(4) providing educational programs

(5) preventing adverse impacts to the watersheds through monitoring, inspection, and analysis

(6) conducting necessary research

(7) formulating plans to address threats to Division resources

(8) maintaining high quality levels in implementing goals and policies.[41]

Massachusetts Water Resources Authority

Creation and Mandate. The state legislature created the Massachusetts Water Resources Authority (MWRA) to assume the Metropolitan District Commission's responsibilities for providing water and sewer service to 46 communities in the metropolitan Boston service area. The MWRA Waterworks Division is directed to fulfill the public purpose of delivering pure water to its user communities, and the MWRA is dependent on the DWM's watershed protection policies to fulfill this goal.

Effective July 1, 1985, "ownership, possession, control of the system's personal property as it relates to the sewer and waterworks systems..." was transferred from the MDC to the Authority (MGLA Ch. 372, Sec. 1-4(a)). The MDC transferred all documentation relating to waterworks, but the enabling legislation specifies that the Authority has no jurisdiction for watershed management. That responsibility remains the sole domain of the MDC's DWM.

> Books, maps, papers, plans, records, documents pertaining to the design, construction, operation and affairs of the MDC...water system, exclusive of those pertaining to the MDC watershed management system...shall be transferred to the Authority to its use, ownership, possession, and control (MGLA Ch. 372, Sec. 1-4 (a)).

Operating responsibilities. As the Authority charged with delivering water to user communities, the MWRA owns the system's transmission and delivery infrastructure. The

transmission system includes 129 miles of aqueducts and tunnels, five hydroelectric power stations, and 13 chemical feed stations. The distribution system consists of 260 miles of delivery pipes, four active open distribution reservoirs, thirteen pumping stations, and seven standpipes and elevated tanks.[42]

The legislation directs the Authority to operate, regulate, finance, and improve the water delivery and sewerage collection systems, and to encourage water conservation (MGLA Ch. 372, Sec. 1-1(c)). The DWM retains the water rights to regulate reservoir operating levels, and the MWRA gains control of the water supplies once they enter the transmission system aqueducts.[43] The Authority's use of the watershed system is limited to

> the delivery, distribution, and sale of water thereof by the Authority and the receipt by the Authority as its revenues of the Authority's charges therefor (MGLA Ch. 372, Sec. 1-4(b)).

The provisions limiting state control do not imply that the MWRA is free from oversight. The MWRA is governed by an 11-member Board of Directors which is representative of both watershed and water supply communities (MGLA Ch 372, Sec. 1-3(b)). Board members are appointed by the following officeholders: The Secretary of Environmental Affairs is automatically appointed as the chair of the Board, the governor appoints two[44], the mayor of Quincy recommends one, the Board of Selectmen of Winthrop recommends one[45], and the

MWRA Advisory Board appoints three[46] and the mayor of Boston appoints three[47] (MGLA Ch. 372, Sec. 1-3 (a)-(e)).

In addition, the enabling legislation created an advisory board comprised of user communities (MGLA Ch 372, Sec. 1-23(a)-(h)) and a citizen's water-supply advisory committee whose members comment on MWRA policy actions.

The MWRA interprets its legal mandate as an obligation to improve systems operations and protect and conserve water supplies and the environment. Common goals are evident in the DWM's watershed management policies and the MWRA's ownership of reservoir water. The DWM must manage the watersheds so that the MWRA is guaranteed pure water for delivery to system users.

As an independent authority, the MWRA is not subject to control or supervision of "the executive office of environmental affairs or any other agency, board, or commission" except where specified in the enabling act (MGLA Ch. 372, Sec. 1-3(a)). This independence from legislative intervention in operation also extends to financing. It must recoup water delivery and sewage collection costs from its user communities (MGLA Ch. 372, Sec. 1-10(a) (vi)) and can raise revenue to finance its capital costs through bonding powers (MGLA Ch. 372, Sec. 1-12). Unlike the former MDC, the MWRA is not constrained by the provisions of Proposition 2 1/2, and can raise its water fees to its member communities.

In addition to transferring water supply responsibilities from the MDC to the MWRA, the enabling legislation stipulates that the MWRA reimburse the state's general fund for its appropriations to the DWM's operations and maintenance costs (MGLA Ch. 372. Sec. 113).

The payment process is broken down in the following manner:

1. Reimbursement to the State's General Fund: Fifty percent of the costs of DWM must be reimbursed to the state's general fund by the MWRA, including operations, debt service, and other authorized charges for DWM after credits are applied and,

2. Credits: For any hydropower revenues for use by DWM and for payment in lieu of taxes to watershed communities that are hosts to state-owned lands

(Source: MGLA Ch. 372, Sec. 113)

The enabling act originally specified a 50 percent reimbursement figure which the legislature increased to 75 percent in January, 1990. The state considers this figure appropriate compensation for the MWRA to pay in recognition of the benefits it receives from the DWM's continued delivery of clean water to its supply reservoirs.

In summation, establishing dual-agency management of the water supplies was motivated by genuine concerns about land management accountability as well as more questionable motives of retaining legislative percs within the legislature's control. Whatever the motivation, watershed management responsibilities received inadequate

consideration in the drafting process. An organizational structure emerged that holds implications for successful compliance with the SDWA's watershed protection plan directive. Should conflict impede their interaction rather than encourage creative solutions to the protection problem, the water system may require construction of costly filtration facilities.

The following chapter provides an outline of interorganizational and conflict theory to identify potential dysfunctional areas of interaction that may inhibit the DWM and MWRA from acting in concert to produce a plan.

CHAPTER 4

ORGANIZATIONAL PROBLEMS:

THEORETICAL FRAMEWORK

This chapter introduces the theoretical framework derived from the field of interorganizational relations (IOR) and conflict theory which provide a basis for assessing the effectiveness of DWM and MWRA in protecting watersheds. One of the chief applications of these literature fields is the acknowledgement of interdependency between organizations and the need to consider the types and degrees of ensuing interactions when designing such systems (Bozeman and Crow 1986).

IOR theories are appropriate for this case study, because they address service delivery and the nature of the system that delivers the services--in this case, protection and delivery of safe water to end users. Service costs and benefits to the public also raise the issues of power and operational tensions that exist between organizations in attempts to expand their power base (Turk 1970). An outline of the theory's basic precepts includes external influences, resource dependence and exchange, autonomy, power, and conflict.

Open versus Closed Systems. Organizations are social units deliberately constructed and reconstructed to seek specific goals (Etzioni 1964). Early theory viewed the organization as an autonomous unit--a closed system--that flourished or failed on the actions taken within its own structure. This was replaced by an open-systems interpretation which acknowledged that an organization's internal workings are affected by the external environment (Litwak and Hylton 1962, Etzioni 1961). An open system focuses on a population of organizations in interaction with its environment, thus implying external influence on internal organizational operations or an exchange of resources with its environment (Negandhi 1975). This definition applies to the DWM/MWRA interaction, because neither of these agencies can act independently of the other. The DWM relies on the MWRA for a portion of its operational costs and the MWRA depends on DWM to manage water supplies in compliance with water-quality standards. Open systems analysis is the basis for moving out of the internal operations of the organization to view organizations in a larger social system perspective, thus introducing the idea of environment (Negandhi 1975).

Environment. The open-systems method relies on the concept of environment as its main analytical determinant. This approach is based on the contention that factors external to the internal operations of an organization play

a crucial role in what happens to a particular organization and introduces the idea that groups of organizations could be treated as a system (Hall and Clark 1975).

In this case study, both agencies are closely linked by shared goals, yet are also affected by the actions of an external player, the state legislature. Inclusion of the legislature's external influence is essential in analyzing DWM's and MWRA's association, because the legislature ultimately controls them both. If an organization is affected by and adaptive to its larger external environment, then to understand how an organization interacts with other organizations, one must examine external environments as the primary determinant of behavior (Pfeffer 1982).

Resource Dependence and Exchange. Resource dependence and exchange theory is an important consideration in analyzing the Boston case study. To establish that the DWM and MWRA are closely linked in actions and goals, the types of resources they share must be examined.

Pfeffer (1982) introduces the concept of resource dependence between and among organizations, thus connecting external influences and resulting resource exchange. Generally defined, resources are the "...means or facilities, that are potentially controllable by social organizations, and that are potentially usable--however indirectly--in relationships between the organization and its environment" (Yuchtman and Seashore 1967: 900). Four

types of resources include personnel, information, products and services, and operating funds. The DWM and MWRA are involved in exchange and receipt of all these four types.

Because organizations are not self-sufficient, they seek exchanges with other organizations that can provide needed operational resources. Organizational exchange "...is any voluntary activity between two organizations which has consequences, actual or anticipated, for the realization of their respective goals or objectives" (Levine and White 1969: 121). In order to obtain needed operational resources, organizations develop interdependencies with other organizations that can offer required resources (Evan 1965). Chapters 5 and 6 discuss in detail the interdependencies and resource exchanges that occur between the DWM and MWRA.

Conflict and Cooperation. Because the Boston case study focuses on the extent and results of cooperation and conflict, it is helpful to explore the underpinnings of these principles.

Early studies tried to differentiate between intra- and interorganizational situations solely on the degree and type of conflict identified. Litwak and Hylton (1962) assumed conflict between organizations as the norm and stressed the need to examine social interaction under conditions of unstructured authority. Conflict as an inherent characteristic of organizational interaction is attributed

to professional resistance, bureaucratic restraints, and diverse political mandates (Weiss, 1981). If an organization's main objective is autonomy and survival, cooperation threatens self-perpetuation.

Prior to accepting the assumption that cooperation is good and conflict is bad, one must to explore the effects of both on organizational relations.

> ...policy designers and advocates who seek improved performance through better cooperation must acknowledge the complex antecedent conditions necessary for cooperation to take place. Such analysis precedes the question of whether cooperation actually improves policy outcomes (Weiss 1987: 114).

Just as organizations interact within a system open to the influences of external environments, the conflict that characterizes such interaction is also part of a general social system (Boulding 1964). The resource dependencies that develop between the DWM and MWRA imply varying degrees of cooperation and conflict in actual interaction situations. Cooperation is evident when environmental constraints on an organization's growth lead to interdependencies and symbiotic relationships. This cooperation occurs for several reasons, including (1) shared common goals and a similar interpretation of problems facing organizations, and (2) the desire for domain expansion that results in interdependencies (Aiken and Hage 1968). Other theorists (Miller 1958; Olson 1965; Warren, et al 1973) see cooperation only as a vehicle for organizations to

gain advantageous bargaining positions and autonomy. They contend that cooperation is not the norm in resource exchange; rather, interorganizational relationships operate under conflicting internal tendencies, the realization of mutual dependence, and competitive interests--often resulting in conflict (Weiss 1981); and that cooperation occurs when individuals (or groups) are forced to do so. Cooperation occurs in the DWM/MWRA relationship and will be analyzed in the following chapters in the context of the above theory.

Conflict--characterized by antagonistic relations--can occur when: (1) organizations interact if there are overlapping domains[48], (2) a competition for public funds, or (3) ambiguous boundary definitions due to legislative drafting making organizations anxious about their boundaries and conserving or expanding their domains (Aikens and Hage 1968). DWM and MWRA interaction is influenced by all three of these factors.

In instances where cooperation is legally mandated, the costs of cooperation (in terms of time, income, and staff) present a natural impediment to smooth implementation. Mandated interactions involve laws or regulations that detail domains, information, and/or financial obligations (Turk 1973); and the interactions that ensue tend to be more intense and imbalanced in favor of one organization over the other (Aldrich 1976).

Even when cooperation is desired by the interacting organizations, it requires specific procedures to coordinate information, programs, and planning resources (Weiss 1981).

> Passing laws that prescribe cooperation may be an exercise in futility unless those asked to cooperate see it as a real solution to real problems, have the resources to devote to cooperation, and can muster the institutional capacity to implement a cooperative program (Weiss 1987: 114).

For example, in the DWM's and MWRA's enabling act, legislation structures the symbolism of cooperation, but provides no guidelines for effective implementation.

