Environmental Stewardship in Agriculture: A Case Study of the NYC Watershed System

Honors Thesis
Presented to the College of Agriculture and Life Sciences,
Biology and Society
of Cornell University
in Partial Fulfillment of the Requirements for the
Research Honors Program

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May 2007

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Abstract

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Cornell University 2007

Agriculture has always been and will continue to be an important player in environmental integrity throughout the world. Because the manner in which humans manage agriculture has such serious implications on the environment and in turn people, it is imperative that some sort of environmental stewardship be practiced in agriculture. This research focuses on various methods of stimulating environmental stewardship (i.e. regulations, monetary incentives, etc.) and which method(s) might be the most suitable for agriculture. Management of agriculture in the New York City watershed system will function as a specific case for observing and evaluating how a socially-oriented management style incorporating such tools as partnerships, reciprocity and education can be formulated and implemented. Given the degree of environmental stewardship that has been fostered in the NYC watershed, the case is made that a socially-oriented form of environmental management can be incredibly effective at creating environmental stewardship in agriculture and ought to be applied on a broader scale.

Acknowledgments

I wish to extend a special thank you to David Pimentel, Anusuya Rangarajan and Max Pfeffer for their guidance and valuable suggestions throughout the course of this research. I could not have completed the project without their advice and support.

Further warranting recognition are the knowledgeable, receptive and enthusiastic individuals with whom I interviewed for this research. From them I garnered both precious information for this project and a new found respect for their priceless efforts in maintaining environmental quality throughout the New York City watershed. To the Watershed Agricultural Council, Cornell University, Cornell University Cooperative Extension, County Soil and Water Conservation Districts, United States Department of Agriculture – Natural Resources Conservation Service, New York City Department of Environmental Protection – thank you.

Lastly, I would like to thank my family, friends, teachers and Bonnie for their support before and during the project. I appreciate your persistent encouragement that I challenge myself.

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Chapter 1 Evolution of Environmental Stewardship

William Cronon (1996) argued in his piece *The Trouble with Wilderness* that humans have recently come to perceive nature as "the place where we are not." Nature, he suggested, is viewed as an entity found in the majestic waterfalls of Yellowstone National Park or in the sublime hilltops of Yosemite National Park, but not in our backyards or roadsides (Cronon, 1996). Humans are accustomed to thinking of their day to day lives in cities, homes and shopping malls as devoid of the environment and nature – those things are miles away in protected parks (Cronon, 1996).

Modern environmental stewardship can be characterized as a movement away from the type of separatist thinking described by William Cronon, and a movement towards a view where humans see the environment as an omnipresent and influential factor in their lives.

The underlying ethics of the environmental stewardship movement were established by notable environmentalist Aldo Leopold in the mid 1900s when he preached of a land ethic where "conservation was a state of harmony between land and men" (Leopold, 1987). Central to this philosophy was the view that humans were one small part in a very large and dynamic world and it was their responsibility to "preserve the integrity, stability, and beauty of the biotic community" (Leopold, 1987). This perspective has humans as an integral and reciprocal part of nature; capable of influencing it, and unable of escaping it. In short, humans depend on the integrity of the environment and for that reason must maintain a high quality environment to sustain high quality human life (Leopold, 1987).

Rachael Carson and her 1962 novel, *Silent Spring*, brought Leopold's land ethic to life with a vivid depiction of DDT and its impact on the environment; a real issue people were witnessing, relating with and responding to at the time of the novel's release (Carson, 2002). Carson helped Americans start to develop and apply a more accurate perception of our relationship with nature – a philosophy comparable to Leopold's land ethic, which recognizes our ability to impact the environment and need to curb our influence if not for the sake of maintaining the biotic community, then for the sake of humankind (Leopold, 1987). Through Carson's work and the efforts of environmental advocates who have followed in her footsteps, more and more Americans became increasingly familiar with their place in the environment and less representative of Cronon's disconnected humans.

Carson's novel challenged Americans to think seriously about the environment, their behavior and how it related to their quality of life. During the late 1960s and early 1970s clean and plentiful resources (e.g. water, air, biotic units) were being seen less as authentically wild, rare and distant, and more as natural rights worthy of being protected and present in our everyday lives (Vig and Kraft, 2005). Rivers setting ablaze (e.g. Cuyahoga River), commercialization of serene wilderness areas (e.g. Storm King Mountain), and irresponsible wrongdoing of rare and precious species (e.g. Bald eagles) would no longer go unchecked by American citizens (Vig and Kraft, 2005). Government, Americans believed, ought to be responsible for protecting their natural right to clean and plentiful natural resources.