Both positive and negative results are attributable to conflict. Positive aspects of conflict include showing conflicting parties the extreme negative effects of continued conflict, such as organizational ineffectiveness or potential injury (Simmel 1955). Negative aspects include a lack of creativity (Bisno 1988) resulting in an organization that is characterized as 'chronically defeated' by power imbalances resulting in increased bureaucracy (Shepard 1964). Table 4.1 lists additional benefits and drawbacks of conflict.

The DWM/MWRA interaction generally exhibits the negative consequences of conflict, because the motives for competition are not to produce the most creative watershed protection plan, but to gain jurisdictional control of state-owned watersheds. This finding is discussed in detail in the analysis in Chapter 5.

TABLE 4.1: CONFLICT: POSITIVE AND NEGATIVE CONSEQUENCES OF CONFLICT

POSITIVE	NEGATIVE
• Necessary social changes (such as attainment of a more just society)	• Physical or psychological injury
	• Interference with reasoned problem-solving
• Development of a sense of solidarity among members of group engaged in conflict	• Rupture of social relationships
• Emergence of creative ideas	• Escalation of differences into hardened antagonistic positions
• Formulation of new policies, procedures and services	• Increased hostility and misperceptions
• Reformation and renewal of organizations and their programs	• Emotional exhaustion
• Heightened enthusiasm and purpose among the conflicting participants	

(Source: Bisno 1988: 45)

In the recommendations in Chapter 6, the potential for conflict management resulting in positive consequences of conflict is explored. In order to derive the benefits of conflict, conflict management techniques must be employed (Boulding 1964: 138-144). Conflict management can be considered successful if there exists a mechanism to detect conflicts that approach the boundary of pathology and steer the interaction away from that edge. Boulding identifies two types of mechanisms, unilateral and organizational. The former occurs when one party deliberately manipulates its responses to control mutual equilibrium. The latter is more political and involves the institution of government and laws to encourage behavior away from conflict. (Refer to Appendix B for a description of Boulding's dimensions of conflict management).

Dimensions of Interorganizational Interaction. Marrett, in her classic work "On the Specification of Interorganizational Dimensions" (1971), provides structural dimensions against which to assess interorganizational interaction and ensuing conflict. In this work, she explores the origins of conflict and potential avenues to cooperation among organizations sharing similar activities.

Marrett isolates five possible dimensions for analysis of an organization including: (1) Interorganizational properties, (2) Comparative properties, (3) Relational properties, (4) Formal contextual properties, and (5) Non-

organized contextual properties. (These dimensions are outlined in detail in Appendix C).

The following analysis of DWM and MWRA interaction relies on comparative and relational properties, which compare organizational attributes and explore the network of linkages between organizations to determine areas of conflict and cooperation. These two types of properties consider structural traits, similarity of characteristics, and the nature of linkages between organizations.

Once the dimensions of interorganizational analysis and exchange are identified, the extent and intensity of interaction between DWM and MWRA can be assessed and analyzed.

The following chapter presents findings of conflict and cooperation and analyzes them in the historical and descriptive context of the last three chapters. Determining the extent and type of conflicts that characterize the DWM's and MWRA's interaction will shed light on their ability to work in union to protect watersheds, the potential of which is offered in Chapter 6.

CHAPTER 5

COOPERATION AND CONFLICT: RESEARCH FINDINGS AND ANALYSIS

This chapter presents the results of the interviews and analyzes them in relation to interorganizational and conflict theory. The cooperative areas are identified and assessed first, followed by the conflicting relations and their analysis.

COOPERATION

Memorandum of Understanding

After the legislative conference committee voted on the Act and avoided a court takeover of the sewer system, the task fell to the personnel of the MDC and the MWRA to define their new relationship. This was accomplished by a committee comprised of agency representatives that organized the transition and defined the boundaries of the new entities. Both parties almost immediately in their relationship acknowledged interdependencies and officially sanctioned them in a legal agreement. Using the legislation as a guide, the committee drafted a Memorandum of

Understanding[49] (MOU) and established monthly meetings held at alternating or neutral locations.

The MOU constitutes the formalization of relations between the two agencies and symbolizes cooperative action by providing a forum for interaction. But cooperation that occurs is largely due to the presence of former MDC staff in the MWRA, and not to the MOU's substantive guidance. Cooperation evidenced in the DWM/MWRA interaction is attributable to the presence of former MDC employees in key positions at the MWRA Waterworks Division and their continued reliance on current MDC personnel with whom they worked before the reorganization in 1985.

The important role served by this personnel structure is illustrated by the manner in which MDC staff transferred to the MWRA and the effects of this process on resulting conflict management.

Staff from both agencies report that personnel transfers from the MDC Water Division to the MWRA were based on two contradictory criteria. The first criterion is the nature of the job; those employees whose duties included watershed management were expected to remain in the MDC while all other Water Division staff moved to the new authority. The second basis for transferring to the MWRA involved personal preference of the individual employee for one agency or the other.

Interaction Resulting from the Formal Agreement. Staff at both agencies report that the monthly interagency meetings are a vehicle for confronting tensions and that agendas often identify and address issues of conflict. If the dispute is one which the two staffs can not resolve cooperatively, the issue is referred to the division heads of the DWM and MWRA who settle such conflicts in private conference.

This conflict management technique worked well in the initial stages of organizational relations. A former MDC employee became the MWRA's Waterworks Division Director and continued to work with his former supervisor to implement the MOU and effect the transference of personnel and property to the new authority.

Cooperative relations were most evident when the current MDC Commissioner was DWM's director, because he and the current MWRA Waterworks Director enjoyed a close personal relationship that they easily applied to their new professional roles. MWRA staff assert that cooperation was more common when the interaction relied on the successful previous working relationship, but that this smooth interaction deteriorated when a new DWM Director assumed division operations. Despite this critique, MWRA staff acknowledge the staffing and funding constraints under which the new DWM director must operate. There is an appreciation for the difficulties under which the MDC works. The

personnel overlap at the MWRA exists today--numerous former MDC staff are now employed in the MWRA Waterworks Division--and is the common thread that binds the DWM and the MWRA. The importance of personnel overlap, as opposed to the MOU's procedural structure, as a basis for cooperative interaction is further illustrated by an analysis of the 1985 MOU's contents and a further comparison of this original and its 1989 revision.

Analysis of 1985 Original MOU. The general features of the two MOU versions are presented in Table 5.1, which summarizes the major points of the first MOU and identifies areas of change between the 1985 and 1989 agreements. The 1985 MOU acknowledges the lack of legislative direction in the enabling act, but does little to design procedures to address potential conflicts arising from this omission. This version stresses avenues by which the two organizations would settle disputes if an agreed-upon solution could not be reached in bi-monthly meetings. The first MOU states that cooperation is desirable and suggests that effectiveness must be carefully monitored; but other than a mutual acceptance of dispute resolution procedures (which occur after conflict has occurred), it provides limited additional guidance on interaction beyond a physical distribution of properties.

Table 5.1: DWM AND MWRA MEMORANDUM OF UNDERSTANDING COMPARISON BETWEEN 1985 AND 1989

1985	1989 Change
1. General Matters	
• continued need to cooperate in interpreting Act and monitoring the effectiveness of the division of responsibility	• communication an essential element to cooperation • jointly review MOU at least once every two years • clarifies the daily decision-making authority, allocates it to field staff
• bi-monthly meetings for the first year	• monthly meetings
• acceptance of dispute resolution procedures	
2. General Nature of the Interaction	
• MWRA has rights to use and improve the real property of the waterworks system and the right to list them as assets for accounting purposes and abandon if not needed	
• agree on transferring MDC staff functions to Waterorks	• more detail on the DWM's responsibilityfor real property: structural and operational integrity of dams and bridges; spillways for flood control; O/M for ponds, lakes, and streams in the watersheds • inclusion of a chart for parties to agree on responsibility for policy and operations

(Table 5.1 continued)

1985	1989
3. Intent as to Future Contingencies	
	• specifically directs DWM to eliminate activities in the watersheds that may lead to filtration; if impossible to eliminate, charge fees to recover the costs such activities impose on the MDC/MWRA system
4. Division of Functions	
• MWRA responsible for pumping and distribution; planning; engineering and construction management	• DWM responsible for regulating reservoirs, determining safe flow and withdrawl from reservoirs. Consultation with MWRA in determining if a water shortage condition exists
• development of written policies and procedures to be followed during wet weather and floods to enable MWRA to determine the amount of water above statutory requirements to be discharged through MWRA waterworks facilities	
• allows MWRA a right of inspection to ensure that its policies are being followed	
• DWM has exclusive rights to the power generated, except that the MWRA is credited with all the revenues derived from the hydroelectricity	
• MWRA assumes responsibility for completing the EIR 2020	
5. Planning Liaison Officer	
• creates a liaison position between the DWM and MWRA; planning liaison officer will be notified of all relevant meetings of the MWRA Board and its member committees, and shall be consulted during design and execution of environmental water needs studies	
• guarantees the liaison substantial involvement in long range planning and full involvement in design, review, and evaluation of all water supply studies, including public participation	• removed from the 1989 version

(Table 5.1 continued)

1985	1989
6. Draft Capital and Operations/Maintenance Budgets	
• agree to share copies of draft capital and O/M budgets in manner that allows for timely review	• more detailed agreement by MDC to submit its budget at the earliest point in the fiscal cycle to allow MWRA to draft comments to EOEA secretary • MWRA agrees to support budget requests that come before the legislature that deal with funding maintenance and improvement of the watersheds • defines specific DWM responsibility for the Rutland-Holden sewer; entering into agreements with local communities, approving connections, providing all capital improvements • MWRA will operate and maintain the Rutland-Holden lines
7. Facilities, Inspections, Maintenance	
• when MWRA exclusively uses state-owned buildings, will pay for maintenance and repair • MWRA and DWM have the right to inspect the records and facilities of the other party that pertain to one or the other's successful operations	
8. Regulatory Authority	
• MWRA has exclusive authority for permits and rights-of-way	• MWRA is the controlling agency in terms of property disposition

Note: The Planning Liaison position was contractual and has been eliminated

Source: Joint Memorandum of Understanding, DWM and MWRA, 1985 and 1989 versions

Comparison to 1989 Revisions. As illustrated above, DWM and MWRA interaction is characterized as situation-specific conflict management based on personnel attrition from the DWM's predecessor to the MWRA. The revisions made in the second MOU reinforce this observation. Although four years passed between the first and second MOUs, the revision exhibits limited reflection on lessons learned during that period. Both versions espouse the virtues of cooperation and communication without instituting guidelines for interaction beyond dispute resolution procedures should an impasse occur.

Although dispute resolution and a commitment to open communication characterize the two versions, the changes in the four years of operation are specific examples of conflicts that the original agreement did not address--and not a new procedure or implementation of an existing one to foresee future conflicts.

The changes in the 1989 version are clarifications of former conflicts, not additional procedures to manage conflict; they pertain to general planning needs--including maintenance, management, and ownership of real property. The changes specify the two organizations' roles in managing the water supply and distribution system, particularly in those areas where there is no neat boundary between the operational jurisdictions of either organization, such as the sewer-line maintenance (normally an MWRA function)

within the watershed boundaries of DWM's jurisdiction. As shown in Table 5.1, specific changes include detailed clarification of management and decision-making responsibility and reduced influence of the Planning Liaison Officer.

For example, under Draft Capital, and Operations and Maintenance Budgets, the 1985 agreement to share financial information is clarified in 1989 regarding timely submittal, support for legislative budget requests, and DWM responsibility for sewer line capital improvements. The DWM/MWRA liaison position undergoes reduced influence between the first and second versions with the removal of substantial involvement in planning, review, and evaluation of all public water-supply studies. In an agreement as formalized as that of the DWM and MWRA, an intermediary or liaison position is expected to exist (Marrett 1971). The 1985 original MOU provided such a coordinator position and gave it broad jurisdiction in both organizations (Refer to Table 5.1).

Between the 1985 and 1989 MOU versions, the power of the coordinator's position was reduced and the position was recently eliminated. Staff at the DWM relate that the position was once necessary due to a need to define personnel roles during the transition and to smooth out early personality differences and "bickering" resulting from

jealousies over salaries and prestige associated with working at the MWRA.

Cooperation Analysis. The assumption that the MOU is a vehicle for cooperation that results in design and effective implementation of watershed protection policies is incorrect. This is explained by two factors. First, cooperation is accepted and encouraged by DWM and MWRA as an organizational precept, but it does not characterize the agencies' actual interaction. Second, while the MOU is an important tool in encouraging interaction[50], it accomplishes this by documenting conflicts after they are resolved--and not by identifying potential conflict situations and managing them to produce creative solutions. These two factors account for ultimately ineffective watershed protection, because agency association focuses on organizational power struggles rather than on pooling resources to produce the best possible water-quality protection plan.

A formal agreement, as an attempt to interpret interaction in a cooperative manner, must produce specific procedures that address coordinated action; but in attempting to foster cooperation in pursuit of a common goal, the DWM and MWRA must also address the primary goal of any organization--self perpetuation and autonomy. Organizations naturally pursue two tendencies--resisting change and maximizing autonomy and survival.

The specific nature of the changes between the MOUs should not be interpreted as a failure to address complex agency interaction; rather, these changes correspond to the contention that the above organizational processes inherently impede cooperation and coordination (Weiss 1981). The changes from 1985 to 1989 reflect a balancing act between encouraging cooperation and maintaining organizational identity. The interaction that results is vague and supports Marrett's contention that the more formalized an agreement is, the more an organization's autonomy is reduced. If the MOU were too specific in terms of cooperative responsibilities, either the DWM's or the MWRA's autonomy would be reduced, because it would be bound to a specific code or action. Dispute resolution procedures focus on preventing a breakdown of any relations at all while still leaving interpretive grounds for daily interaction.

Staff from both agencies support interaction as an essential element to fulfill their mandate, but they assert that the MOU, while serving as the formal guide to interaction, is not the only or most important method. This is supported by the fact that the 1989 revisions emphasize specific substantive issues as opposed to procedures for encouraging cooperation, including the reduced influence of the planning liaison position and cancellation of the position's contract.

The MOU advocates open communication during impasses and offers clarification on previous specific disputes, but the MOU is most effective in reacting to conflict situations rather than anticipating them. It serves as a working document that is still addressing a division of responsibilities that was not addressed in the enabling legislation and divides responsibilities without designing procedure to address conflicts.

Although the legislature simultaneously created the two entities and afforded them overlapping missions, it did not mandate cooperation or provide a process. It assumed that cooperation would naturally follow, but it did not. As a result, the MOU serves as a medium for continuing to define jurisdictional rights and duties without including a complementary process for discussing watershed protection needs.

CONFLICT

Despite the MOU agreement, conflict more accurately characterizes the interaction between the DWM and the MWRA. Through extensive interviews with personnel from both organizations, two major categories of conflict emerge, structural and philosophical.

Structural

The first, structural, is further broken down into (a) institutional structure, which is exemplified by comparing the differences between a public enterprise and a public agency, and (b) physical structure, which is defined as the infrastructure of the supply and delivery systems.

Institutional. Institutional structure, which refers to the organizational design of a service-delivery agency, affects interaction between the DWM and MWRA. In this case, the two entities charged with management responsibility for Boston's water supplies have differing organizational structures; the DWM is a public agency and the MWRA is a public authority. This structure complicates the current interaction process, causing tensions that pervade every aspect of their association.

As a public agency, the MDC is dependent upon the state legislature for funding all of its operation and maintenance activities and is subject to competition among other public agencies for increasingly limited state funds.[51] As discussed in Chapter 3, the MWRA's creation was based on the state legislature's history of recalcitrance in funding needed water and sewer-system upgrades, resulting in near failure of the system.

Insufficient allocations to MDC are reflected in the MWRA's structure; a public enterprise's ability to finance capital projects independently was seen as a way to effect

the upgrade of greater Boston's wastewater treatment facilities without interference from partisan politics.

As a public authority, the MWRA is not subject to the financing constraints of a public agency. Despite the fact that authorities are legislative creations, they maintain relative political freedom from policy intervention in their exercise of fiscal authority. Public authorities differ from public agencies in that they raise capital from private investors through the money and capital markets to invest in public facilities and services and need not compete with other public agencies for state monies. Authorities have the dual advantage of "...access to private finance capital without dependence on venture capitalists, SEC registration statements, or mortgage conditions" (Walsh 1980: 210).

Public authorities have been described as "...hybrid creatures, possessing some of the characteristics of private firms and some of public agencies. They are corporations without stockholders, political jurisdictions without voters or taxpayers" (Walsh 1980: 4).

While the MWRA exercises independence in financial decision making, the DWM relies on legislative largesse. Conflicts in this arrangement occur due to the continued underfunding of the DWM resulting in its inability to fulfill its protection mandate and legitimate its legal jurisdiction. This issue has become particularly important due to DWM's role in preventing filtration of Boston's water

supplies. The DWM exists solely to manage the watersheds; but if it is unable to protect them adequately and a filtration facility is constructed, the DWM's reason for being will no longer exist. What need is there to fund a watershed protection agency when the water supplies are no longer protected from contamination, but are rather treated after degradation occurs?

DWM staff cite financing inequities as the main source of conflict in interaction, and staff feel hindered in the execution of their mandate by two factors: (1) the reliance on the state budgetary process to determine the dollar amount spent on the Division each year and (2) the fact that the MWRA reimburses the state for DWM's legislative allocation.

MWRA personnel also cite the funding arrangement as the major conflict but for different reasons, including: (1) financial responsibility without decision-making responsibility, and (2) additional MWRA funding for watershed-related programs beyond the required state general-fund reimbursement.

In addition to transferring water-supply responsibilities from the MDC to the MWRA, the enabling legislation stipulates that the MWRA reimburse the state for its appropriations to the DWM's operations and maintenance costs. The enabling act originally specified a 50 percent reimbursement (MGLA Ch. 372, Sec. 113) which the legislature

increased to 75 percent in January 1990. The state considers this appropriate compensation for the MWRA to pay in recognition of the benefits it receives from the DWM's continued delivery of clean water to MWRA's distribution system.

The MWRA is opposed to paying the 75 percent state reimbursement with no resulting policy input into decisions made about the watersheds. In addition, the MWRA staff express dissatisfaction that these funds are still subject to the legislative allocation process; even if MWRA wanted to initiate an independent funding arrangement with the DWM, it can not do so. Although MWRA reimburses the state for 75 percent of DWM's costs, neither the MWRA nor the DWM can independently change the legislatively mandated amount.

In addition to the required reimbursement, the MWRA also funds watershed-management program costs through its own budgetary process. The MWRA has in the past or is currently funding projects that pertain to watersheds, but which the DWM is unable to finance due to budget reductions. For example, MWRA is funding entirely the consultant's costs for the preparation of the Watershed Protection Plan to be submitted to the Department of Environmental Protection (DEP) in January 1991.[52] Although the DWM agrees to "consult" with the MWRA on watershed policy decisions, it remains unclear whether or not the MWRA's acceptance of the

full costs of hiring the consultant constitutes access for the MWRA to watershed decision making.

DWM's limited budget also results in staff reductions which translate into an inability to perform maintenance functions. For example, routine grounds maintenance at Sudbury Reservoir field office is performed by MWRA personnel although it is in DWM's jurisdiction.

Despite the conflicts on the financing issue, both organizations consider it beyond the control of their interaction. Staff from the DWM and the MWRA unanimously cite insufficient legislative allocations as the cause of DWM staff reductions. These staffing cuts prevent the DWM from fulfilling its mandated goal to provide safe water supplies to the MWRA.

The differences in organizational structure also result in the DWM comparing its finances to those of the MWRA, rather than to another state agency. Also, the DWM personnel choose the MWRA as the object of their funding frustration more so than they do the legislature. This frustration is not targeted at other state agencies, possibly due to the similarity in the type of service functions of DWM and MWRA. At any comparison in time, the resource gap between the DWM and MWRA would be evident, but the state's present economic shortfall makes it more glaring at this time.

Finances pervade much of the conflict described in the remainder of this chapter, specifically the jurisdictional conflicts, and the funding issue will be discussed as it pertains to ensuing sections of the thesis.

Physical Infrasructure. A second type of institutional structure that accounts for conflict between the two entities is the system's physical infrastructure. When the engineers designed and constructed the water system, a single agency operated and maintained the supply and delivery infrastructure. The 1985 agency split resulted in dual management of these functions for the first time in Boston's water utility history. Although the transition team that drafted the original MOU attempted a division of properties and responsibilities for each organization that would be implementable, the operational results have not fulfilled early expectations of a simple delegation of responsibilities. This is best exemplified in the conflicts resulting from split responsibility for water-quality monitoring in the watersheds and the distribution system.

Water Quality Testing. Water-quality monitoring best exemplifies physical- structure conflicts because, under the current organizational structure, sampling must be done separately for the water supply and delivery systems--even though the water quality that is eventually received in the distribution system is dependent on the monitoring practices in the watersheds. Despite the fact that the actual water

quality laboratories were allocated to either the DWM or the MWRA, this issue still creates tensions, because the two agencies must individually sample for contaminants and share this information with the other.

The water quality labs had been built for a single-system operation; but when the management split occurred in 1985, there was no systematic approach as to which agency received which water quality facility. MWRA, according to a DWM staff person, did not want Quabbin but did want Southborough due to its ability to monitor the entire distribution system from that point. DWM received Wachusett and Quabbin laboratories. The conflicts that ensued over this issue are due to the complexity of dividing management of the reservoirs and watersheds from the delivery system. When the legislature restructured the management agencies, the DWM and MWRA divided responsibility for water-quality monitoring along geographical lines. The DWM is responsible for monitoring in the streams and reservoirs of the combined system and for conducting sanitary surveys of the watersheds. DWM monitors upstream of the distribution intakes which are the Cosgrove Aqueduct (at Wachusett Reservoir), Winsor Dam (at Quabbin Reservoir), and Shaft 4 (Sudbury Reservoir). MWRA monitors in the distribution system and at the tributaries and reservoirs of the Sudbury watershed and the Chicopee Valley Aqueduct (at Quabbin Reservoir).

Operation of water-quality laboratories is a crucial component of the eventual watershed protection plan due to the SDWA's monitoring requirements for listed contaminants and the Environmental Protection Agency's (EPA) assumption of public water systems as a single supply and delivery unit. According to a DWM staff member, there are two stages to the plan's preparation:

1. Identification of pollution sources in the watershed

2. Development of the policies to address these pollution sources

Most staff at both the DWM and MWRA believe that water-quality testing will be the least problematic area of interaction in the production of a watershed protection plan. The standards are set, and it matters not who sets them; both the DWM or MWRA must comply with routine analytical procedures required by the DEP and EPA.[53]

Although several MWRA staff members criticized the DWM for its monitoring techniques and for focusing on Quabbin water quality to the exclusion of the MWRA's eventual distribution needs, the underlying conflict lies in the dual management of a system considered as a single operating unit by the EPA. The conflicts resulting from this arrangement are attributable more to the uncertainty caused by unclear delineation of responsibilities and a lack of coordination on submitting data than to conflicting testing methods.

Rather than to acknowledge the limitations imposed by this physical structure, several personnel from both agencies frame the conflicts as operational-management issues. The conflicts expressed by DWM personnel can be attributed to dissatisfaction that the MWRA received the Southborough facility, which had just been completed at the time of the reorganization.

Although conflicts between agencies can produce creative solutions that no single organization could individually design, the debates about water-quality testing do not lend themselves to this interpretation. Redundancy and overlap of testing procedures could ostensibly lead to better performance due to idea-sharing and creative solutions but in this case--where the overlap involves submitting standardized test results of identified contaminants--redundancy translates into unnecessary bureaucracy. The conflict is a direct result of splitting responsibility for monitoring contaminants in the watersheds from that of the delivery system. If the EPA standards are to be met, DWM and MWRA must either coordinate water quality testing better or more specifically designate locational responsibility for testing.

Operational Philosophy

The second conflict category, operational, is epitomized by philosophical differences reflected in management style. These conflicts result in attempts by both entities to expand (MWRA) or retain (DWM) their operational jurisdictions.

Interorganizational theory predicts that organizations will cooperate when they share similar ideological goals. Although this initially appears to apply to the DWM and MWRA based on the legislative directive for DWM to manage watersheds to ensure delivery of safe water to the MWRA, their similar goals should not be confused with conflicting strategies to implement these goals. Any two groups united by ties of any kind, such as economic or political organization, are frequently observed to experience intense conflicts (Duke 1976), and the DWM and MWRA fulfill this expectation.

Jurisdictional. The first type of philosophical conflict is epitomized by jurisdictional disputes. Because the DWM and the MWRA share similar operational goals, they experience conflicts characterized by competition for jurisdictional control in the watersheds. Competition for jurisdictional control is reflected in the second type of philosophical conflict, disputes about policy operations and implementation. Competition over this issue is evident in

the perceived operation of the system and is characterized by differing philosophical approaches to system management.

The MWRA views the DWM as well-meaning and committed to watershed protection but limited in its vision based on historical expectations of underfunding and political intervention. The DWM is perceived by the MWRA as spending its time prioritizing what it should do rather than doing it. MWRA sees itself as visionary and capable of implementing its vision with action-oriented policies. This prevailing MWRA attitude is captured by one staff member as "A lack of progressive vision pervades much of what they (DWM) are doing", and another MWRA staff person identifies the DWM approach to watershed management as ..."vision limited by imagination versus vision limited by finances". MWRA staff assert that the DWM succumbs to political pressure to manage the watersheds and reservoirs more for recreational use than for the goal of water-supply protection.

DWM conversely regards the MWRA as the bureaucratic citadel lacking an emphasis on the aesthetic or human side of watershed management. DWM personnel see themselves as more emotionally attached to protecting watersheds, and they point to good local relations with watershed communities as evidence of this. The DWM's good relations with local communities is supported by observers outside the two agencies.

Safe Drinking Water Act Impact Study. Both jurisdictional and philosophical conflicts are evidenced in the Safe Drinking Water Act Impact Study completed for MWRA by a consultant in 1989.

MWRA staff declare that their agency recognized the far-reaching implications of the SDWA amendments much earlier than did the DWM, and that they acted on them in a request to the MWRA's Board of Directors for line-item funds supporting an assessment of the SDWA's impacts. MWRA staff contend that the DWM did not appreciate the need to respond promptly and proactively to the anticipated EPA rules. MWRA wanted the line item and hired a consultant to assess implications of SDWA on the authority.

MWRA staff are in consensus that they have a role in the watersheds based on their responsibility to construct a filtration facility if the SDWA watershed protection alternative cannot be met. One MWRA staff member characterized the intervention as applicable due to the SDWA provisions that specify the public water supplier to "own or control" the watersheds as one of the ways to get a waiver from the filtration component. The SDWA, as discussed in the Introduction, holds the public water supplier responsible for the water system from cradle to grave. MWRA interpreted the provisions of the SDWA relating to public water suppliers as a mandate for action and the portion of the study that dealt with watershed management resulted in MWRA

writing the scope for the watershed protection plan. Projects included mapping the watersheds, projecting capacity buildouts, and addressing private property land use.

MDC staff are incensed at what they construe as a territorial violation and reassert that DWM has primacy in the watersheds, despite what MWRA contends. DWM reacted negatively to the MWRA intervention in their jurisdictional sphere by clarifying that MWRA's jurisdiction is in transmission and delivery, not watersheds. DWM staff assert that MWRA, without regard for legislative intent, approached its Board of Directors with a request for funding to study the impact of the SDWA on the watersheds. DWM staff state that MWRA received funding without apprising the DWM and that DWM was consulted only when the SDWA impact study was completed. MWRA staff dispute this charge.

The DWM cites jurisdictional disputes second only to financing as a major source of conflict between the two agencies. DWM characterizes the MWRA as infringing on DWM operational and regulatory jurisdiction whenever possible, despite the fact that the MWRA possesses no legal mandate to do so. In addition to interaction with the DWM, the MWRA has privately lobbied legislative interests to consolidate watershed-management responsibility in the Authority.[54] No MWRA staff, however, raised this issue as a conflict.

Despite the fact that DWM reiterates its sole responsibility for watershed jurisdiction, it tolerates MWRA intervention in its domain due to the financial resources inherent in the MWRA's public enterprise structure. Although DWM perceives MWRA as expanding its domain into watershed jurisdiction, it grudgingly appreciates the additional monies MWRA targets for watershed management programs. DWM staff contend that the MWRA is a good source of money and that DWM will take advantage of it to accomplish a mutually beneficial and necessary objective.

DWM's willingness to depend on MWRA monies is tempered by the belief that MWRA will continue to expand its power base into DWM territory. This is illustrated by the MWRA's participation in site-plan reviews of development projects in watershed communities and establishment of personal contacts with parties to the proposed development. DWM asserts that this activity intrudes on DWM jurisdiction by going beyond the Massachusetts Environmental Policy Act review process.

The MWRA asserts that it engages in review because it is vital to approach watershed management comprehensively and consider land use policies on private land holdings as well as monitoring to prevent water-quality degradation. MWRA further states that it pursues this strategy, because the DWM provides only a checklist of items for the towns to consider in their review of development proposals.

MWRA acknowledges that the DWM has access to state funds for the purchase of critical lands, but MWRA asserts that even these critical purchases will not fully protect the sensitive watershed areas. In an acknowledgment that residential and commercial growth poses threats to water supplies, MWRA envisioned a working relationship with DWM to identify these critical areas.

The working relationship never materialized; rather, conflict based on jurisdictional disputes surfaced and the MWRA reassessed its intervention. This change is illustrated in the MWRA's program briefing on watershed management to its Board. In this document (MWRA Long Range Water Supply Policy Program 1987), the MWRA redefines a less comprehensive role for itself--from a leader in proactive protection strategies to one of assistance to the DWM in completing an environmental impact report for increased yield from watershed management.

Operational Management. Other examples of conflicts arise from differing views of operational management, including (1) recreational, (2) forestry, and (3) hydroelectric generation.

Recreational access. Recreational policy in the watersheds is one of the most important factors in the eventual approval of the joint DWM/MWRA Watershed Protection Plan, because it is politically charged. It is also the one area that the two organizations agree on philosophically,

but not operationally. Both agencies assert that allowing the current recreational access to the watersheds to continue will jeopardize DEP and EPA approval of a watershed protection plan. This is corroborated by both DEP and EPA personnel, who assert that in reviewing the eventual plan, they will closely assess any recreational access to the watersheds.

Although there are several examples of philosophical conflicts over recreational policies, sports fishing regulations at Quabbin Reservoir best illustrate the issue. (Refer to Appendix D for general recreational access at Quabbin and Ware River watersheds). Current policy[55] allows rental[56] of motor boats of up to 20 horsepower at Quabbin Reservoir, an increase from the previous seven horsepower. (Refer to Figure 2.2 in Chapter 2 for boat launching sites.) DWM staff concede that allowing the present recreational uses to continue will jeopardize acceptance of the eventual protection plan by DEP/EPA, but they feel incapable of reducing uses due to political pressure from interest groups (particularly sportsfishers) and local legislators.[57]

MWRA staff also disagree with current motor boat policy at Quabbin Reservoir and cite increased usage as a sign of former MDC inept management and current DWM lack of political will to accomplish passive use guidelines. MWRA staff allege that the DWM is a victim of the MDC's historically low expectations for agency performance and is

programmed to concede to political pressure resulting in an inability to protect the watersheds adequately. MWRA staff contend that they, as a single purpose agency, would institute much stricter controls on human access in the watersheds. Staff from both the DWM and the MWRA agree that the MWRA's watershed strategies should be more single purpose, but opinions varied when citing the reasons for this.

Most MWRA staff assert that their agency is better suited to address the recreational issue, because they are more concerned with water quality than is DWM. In their opinion, the agency structure of the DWM forces it to accommodate multiple uses that are not supportive of MWRA's primary goal, delivering safe water to its users. They contend that DWM treats recreation and wildlife issues as a priority rather than as a secondary use.

Conversely, DWM interprets MWRA's single-purpose status as a liability--that the single purpose of the authority is to comply with court-ordered sewerage issues, not water-quality protection. Although the DWM must consider recreational and wildlife issues as well as water quality in its mandate, it contends that giving watershed stewardship to a separate division in a public agency is a better management practice than allowing watershed concerns to be subsumed in the MWRA's large sewerage-focused bureaucracy. DWM staff contend that if the MWRA supervised watershed

activities, the needs of publicly-owned lands would be sublimated to the primary concern of the authority--the Boston Harbor clean up. DWM also cites the MWRA's lack of local presence in the watersheds as a reason for the authority's imminent failure in managing recreational policy better than DWM does currently.

Forestry. The DWM and the MWRA also diverge on appropriate forestry-management practices. MWRA staff assert that DWM manages the watershed forests for the profit value of timber rather than as a natural filtration technique. The MWRA claims that the DWM favors cutting oak rather than pines for the market value of oaks, and that DWM is pressured to do this to compensate for consistent underfunding. The MWRA also charges that clear-cutting practices result in sapling growth which attracts deer.

DWM staff contend that the MWRA and other opponents to this issue prefer no management at all and are unaware of the principles of silviculture. In response to the claims that oak is preferred as forest cut for its market value, DWM contends that it manages the forests to: (1) diversify the species and age classes of trees, (2) increase water yields, use trees as natural filters for contaminants, and (3) diversify wildlife habitat.

DWM also states that forestry management issues have changed in the past 20 years and the land is now in need of reforestation due to losses from storms, wind, and acid

deposition. In the past, when deer ate the seedlings, the problem was not significant because the forest was not that old and deer were eating undergrowth. The problem is not that there are so many more deer today but that the forest management needs are different.

Hydroelectric Generation Facilities. Operation of the system's hydroelectric facilities comprises a third example of contradictory operational philosophies resulting in conflict. Four plants are currently in operation, including Winsor, Oakdale, Southborough, and Wachusett. MDC maintains exclusive rights to the revenues and has sanctioned MWRA as the contractual operator. The DWM claims that MWRA operates the hydro plants at the expense of water quality by releasing water from the reservoirs in excess of that necessary to maintain water quality standards. One DWM staff person claims that the MWRA wants to reactivate Sudbury solely for the hydro power potential. This is disputed by the MWRA, which counters that if Sudbury were reactivated, all the head would be needed to feed the water into the Weston Aqueduct. MWRA claims that it treats hydro as an important secondary byproduct of water system management. The Authority attempts to quantify this to see if the cost of production is greater than the return from sales. They are now making a profit on it, so it is a viable secondary use.

MWRA claims that the dispute arises due to a new accounting system using avoided costs rather than average costs. MWRA contends that it keeps the records and transfers this information to the MDC, which sends bills through its treasurer to the power companies.

Conflict Analysis: Finances and Jurisdictional Control. The illustrations discussed above are all symptomatic of an organization's attempts to perpetuate itself. Although the DWM's and MWRA's operational boundaries are specified in the enabling legislation, financing inequities result in this statute serving as a guide for operations rather than as a rule. Conflicts between the DWM and the MWRA occur due to a struggle for jurisdictional and resource control characterized by the power associated with funding capability. This runs counter to observers' assumptions of a productive cooperative relationship and threatens the good working relationship necessary to produce and implement a watershed protection plan.

Finances. Interorganizational theory predicts that organizations with the most in common will have the least incentive to interact, because there are no unique resources one can offer the other. The DWM and MWRA relationship runs contrary to that hypothesis; their operational goals overlap, yet the two interact frequently. This is due to the financial relationship between the two organizations.

DWM and MWRA interact in an asymmetrical power relationship that is characterized by DWM dependence on MWRA financing resources. Resource exchange is mandated and unilateral; the DWM receives but can offer little in return. The statutory directive for MWRA to fund 75 percent of DWM's costs may initially have been a strategy to increase DWM's power base by reducing MWRA autonomy, but the result has backfired. Rather than solidifying independence for the DWM, it further reduced its autonomy by making DWM more dependent on the MWRA. DWM, as the weaker administrative unit, became dependent on the stronger unit, MWRA, that controls resources.

Interaction occurs in such a relationship to the extent that those in the group receiving benefits (DWM) pursue their goals through conflict oriented strategies. The relationship is characterized by conflict, and each agency wants to achieve its goal at the other's expense; but the DWM is externally constrained from expanding due to limited funds. The efforts that each organization expends toward maximizing its influence inhibits resource sharing in the production of a workable protection plan.

The DWM operates under the irony that it was created to be a steward of public land, yet is not given the resources necessary to perform its job. Despite elevating the status of watershed management activities by creating a separate division within the MDC devoted to stewardship of public

lands, actual protection policy is effectively as hindered as it was when watershed management had to compete for status within a larger MDC Water Division. This is due to two factors: (1) a symbolic recognition of the importance of watershed protection with subsequent decreases in appropriations and (2) dependence for financial support on the MWRA--the DWM's primary competition for jurisdictional control. Table 5.2 shows the amount of legislative funding for DWM from the agency's creation to fiscal year 1991.

TABLE 5.2: LEGISLATIVE ALLOCATIONS TO DWM 1985 - 1991: (1989 DOLLARS (*) IN THOUSANDS)

Fiscal Year	Legislative Appropriation	Annual Percent Change
1985(+)	3,100	---
1986	6,042	95
1987	6,613	09
1988	6,557	(01)
1989	5,730	(13)
1990	5,485	(04)
1991	5,185	(05)

(*) CPI 1989 = 100, U.S. Department of Labor, Consumer Price Index, 1982-1984 base)
(+) First year of water system's dual-management, represents partial fiscal year funding

Source: Massachusetts House 1 Budget Requests 1985-1991.

Even though the MWRA is actually reimbursing the state, the DWM's operational funding is still dependent on legislative discretion. The legislature increased DWM funding for the first two years of operation, but appropriations have decreased each year since 1987. This is

particularly problematic considering the 1986 Safe Drinking Water Act's watershed protection-plan option and the commitment of DWM, MWRA, and other environmental interests to qualify for this alternative. The difference between the rhetoric of effectiveness of a single-focus MDC division and the reality of decreasing funding is complicated by the DWM's ultimate reliance on it chief competitor, the MWRA, as the source of these funds. Whether watershed management responsibility remains separate from the delivery function or is eventually consolidated in one agency, continued insufficient funding prevents successful implementation of even an exemplary plan.

Jurisdiction. Although the MOU is a formal agreement and the financing arrangement is statutory, determining organizational boundaries has occupied and continues to occupy most of the DWM and MWRA's interaction. Interorganizational theory predicts that power issues are less problematic in mandated situations (Hall, et al 1977), because power is less easy to manipulate; but MWRA's financial independence overrides this assumption and challenges DWM's legal domain. This results in conflicts that jeopardize goal attainment of continued safe water delivery from unfiltered sources.

The MWRA interprets the financial reimbursement as the basis for claiming jurisdictional rights to watershed management. Despite having broad regulatory power in state-

owned land, the DWM is prevented from fully claiming the domain the legislature granted it because the legislature's act was symbolic, not substantive, due to a failure to reinforce the jurisdictional mandate with funding. The legislature is willing to expand the DWM's power base only indirectly by intervening in MWRA decisions, but not directly by increasing DWM revenues.

Ambiguous boundary definitions due to legislative drafting make organizations anxious about conserving or expanding their domains (Van de Ven, et al 1975). Although jurisdictional boundaries between the DWM and MWRA are specified in their shared enabling legislation, the resulting operational interpretation became a valid controversy because the two organizations share similar goals. Organizations attempt to differentiate themselves from other organizations with highly similar goals (Van de Ven, et al 1975), but DWM is prevented from claiming its domain due to a lack of resources.

The fact that DWM is dependent on the MWRA as the source of these resources makes it more difficult for DWM to assert its jurisdictional boundaries. Because, if DWM funding is to increase and legitimate the agency, the legislature will most likely target the MWRA as the source, thus defeating consolidation of DWM power by giving MWRA more of a claim to jurisdiction through decision making.

DWM also suffers from an historical perception of the MDC as a haven for political patronage. Conversely, the MWRA (without any legislative mandate in the watersheds) is able to expand its boundaries to include those activities the DWM cannot implement, thus expanding its jurisdiction in attempts to solidify autonomy and guarantee self-perpetuation.

Results of Conflict. Does the tension between the MWRA and the DWM produce more creative approaches to watershed management or, because it focuses exclusively on expanding organizational influence, does it divert attention from the management issue? Conflict often produces more creative solutions; but in this case, the conflict produces disputes based on territorial challenges, not innovative action. For example, the two agencies are effectively in agreement on recreational policies in the reservoir's watersheds, but their interaction on this issue is conflictual. Rather than an association focusing on drafting the best protection policy possible, each agency counters the claims of the other that it alone is better suited to control watershed policy. The conflicts become tailored to bolstering the case for jurisdictional control and not to the production of a protection plan.

In interviews with representatives from the DWM and MWRA, it is obvious that both agencies are singularly focused on maintaining the water quality, but conflicts still occur for

jurisdictional control. The DWM struggles to establish an organizational identity and maintain its domain, and the MWRA attempts to increase its autonomy and expand its influence based on a mandated operational philosophy and the funds to implement programs.

The conflicts on recreation, forestry, and hydroelectric power generation result not so much from a differing perception of the needs and goals in watershed management as from the desire to control and direct the common interpretation of watershed management. Although staff identify conflicts as differing philosophies, the distinction is more a need to control that similar philosophy. While attempts to preserve or expand influence in the watersheds is characteristic of expected organizational actions, such maneuvering hinders the communication necessary to produce and eventually to implement a protection plan.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

As illustrated in the analysis of Chapter 5, conflict characterizes the relationship between the DWM and MWRA. While competition and conflict can produce positive results (such as innovative ideas and better service delivery), this does not occur in the Boston case study. Competition here produces conflicts that serve as release valves for antagonisms that have accumulated due to financial and jurisdictional disputes--not conflicts that produce an innovative protection plan. This results in competing organizations that are delivering services at less than capacity.

Despite this conflict and the lack of creative policy it produces, the DWM and MWRA will most likely interact successfully in the upcoming year to produce a protection plan. Although the liaison contract position was cancelled, the MWRA is hiring a consultant to prepare the plan--effectively substituting the consultant for an interorganizational intermediary. Relying on a consultant to draft the plan will reduce tensions between the DWM and MWRA; a third party will deflect jurisdictional animosity,

and hopefully deal fairly with the additional accountability questions which are sure to arise--whose views are represented in the eventual plan. Is the consultant serving the needs of the MWRA or the DWM, or both?

The conflict, therefore, will probably not prevent the short-term production and acceptance of a watershed protection plan that complies with the SDWA, but a plan's acceptance raises the larger questions of implementation. Both the Department of Environmental Protection and the Environmental Protection Agency will accept a protection plan that exhibits a good-faith effort to protect water supplies. Public water suppliers need not exhibit proof that the plan's components ensure compliance with the SDWA maximum contaminant levels or even that the water supplier is capable of implementing the plans. The true test of the extent to which the DWM's and MWRA's antagonistic cooperation will aid or impede successful watershed protection is in the plan's implementation.

This vital step will be problematic. This prediction is based on the type and extent of protection strategies that will be necessary for successful implementation. The MWRA's attempts to broaden the interpretation of watershed management to include land-use policies on private lands was received with animosity by DWM. The DWM responded to MWRA's reservoir risk assessment as an affront to its territory

rather than as an opportunity to protect adequately the watersheds.

In the best of worlds, the current DWM and its watershed management responsibilities would be absorbed into the MWRA. MWRA's track record of supporting innovative water programs is documented,[58] and it has the financial and human resources to institute innovative watershed protection strategies. In addition, the authority has exhibited a willingness to fund protection programs in excess of its legal requirements.

DWM's approach to watershed management stresses water-quality monitoring and does not incorporate private land use strategies in a protection plan. A DWM staff member states that the agency must "get back to basics" and institute monitoring techniques that were neglected in the MDC's former Water Division. This approach is admirable in its attempts to reintroduce and standardize monitoring and sampling for contaminants, but it is not the comprehensive approach needed to ensure water quality without filtration. In addition, such efforts concentrate on reacting to contamination once it occurs, not preventing it.

Furthermore, it is unlikely that the DWM will incorporate integrative management practices in its protection policies. Part of this can be attributed to funding and staffing shortages, but it is also due to placing more importance on

maintaining its tenuous claim to its jurisdiction than to protecting water quality.

Although watershed protection would be better served in a centralized system with the resources currently available to the MWRA, this will probably occur only under several scenarios. The first would be an environmental crisis similar to the Clean Water Act's wastewater treatment standards that galvanized an 11th-hour legislative response to Boston Harbor. The legislature is willing to provide the rhetoric of watershed protection, but not the dollars to make it a reality. If a crisis occurs, the legislators could transfer watershed management responsibility to the MWRA as it did for sewerage and most of the waterworks.

The second instance in which the system would be consolidated would be based on naturally occurring cycles in organizational growth and decline. At any point in time there will be multiple agencies performing the same service in the same area. Service delivery may actually be more effective with a single agency providing the service, but multiple agencies persist because social values--such as public accountability and serving the commonweal--favor overlap, and naturally occurring cycles of centralization and decentralization change slowly (Litwak and Hylton 1969).

But time is a luxury in protecting sensitive watersheds. While the creation of the DWM and its ensuing conflicts with the MWRA highlight the importance of watershed-management

practices, the Safe Drinking Water Act imposes a time limit to test both substantive and symbolic values of dual management by requiring submittal of a joint Watershed Protection Plan by January, 1991. Measurable environmental protection is especially pertinent in cases such as Boston, where limited state ownership of Wachusett watershed necessitates innovative protective actions in private land holdings. If protection of private lands can not be realized, the costs of non-productive conflict translate into the high costs of maintaining water quality via filtration. These costs are estimated at 300 million dollars and will most likely be borne by the Commonwealth, not just system users.

SHORT-TERM CONCLUSIONS AND RECOMMENDATIONS

The following are the conclusions of this thesis and recommendations to guide dispute-resolution procedure for the DWM/MWRA relationship. These recommendations are designed in consideration of the current dual-management structure and are confined to the short-term goal of drafting a plan acceptable to the DEP and EPA.

Memorandum of Understanding

Two summaries of the conclusions pertaining to the MOU follow:

1. Conflict Management Based on Personnel Structure. Cooperation, as embodied in the MOU, is more dependent on personnel overlap than in the inherent structure of the agreement. This works to the advantage of both organizations, for each can maintain its autonomy as long as the MOU language remains vague. If the MOU were to delineate too sharply a division of responsibility, the DWM and MWRA would be locked into a performance expectation that runs contradictory to an organization's attempts to perpetuate itself and maintain autonomy.

The MOU provides a vehicle for working out the division of responsibility that was not provided by the legislature. Broad statutory directives offer little concrete grounds for agency interaction, and the MOU provides the substantive forum for distinguishing domain as a result of incremental organizational conflicts.

In contrast, there are some negatives to this approach as well. The MOU, while serving as a forum for establishing domain, is not a mechanism for managing conflicts that arise. Conflict management is dependent on the presence of former MDC Water Division personnel in key Waterworks positions at the MWRA. Conflict management based on personal relations will not exist indefinitely. Both

agencies should be concerned that, through attrition, the personnel overlap will eventually disappear. Current MWRA staff from the old MDC regime will no longer bring that institutional memory with them, including a knowledge of the constraints under which DWM must operate. In time, the MOU will be looked to for guidance but will be unable to serve as a conflict-management tool; it will be capable only of providing the consequence of conflict--distinguishable jurisdictions--not the process for management.

An MOU stressing dispute resolution only after the conflict occurs will be inadequate, because watershed protection, like other environmental issues, is subject to a limited time frame in which to evaluate success. Land either must be purchased by a controlling agency or put under use limitations to ensure protection. Once a development project is approved, mitigation measures may be inadequate to maintain acceptable water-quality levels, thus jeopardizing an implementable watershed protection plan.

2. Legally-Mandated Cooperation. The MOU shows that interorganizational cooperation will not occur just because it is statutory or formally sanctioned. The MOU is a formal sanction of cooperation, but the preceding analysis shows that conflict is the norm. Other necessary preliminary requirements--such as an awareness of costs in terms of time, staff, morale--are not outweighed by the benefits of

producing a protection plan that can result in maintaining water quality and avoiding filtration construction costs.

Conflict Management Procedures

Although the MOU is effective in documenting the results of conflict, it is necessary to design and institute a dispute resolution procedure to guide personnel from both agencies in channeling conflicts into creation of watershed management policies. The following are ten short-term recommendations to effect the positive results of conflict discussed in Chapter 4.

1. Liaison Position. Reinstate the liaison position that was removed from the 1985 MOU. While staff say that the liaison position is no longer necessary due to improved lines of communication, this is not the case, as evidenced by the conflicts identified in the analysis in Chapter 5. Communication is cleared up only to the extent that personnel from each agency know with whom to initiate a conflict, and not how to manage that conflict. Despite potential effectiveness of the division directors at settling disputes, relying on these two individuals to settle conflicts fails to separate people from the problems (Fisher and Ury 1981). When this occurs, personality is cited as the reason for conflicts, and participants search no further for the root causes of conflict.

The need for an intermediary is illustrated by the concern of the DWM and MWRA staffs about joint public relations. Who will take the lead on presenting a public response to issues? Currently, both agencies are concerned about receiving credit for positive watershed-protection actions (and, conversely, who bears the burden for public relations failures).

A staff member of DWM stated that there is coordination, if not cooperation, in presenting information to DEP and EPA, but this perception of coordination is not shared by either DEP or EPA. Representatives from these agencies state that the DWM and MWRA do not approach joint meetings with a united policy; rather, they individually seek conferences with the regulatory agencies. DEP and EPA both state that they expect to see some indication of who will take the lead in the protection plan.

In addition, the DWM and MWRA indirectly acknowledged the need for an intermediary by hiring a consultant to prepare the protection plan. The consultant's role as de facto intermediary poses additional accountability questions; for example, to which agency does the consultant owe ultimate loyalty, the DWM (with legal jurisdiction) or the MWRA (with default jurisdiction based on funding the consultant)? Accepting a more active role for the liaison raises similar issues of potential conflict of interest, but these can be addressed in the context of an identifiable position of

public accountability, rather than indirectly as a consultant.

2. Define Clear Boundaries for Procedural versus Substantive Intervention. The DWM and MWRA staff must determine how great a substantive role they want for the liaison position. If this is not accomplished, the first time the liaison oversteps process to contribute to substance, staff may feel that the liaison is exhibiting preference for one agency over the other.

In addition to relaying information between organizations and commenting on policy, the intermediary should serve as a go-between who can help the parties define their jurisdictions. Competition can be managed by constantly readjusting organizational jurisdictions (Levine and White 1969), and a liaison can facilitate this by (1) guiding and structuring both the overt and covert messages that each agency transmits, and (2) serving as a sounding board for ideas that an agency or particular individuals are hesitant to voice directly.

3. Commit to Joint Problem Solving. In addition to the liaison position, it is necessary to implement a mutually agreed-upon procedure for ensuring the active participation of the DWM and MWRA staff in monthly meetings. An initial step in designing an effective conflict management system is for both the DWM and MWRA to commit to a working relationship that emphasizes creation of effective watershed

management policies. Currently, the accepted interaction is to confront conflicts that reflect jurisdictional disputes.

Despite this stalemate, DWM and MWRA exhibit have several incentives for redefining their commitment. First, even though conflicts occur, they are based on substantive areas of operation and are not characterized by threats. Second, as detailed in Chapter 3, the two agencies share common and interdependent goals. Although shared goals can inhibit interaction when disputes center on controlling the definition of those goals, they can also bind the DWM and MWRA if they recognize the potential lobbying power two agencies possess.

And third, staff from both agencies are personally committed to watershed protection. This last point is worthy of examination. A schism exists between the altruism of individual agency personnel and organizational attempts to ensure self-perpetuation. Staff from both agencies are dedicated to fulfilling organizational goals. A clear sense of commitment is evident in words and actions; DWM staff operate under austere funding limitations yet remain strong watershed advocates, and the MWRA staff champion and pursue watershed protection policies additional to those funded by the mandatory reimbursement. But the organizational motives to claim jurisdictional influence and obtain resources inhibit individual altruism from overpowering inherent organizational tendencies to expand domains. Initial

attempts by the MWRA to broaden the management spectrum to address non-state-owned lands were rebuffed by DWM--not because they were unsound, but because their implementation would give credence to a role for the MWRA in the watersheds.

4. Establish Procedural Ground Rules. DWM and MWRA currently interact in the absence of explicit procedural ground rules. To institute rules, the two agencies must define norms that both can agree on to guide the meetings (Susskind 1987). For example, implicit norms of professional courtesy and respect for organizational leadership exist in the current interaction of division heads. Staff, aided by the liaison, should complement these implicit norms with explicit standards of interaction and persuasion--such as honesty, fairness, and a commitment to the end result of watershed protection policies. Once accepted, the agencies must agree to stand by these definitions.

5. Distinguish Among Conflict Types. The findings in Chapter 5 can greatly aid in this procedural step. It is vital to recognize the difference between conflicts that are due to the inherent logistical problems of managing an extensive and geographically dispersed system from those that are based on actual philosophical differences in watershed management. For example, the conflicts that center on water-quality monitoring and hydroelectric

facility operation are more due to the difficulties of dual management of a single supply and delivery system than to actual disputes about how best to protect the watersheds. A more appropriate example of a philosophical management dispute is the forestry conflict. Varied management practices will result in improved or degraded water quality. Regardless of which agency espouses the better management practice in this specific case, forestry is an area of conflict that can result in improved reservoir water quality.

6. Prioritize the Issues. This thesis has isolated a number of disputes, some of which are more indicative than others of conflicts that will have an impact on watershed management policies. For example, the conflicts surrounding hydropower operations repeatedly surfaced in the interviews as an important dispute. But when compared to other conflicts, such as the impacts of recreational policies on the acceptance of a protection plan, hydropower issues are less significant. Although the tensions that cause hydropower conflicts should be explored, they are not priorities in light of the goal of drafting an acceptable plan. Isolating the important conflicts will reduce unproductive time spent on unrealistic disputes (Dilts and Walsh 1988).

7. Break the Issues Down into Manageable Portions. Dividing major issues into smaller portions can make the conflicts more manageable and result in an agreement that protects the watersheds. For example, in recreational disputes, DWM and MWRA should not debate the broad spectrum of passive versus non-passive uses of these lands and waters. Both agencies should acknowledge their similar views on reduced motor-boat usage and act in union to effect a use-reduction policy. Currently, recreational conflicts focus on controlling decision making. By breaking the issues down, there is less possibility of a stalemate and greater potential for incremental consensus building. It is not unrealistic to believe that the MWRA and DWM, in union with other state players, can successfully present the need for watershed protection to the public.

8. Identify Resource-Sharing Opportunities. In Chapter 4, it was stated that organizations will cooperate more readily if they can identify resources they can trade. It is obvious the that MWRA has the finances DWM requires, but DWM also can offer MWRA needed resources. These include an historical familiarity with the system, institutional memory of procedures, expertise, information, and the influence that accompanies a legal mandate. Identifying potential trading opportunities helps define a shared expectation of the results of conflict and can unite the DWM and MWRA to seek a more responsive role from the legislature.

9. Decentralize Conflict Management. DWM and MWRA should institute a procedure for potential conflicts to be diffused at the levels at which they occur. By waiting for division directors to manage the conflict, (1) the conflict is automatically prioritized by relying on upper-level management to settle it, and (2) tension accumulates until the division directors can address it--possibly long after it could have been addressed by the staff who had direct knowledge of the issues.

To the credit of the DWM and MWRA, they have partially addressed this issue by streamlining communication and allowing supervisors to effect decisions rather than requiring automatic clearance from a program manager or the directors.

10. Document Conflict Results. A binding agreement that documents the results of conflicts is currently embodied in the MOU. The substantive changes between the first and second versions of this document serve as the joint acceptance of new procedure defined by previous conflicts. The important difference between what exists now in the MOU and what is possible after managing the conflicts is prescriptive protection policies, not gains or losses in territorial influence.

LONGER-TERM RECOMMENDATIONS

The following are longer-term recommendations of how to guide the DWM and MWRA relationship in the implementation of effective protection policies. These recommendations address jurisdictional issues.

Jurisdictional

Conflict between the DWM and MWRA is motivated by organizational attempts to assume (MWRA) or maintain (DWM) domain in the watersheds. This results in a territorial battle over which organization is better suited to control watershed management, not in asking and answering the question "How can we best protect the watersheds?" The following recommendations address the jurisdictional conflicts between DWM and MWRA. Two issues are considered here--land management of state-owned lands and management on private lands.

1. State-owned lands. The original concern over land management accountability of an unproven and less accountable public authority was an important consideration when the state created DWM and MWRA. This concern focused on the wisdom of transferring the fee title of state lands to a quasi-public authority. By retaining watershed management in a public agency, the Commonwealth achieved accountability and retained legislative control of state lands but failed to guarantee effective protection. This

means that when watershed protection is unattainable due to land uses incompatible with safe drinking-water quality, and filtration is instituted, the agency with legal accountability will be identifiable. Effectiveness is a secondary consideration.

I recommend that the state consider keeping the fee title to the currently-owned watershed land and authorize the MWRA to enact watershed-management decisions.

When the legislature drafted the enabling legislation, only two land-management alternatives were envisioned--giving a public authority total control (including land ownership) in the watersheds or retaining land ownership as well as land management in the state. No consideration was given to designating the Commonwealth as the land owner and designating the water utility to manage the lands to protect water quality.

Accountability of a public enterprise can be addressed by oversight from the Executive Office of Environmental Affairs (EOEA) and by specifying a protection mandate in a revision of the enabling act. Environmental concerns, such as encouraging water conservation and limiting construction projects to augment supplies, were incorporated in the 1984 enabling legislation. The MWRA has exhibited exemplary efforts at fulfilling these mandates and would probably do so with watershed management as well. Lands will still be

held in public trust and the waterworks infrastructure will be managed as a single system.

A second, and more incremental, option would be to increase MWRA watershed funding to 100 percent (from the current 75 percent) with increased policy input. In the past five years, MWRA has shown itself to be a good steward of the lands in its willingness to fund above and beyond the 75 percent mandated figure. Even some initially skeptical observers have no problem now with more MWRA input.[1]

2. Private lands. The areas of conflict and cooperation attributable to the DWM/MWRA relationship almost exclusively focus on watershed land held by the state. Although watershed protection for non state-controlled lands is a factor in the disputes, it is not the motivating one. This occurs because conflicts between DWM and MWRA focus on organizational aggrandizement at the expense of watershed protection, resulting in conflicts directed toward tension release rather than toward the attainment of specific ends. DWM and MWRA interaction is characterized by a moot debate--jurisdictional policy control over lands that are already well-protected compared to adjacent private property.

Management Challenge. Conflicts focusing on jurisdictional claims divert attention from the greater threat to a successful watershed protection program, land use on private property. As illustrated in Chapter 2, the management challenge in successful implementation of a

protection plan will be on watershed lands held in the private sector. What has happened to date is that both DWM and MWRA debate unrealistic conflicts about state land. Action on state lands concerns conflict that is more to release tension than to pursue a specific end. Neither DWM nor MWRA has jurisdiction in the watersheds' private property holdings, but any action MWRA initiates to oversee land uses is interpreted as a domain breach by DWM, such as the conflicts arising from site-plan review. The disputes between DWM and MWRA are raised to an unrealistic level of importance when their individual efforts could be better utilized in concert. If watershed protection policies are to be effective on private property holdings, jurisdictional control issues must be addressed.

Redefined Roles. I recommend a redefined role for the DWM and the MWRA in the watershed lands not owned by the state. First, DWM's duties should be consolidated where they can be most effective--in the purchase of additional watershed properties. Second, the DWM and MWRA should share regulatory jurisdiction in those watershed lands not owned by the state.

Consolidate Acquisition. In regard to the first recommendation, the DWM should concentrate on administering the 30 million dollars targeted for additional acquisition of sensitive watershed lands. A DWM staff member commented on the bureaucratic nature of the acquisition process,

involving identification of land parcels and completion of paperwork for purchase. DWM is capable with current staff of spending 8 million dollars maximum per year. Land prices will only increase, and efforts to purchase sensitive lands should be expedited. This would satisfy observers who favor retaining property control in the public sector and allow the DWM to concentrate its limited staff on a priority task.

A potential problem of this option would be the added management responsibility for already strained DWM resources. If the DWM intensifies acquisition efforts, this results in an increased management burden for the newly purchased lands--a burden that the DWM will be unable to handle with a decreasing budget. The agency will be managing more land with the same or fewer resources. But, if the recommendations above in the state-owned land section are instituted, this potential dilemma is avoided.

Expanded Roles on Private Properties. The second recommendation, expanding DWM and MWRA influence in implementing watershed protection on private properties, is more delicate, because neither DWM nor MWRA can intervene extensively in private-property land-use decisions. Nevertheless, it is imperative for DWM and MWRA to assume active and visible roles in the non-state-owned watershed lands if the agencies want to ensure safe drinking water through protection rather than treatment.

Designating both agencies as negotiators is advisable, because the conflict in their relationship, while detrimental to progress in state-owned lands, has the potential of success when used in the private lands. With a shared and sanctioned presence as negotiators with private property owners, the DWM and MWRA can each capitalize their individual strengths.

The MWRA can define technical assistance programs which will be jointly implemented and supervised by the DWM, which currently enjoys good working relations with local communities. In addition, placing MWRA personnel along side DWM field staff will blur the distinction between the east versus west problem currently confronting the MWRA. This arrangement could also serve as the transition between DWM management of state-owned lands and MWRA assumption of this role. If the DWM and MWRA act in concert on private lands and the DWM maintains a visible presence in its new role, the MWRA presence on state lands will not be a dramatic change to local residents, planning boards, and development interests.

The two agencies can also play off the other to effect a mutually desired policy. For example, the MWRA can assert an edict, which the locals oppose. The DWM can then commiserate with the locals, yet still support MWRA intervention to implement the edict. Both DWM and MWRA benefit when the policy is implemented.

Legislative Support and Local Jurisdiction. If the MWRA is to eventually exercise management responsibility in the state and privately-owned watershed lands, it must address two obstacles: (1) legislative intervention and (2) lack of local presence in the watershed communities. The MWRA claims that with increased regulatory authority, it would protect water supplies more successfully than would the DWM. This is true in terms of resources and innovative programs, but the question of legislative intervention and how best to interact with local property owners presents a challenge.

In regard to the first point, the legislature actively intervenes in the MWRA's daily operations. MWRA claims it would be a better manager, because it would not have to respond to political pressure, but this is doubtful at this time. Given the negative public perception of the MWRA, the legislature is willing to intervene in its daily operations at every opportunity. For example, in 1989, when making an administrative decision for headquarters siting, the legislature intervened by drafting bills mandating location at a certain site.

Gaining legislative support for increased authority for the MWRA depends greatly on perceived costs to the legislature for not extending a greater decision making role to MWRA. Due to the strength of home rule in Massachusetts, communities often respond negatively to regulatory intervention--they view it as territorial encroachment.

One way in which to convince legislators to support such a change would be to stress the increasing capital costs associated with watershed management of additional land acquisitions. If the DWM acts as acquisition administrator as well as watershed manager, the Commonwealth will be responsible for the operations and maintenance costs that accompany real property purchases, thus being forced to increase DWM funding just to break even. An example of these expenditures would be DWM's responsibility to rehabilitate dams and maintain spillways.

In reference to the second problem, local relations, the MWRA must establish a presence in the watersheds prior to being accepted as a negotiating agency with communities adjacent to the water supplies. This can be accomplished by a transitional placement of MWRA staff in state-owned watersheds and an eventual assimilation of DWM field staff into the MWRA. DWM currently has good relations with communities adjacent to its watershed lands. If the MWRA places field staff in the watershed lands currently managed by DWM, it will result in a spillover effect into the communities with privately-owned watershed lands. Once the local communities become acclimated to the MWRA staff, the DWM's claim to superior local relations will become less of an argument for maintaining DWM watershed management. This can result in a transitional acceptance of the MWRA as a regulatory presence in local communities.

AREAS OF FUTURE STUDY

Interorganizational issues that go beyond the limited time frame of this study are offered as suggestions for areas of future study.

If Filtration Becomes a Reality

If filtration is mandated, how shall DWM and MWRA interact in the design process based on the conflicts identified in the production of a watershed plan that involves no capital construction. For example, the planning for a filtration facility will require comprehensive examination of the currently divided supply and delivery jurisdictions, but DWM has watershed control that does not include responsibility for filtration. The current conflicts, detailed in this thesis, impede effective watershed protection, and conflicts will become more problematic when construction in overlapping domains occurs.

Regulatory Authority

There must be a better defined policy toward regulatory powers in the watersheds, especially if the DWM and MWRA consider the private land uses. Currently, the DWM holds broad regulatory authority but does not exercise it to protect the watersheds. This will become more important in the near future due to the need to regulate activities on private property.

Although the DWM currently is authorized to exercise police powers, it has never done so based on its claim that the laws are too broad to be effective. More likely, DWM is concerned that if it exercises existing authority, the legislature will reduce it. If the DWM and MWRA act in concert, DWM would still rely on the MWRA to divert negative public response to intervention in private lands, while MWRA could operate in the watersheds under the DWM's umbrella of local recognition. This would allow MWRA to develop a local presence and dispel its purely eastern image.

The legislature is currently considering statutory protection for Boston's watersheds, but the effort fails to address the most important factor in accomplishing the protection it advocates--regulatory authority on private lands. Omitting this issue, or even failing to identify a lead agency in private land negotiations, hinders protection, because neither the DWM or MWRA has legal jurisdiction in private properties. If the current legislation passes, the jurisdictional conflicts that characterize DWM's and MWRA's current interaction will intensify because ultimate jurisdiction will be a free-for-all.

Assess Interactions of other Environmental Players to Effect Adequate Protection Legislation

Assessing the interaction among the state's environmental agencies and their existing regulatory powers is vital in determining the best approach to legislation supporting watershed protection. Current efforts to pass protection legislation are not crafted to consider existing statutory responsibility. As shown in this thesis, the state legislature mistakenly assumed that creating a public agency automatically translates into effective public stewardship. Well crafted and integrated laws are essential to provide the ultimate manager of the watersheds with the regulatory backing necessary to protect the watersheds. But current attempts at legislation assume that any protection legislation translates directly into adequate regulatory power. Before this assumption can be realized, the interactions of all parties to the watershed issue must be examined for effective implementation.

Reexamine the Dual-Management Structure

The suggestions offered in the above conclusions concentrate on a limited time frame of less than a year and apply to effective production of a Watershed Protection Plan during that time period. The other future issues detailed here suggest the need to reevaluate the structure of the

organizations and the implementation potential of the shared management for long-term protection of the watersheds.

The creation of two water-supply management organizations is, in effect, a reorganization of the previous agency structure, because former MDC Water Division personnel who transferred to MWRA continue to influence policy at the Authority. Reorganization can be valuable in several ways, including: (1) shaping policy in a positive way by improving the flow of communication and influence, and (2) bringing the issue for which reorganization is done to the forefront of public attention implies symbolic importance by giving it political recognition (Peters 1989).

Conversely, reorganization can be mainly a political exercise (Peters 1989) with little to offer beyond symbolic value which results in hollow political gestures that imitate real change. As stated earlier, the directive for DWM and MWRA to cooperate is not accompanied by the requisite items of exchange necessary to encourage cooperation. The MWRA can offer DWM finances but only so much as the legislature approves through the budgetary process. DWM can offer little in return except a share of its jurisdiction; this runs counter to organizational attempts to expand domain. The true costs and benefits of reorganization must be examined to allow restructuring to be more than a political maneuver or a reaction to feeling helpless to make real changes.

APPENDICES

APPENDIX A

BANK OF BOSTON RECOMMENDATIONS FOR PUBLIC ENTERPRISE MANAGEMENT OF METROPOLITAN BOSTON'S WATER SYSTEM

1. The technical amendments of Proposition 2 1/2 limited MDC's ability to generate funds from its member communities.

2. MDC management is subject to budget and appropriations process, meaning that the general court could take account of assessment limitations and prevent significant expenditures which the commonwealth would have to absorb.

3. The MDC is reliant on legislative generosity, given the increasing gap between operations and maintenance costs and the assessment cap.

4. Civil service hiring practices and long delays in legislative scheduling of hiring would interact with the budget process to produce serious understaffing.

5. Cash flow problems exist in both the sewer and water divisions; two years pass between the time expenses were incurred and assessment reimbursement.

6. All the above culminated in the MDC neglecting to take advantage of the EPA funding process.(*)

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(*) refers to repeated attempts to qualify for the waiver from the Clean Water Act's sewerage upgrade provisions

(Source: Bank of Boston Report 1983: 6, 8, 16, 21, 22, 26)

APPENDIX B

DIMENSIONS OF CONFLICT MANAGEMENT

1. The Parties. Conflict must always be visualized as a relationship involving at least two or more parties. The parties can be persons, groups, or organizations.

2. The Field of Conflict. The field of conflict may be designed as the whole set of relevant possible states of the social system. The model assumes that each party to a conflict can rank its locational preferences in a conflict situation and that each party can move within this field of preferences either by "trading moves" or "conflict moves". In the former, both parties benefit; in the latter, one benefits at the expense of the other. Changes in a "conflict move" can occur by bargaining and negotiation that explore the social system to determine where the trading moves are.

3. Dynamics of Conflict Situation. In the simplest conflict situation between two parties, the model assumes that each party adjusts its position to what it assumes the other's to be. This mutual adjustment can result in "negative trading" where both parties are worse off than before trading began. When the parties are merely reacting to the other's position without reflecting on the potential counterresponse, both parties exacerbate hostility and move away from cooperation and mutual benefit, possibly resulting in a system break, such as violence.

4. Conflict Management. Conflict management involves the management, control or resolution of conflict. Control is identifiable by a mechanism that avoids "pathological" moves such as an absence of trading activity in the relationship. Defining the limits of this pathological boundary is difficult, because some conflict situations can result in mutual benefits. Conflict management can be considered successful if there exists a mechanism to detect conflicts that approach the boundary of pathology and steer the interaction away from that edge. Two types of mechanisms are identified, unilateral and organizational. The former occurs when one party deliberately manipulates its responses to control mutual equilibrium. The latter is more political and involves the institution of government and laws to encourage behavior away from conflict.

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Source: (Boulding 1964: 138-144)

APPENDIX C

DIMENSIONS OF INTERORGANIZATIONAL ANALYSIS

1. Interorganizational Properties are the basic structural characteristics of an organization. This dimension does not require analysis of interaction between organizations, because the analysis centers on identifying particular characteristics of a single organization engaged in joint programs. Based on the assumption that the foundations of interdependency may be internal to each organization, no analysis of the interaction itself is required to isolate these internal characteristics.

2. Comparative Properties are those which examine organizational interaction by comparing certain attributes shared by organizations. This differs from the first dimension, because this analysis can be accomplished only by studying the interdependencies associated with exchange.

3. Relational Properties examine the nature of the interorganizational relationship by exploring the network and nature of linkages between organizations. The data accumulated for this analysis are so aggregated that they reflect characteristics of interaction among parties, rather than the more specific attributes of comparative properties.

4. Formal Contextual Properties are those which consider a larger society than the interacting organizations and introduce the concept of a history of organizational activity as a determinant of new organizational interaction. Studies of this type "explore the channels and types of influence on interorganizational character of the context in which a given interaction takes place" (Marrett 1971, p. 87).

5. Non-Organized Contextual Properties are those which also consider elements in the larger environmental setting but relate to a broad social process, not formal organizations. Examples of such factors include "political, economic, and demographic changes in American society which have encouraged if not necessitated interrelationships" (Marrett 1971: 88).

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Source: (Marrett 1971:83-99)

APPENDIX D

QUABBIN AND WARE WATERSHEDS: RECREATIONAL ACCESS PLANS

I. QUABBIN: Quabbin Park, Quabbin Reservation, and North Quabbin Reservation

QUABBIN PARK

Activity	Policy
Public Access Hours	Dawn to Dusk
Bicycling	Allowed on Paved Roads
Ice Fishing	Allowed within Quabbin Park, Reservoir
Handicapped Access	Prohibited on Main for Sanitary and Safety Reasons
Outdoor Games/Sports	Encouraged for Legal and Ethical Reasons
Domestic Animals	Allow Informal Sports (Softball, Frisbee) of Less Than 25 People
Sledding	Prohibited for Sanitary and Wildlife Concerns
Use of Metal Detectors	Prohibited on Dikes and Dams, Allowed Elsewhere
	Prohibited, Depletes Historical Resources

B. QUABBIN RESERVATION

Activity	Policy
Public Access Hours	Dawn to Dusk, with Special Permits for Overnight Use
Public Access Restrictions	Reservoir Islands, Prescott Peninsula, Mt. Zion Island, Administration Area
Visitor Information	Update signs at Public Access Gates, Boat Launch Areas
Motor Vehicle Access Beyond Locked Gates	Limit Access to Professional Researchers, Former Residents, Swift River Historical Valley Members, Educational Institutions (subject to no alternative pedestrian access)
Parking	Discourage Illegal Parking on Adjacent Public Routes
Motor Boat Use	Continue Use of 160 Boat Rentals and 50 Rental Motors from Three Boat Launches. Increase MDC Boat Patrols During Peak Use Periods, Improve Boater Education About Sanitary Concerns
Ice Fishing	Allow at South and North Spectacle and Bassett Ponds Only
Fishing Derbies	Prohibited

Bicycling Gate Sites, During Daylight Hours	Permitted at Specific
Fires	Prohibited
Dogs and Horses	Prohibited
Use of Metal Detectors	Prohibited

C. NORTH QUABBIN RESERVATION

Activity	Policy
Public Access Hours	Allow 24 Hour Use, Prohibit Overnight Camping
Visitor Information	Increase User Understanding through Increased Signage that is Low Key
Recreational Vehicles	Snowmobiles Allowed
Horseback Riding	Allowed
Dogs	Allowed
Overnight Camping	Prohibited
Bicycling	Allowed (Subject to Review)
Cross Country Skiing	Allowed (Subject to Review)
Swimming	

APPENDIX D (cont.)

WARE RIVER RESERVATION

Activity	Policy
Public Access Hours	24 Hour Access with Limited Vehicle Access, Eventual Limitations of 24 Hour Access to Two Locations
Motor Vehicle Access	Restrict Access During March and April
Maintenance Facilities and Office Space	Staff Facilities Insufficient, Secure Adequate Facilities
Recreational Vehicles	Prohibited, Except for Snowmobiles
Horseback Riding Zones	Allow in Designated
Motor Boat Use	Allowed, But Motors not to Exceed 20 Horsepower, Except on a Year Trial Basis with Permits
Dogs	Allow on a Trial Basis
Hunting	Allow without permits
Target Shooting	Prohibited
Ice Fishing	Allowed

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Source: (MDC/DWM, Quabbin and Ware River Watersheds: Recreational and Public Access and Policy Plan, 1988)

NOTES

1. An American Waterworks Association work in progress presents 23 case studies of watershed management throughout the United States. Of the water providers restructured as public enterprises, none follow the pattern evident in Boston--statutorily separating watershed management from water supply responsibilities and instituting authority reimbursement to a watershed management agency.

2. The SWTR seeks to control five of the 83 contaminants identified by the SDWA (Giardia cysts, enteric viruses, heterotrophic bacteria, Legionella, and turbidity).

(Source: MWRA, Safe Drinking Water Act Impact Study, Vol. I, p.7-1)

3. Safe Drinking Water Act, 1986, Surface Water Treatment Rule.

4. Ibid.

5. Most of the town of West Boylston was flooded and its residents relocated. The town of Clinton was taken by eminent domain and part of the mitigation was the provision of free water and sewer service to the remaining residents.

6. Twenty-five hundred residents were moved out of the towns of Dana, Enfield, Prescott, and Greenwich (Nesson 1983, p. 72).

7. Metropolitan Water Board, Annual Report 1889, p. 21.

8. Metropolitan Water Board, Annual Report 1908.

9. Ibid.

10. Ibid., p.11.

11. Threats specific to DWM watersheds include: (1) septic systems in poor soils, (2) stormwater discharge, (3) logging operations, (4) new development of single-family homes, (5) shopping centers, (6) agricultural uses, (7) roadway work, (8) illegal discharge, (9) dumping, (10) underground fuel-storage tanks, (11) storage of salt/fertilizer/pesticides/herbicides, and (12) road salts. (Source: CH2M Hill, Technical Memorandum Task No. 19, "Evaluate Watershed Management Responsibilities", April 1988).

12. For example, when the Wachusett Reservoir was dammed in 1908, only 69 persons per square mile were residing in the 118.23 square miles of the watershed. In addition, population was not expected to increase and the area was so distant from population centers that growth was not expected in the future (Nesson 1983: 21).

13. Metropolitan Water Board, Annual Report, 1901.

14. Metropolitan Water and Sewer Board, Annual Report 1908, and Annual Report 1899.

15. In 1911, nine typhoid cases in Wachusett and 33 cases in Sudbury/Cochituate were documented (Metropolitan Water and Sewer Board Annual Report, 1911).

16. Massachusetts Water Resources Authority, Water Supply Study and Environmental Impact Report - 2020, Summary Report, March 1986.

17. Water Supply Citizens Advisory Committee, September 1983.

18. Ibid.

19. Water Supply Citizens Advisory Committee, "Finding New Water: An Analysis of Eight Proposals to Enlarge the MDC Water System", September, 1983.

20. In 1908, when Wachusett Reservoir was filled, the courts assessed fines for illegal bathing (from two to five dollars) and hunting (twenty dollars). (Metropolitan Water and Sewer Board, Annual Report 1908, p. 121-122).

21. Quabbin and Ware Watersheds Recreation and Public Access Policy Plan, MDC-DWM, 1988.

22. Ibid., p. 25.

23. Chapter 737 of the Acts of 1972.

24. Four supply reservoirs are included in the Sudbury watershed: Framingham Reservoirs No.s 1, 2, and 3 and Sudbury Reservoir. Other surface impoundments include the Whitehall, Hopkington, and Ashland Reservoirs which are managed by the Department of Environmental Management for recreational purposes.

25. One of the reservoirs associated with the Sudbury watershed, Framingham Reservoir No. 2, is located next to the Nyanza Superfund site, resulting in mercury leachate into the reservoir. (Source: MWRA, Task 9: Upper Sudbury Watershed Assessment Report, February 1986).

26. Supra, Note 21.

27. Bank of Boston, Protecting Water Resources: A Financial Analysis, February 8, 1985, p. 16-21.

28. Massachusetts Water Resources Authority, Bond Notes, January 1990.

29. Massachusetts Water Resources Authority, Five-Year Progress Report, December 31, 1989, p. 3.

30. House 5915, April 1984.

31. Senate President Bulger opposed the inclusion of both the water and sewer systems in a new authority structure, asseting that incorporating the water system in the new organization was not as imperative as was the need to restructure the sewerage system's management.

32. This charge was repeatedly mentioned by DWM staff and observers external to the DWM and MWRA. It is noteworthy and supportive of the truth of this statement, that no MWRA personnel cited this.

33. Joseph Trainor, former Budget Director and Chief Legal Council for the Ways and Means Committee, Personal communication, March 29, 1990.

34. Metropolitan District Commission, Long Range Water Supply Study and Environmental Impact Report 2020, September 1984.

35. Personal communication, Doug McDonald, Palmer and Dodge, February 28, 1990.

36. Real property includes the water supplies as well as land, easements, and property rights in buildings owned by the Commonwealth.

37. The other divisions include open space and parks management, the police, and parkways transportation management.

38. Supra, Note 21.

39. Metropolitan District Commission, Division of Watershed Management, Capital Outlay Budget Request: Program Narrative, 1986.

40. Ibid.

41. Supra, Note 21.

42. Massachusetts Water Resources Authority, Long-Range Planning Overview, February 1990.

43. Responsibility for water supplies alternates depending on its location in the system. For example, when water is in Quabbin Reservoir, it is under DWM jurisdiction; but, once it enters the Quabbin Aqueduct, it is the MWRA's responsibility. This jurisdiction reverts back to the DWM when the aqueduct releases water into Wachusett Reservoir.

44. The governor's appointees must fulfill the following criteria: One must be a Connecticut River Basin resident who represents water resources protection interests and serves coterminous with the governor. The other must be a representative of the Merrimack River Basin community and serves the same term as the Connecticut River member.

45. Quincy and Winthrop's recommendations must be approved by the governor and serve for four years.

46. The Advisory Board's appointees serve for six-year terms.

47. The Boston mayor's appointee serves coterminous with the mayor.

48. An organization's domain is "the range of activities claimed by the organization for itself as its particular area of operation" (Levine and White 1961) and organizations strive to maintain or expand this operational range. In the remainder of the thesis, I refer to an organization's domain as it 'jurisdictional influence'.

49. Memorandum of Understanding, Division of Properties, Personnel, Policy, and Joint Functions between the Metropolitan District Commission (Division of Watershed Management) and the Massachusetts Water Resources Authority, 1985 and 1989.

50. Staff from both agencies identified the following benefits of the MOU: (1) cleaned up lines of communication resulting in the two working well together in submission of documentation to DEP/EPA, and (2) monthly meetings apprise one another of updates on spending, programs, and conflicting issues. Using the legislation as a guide, the committee drafted a Memorandum of Understanding[1] (MOU) and established monthly meetings held at alternating or neutral locations.

51. At this writing, the state of Massachusetts is projecting anywhere from a $700 million to $2.3 billion gap between revenues and spending and has received the lowest bond rating of any state in the nation (Source: Boston Globe, Sunday Edition, February 25, 1990. p. 16; Boston Globe, April 10, 1990. p. 1).

52. Projected costs for this project are $600,000 (Source: Personal communication, Stephen Estes-Smargiassi, MWRA Waterworks Division, March 16, 1990).

53. State and Federal regulations include: (1) Massachusetts Surface Water Quality Standards minimum and Class A criteria (314 CMR 4.00), (2) Massachusetts Drinking Water Standards (310 CMR 22.00), and (3) National Primary Drinking Water Standards (Safe Drinking Water Act), and (4) "Guidance Manual for Compliance with the Surface Water Treatment Requirements", US EPA, Office of Drinking Water Criteria and Standards Division, September, 1987.

54. Personal communication, Joe Trainor, March 29, 1990.

55. Current recreational policy is outlined in DWM's 1988 Quabbin and Ware River Watersheds Recreation and Public Access Policy and Plan. DWM is granted broad regulatory authority on both state-owned and privately-owned watershed lands. "Within the watershed of any MDC waters, no person shall engage in any other activity which could degrade the quality of MDC waters or interfere with their use as a source of water supply" (350 CMR 23.02: (9)).

56. Current boating policy at Quabbin Reservoir allows fishing seven days per week from three boat launching areas with gasoline available for sale on shore. DWM user fees for this privilege include two dollars per day for the fishing privilege and three dollars per day for boat rental. DWM staff feel that this encourages more use.(Source: Personal interview, James Holeva, March 26, 1990.

57. Requests for special-use privileges from legislators are continuous and have included private wedding receptions on Quabbin Park grounds. In addition to stretching the boundaries of the passive use category, such uses strain the already limited staff's ability to monitor such intensive use of a restricted area. The regional nature of the issue is highlighted by the fact that votes on MWRA/DWM water issues break down on an eastern versus western Massachusetts basis rather than by party affiliation.

58. The MWRA, as evidenced in its Long Range Water Supply Program, has actively pursued waterworks projects to reduce reliance on additional supply sources, including: (1) reactivation of local supplies, (2) leak detection and repair, (3) and domestic device retrofit.

59. It is revealing of the political sensitivity of the management issue that numerous observers outside the DWM and MWRA structures, as well as DWM staff, support MWRA jurisdictional involvement in watersheds, but refuse to be quoted to that effect.

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