Behind the citizen call-to-action, a flurry of mostly uncontested legislation passed through Congress beginning in 1964 with the Wilderness Act and stretching to 1980 with the Comprehensive Environmental Response Compensation and Liability Act (Superfund). The infrastructure to implement the new legislation was established with the creation of environmentally-oriented government agencies/organizations such as the Environmental Protection Agency and the Nuclear Regulatory Commission (Vig and Kraft, 2005). Pre-existing agencies like the United States Department of the Interior took on a substantial workload through a commitment to execute the Endangered Species Act 1973), and the United States Department of Agriculture had the responsibility of maintaining water quality and habitats as they related to forest management and agriculture (Vig and Kraft, 2005). The U.S. federal government became dedicated to maintaining environmental integrity in response to widespread citizen concern.

The first epoch of the modern environmental movement, focused on a command-and-control approach to improving environmental quality in the U.S. (Mazmanian and Kraft, 1999) (Appendix A). Occurring primarily during the 1960s and 70s, centralized government was relied upon as the primary institution capable of creating environmental change. Through stringent regulations and top-down power schemes, the federal government hoped to mitigate industry pollution in natural media like air and water (Mazmanian and Kraft, 1999). Point source polluters were required to comply with federal and state regulations. Those not complying met stiff penalties from administrative agencies, in addition to public disapproval (Dryzek, 2005). The command-and-control approach to environmental management, however, has its share of problems. It is often characterized as slow, bureaucratic, inefficient, and lacking in the incentives needed to stimulate positive environmental action from both industry and society (Mazmanian and Kraft, 1999).

Despite the challenges, this first epoch was both necessary and productive with regards to the larger environmental movement. The government showed a willingness to spend money; the EPA's budget rose from $500 million in 1973 to $1.3 billion in 1980 (Vig and Kraft, 2005). Also, improvements were made in the nation's environment; as of 2003, the Clean Air Act resulted in a total reduction of emissions from six primary pollutants by 51 percent while the Clean Water Act increased the percentage of lakes, rivers and coastal regions meeting quality standards (Vig and Kraft, 2005). Improvements occurred while both the U.S. population and GDP grew (Vig and Kraft, 2005).

In the early 1980s, the second epoch of the modern environmental movement began with a realization that the command-and-control method of environmental politics had likely achieved its full potential and the Reagan administration's free market attitude (Mazmanian and Kraft, 1999) (Appendix A). The transition from the first epoch to the second was distinguished by a move away from government as the primary institution of environmental governance, and a move towards markets. The focus went from administrative red tape and centralized control to efficiency, incentives and internalized costs (e.g. cost of pollution in industry) (Vig and Kraft, 2005). This epoch added an element of flexibility as well by shifting many regulatory powers to state and local governments (Mazmanian and Kraft, 1999). Moreover, litigation relating to industry's inability to meet regulatory standards decreased and environmentally conscious marketing grew (e.g. organic produce, renewable energy) (Mazmanian and Kraft, 1999; Dryzek, 2005).

Throughout the 1980s and early 1990s the market driven approach resulted in the development of a series of successful policies. A cap-and-trade system championed by the first Bush administration reduced SO_2 and NO_X (Vig and Kraft, 2005). In 1985, the Conservation Reserve Program was introduced as the first U.S. policy with the primary goal of reducing soil erosion (Sullivan *et al.*, 2004). The program incorporates economic incentives by paying farmers to fallow their land – in 2003, for example, the program prevented 446 million tons of soil from being eroded (Sullivan et al., 2004; USGS and USDA, 2004). This is roughly 10 percent of the annual loss of soil in the U.S. (Pimentel *et al.*, 1995) Right-to-know programs and education initiatives became especially prominent during this period as citizen participation played a more central role in decision making (Mazmanian and Kraft, 1999). As an institution, the market proved to be a legitimate actor in engaging both individuals and groups to take environmental action.

The second epoch fell short in that it neither succeeded in correcting for all the downfalls of the first epoch nor took the larger steps needed to create truly sustainable environmental policies and management. A major problem with the market-based approach exists in the fact that privatization of collective goods is often obstacle-laden, if not unfeasible (Mazmanian and Kraft, 1999). For example, political factors have hindered cap-and-trade programs for pollutants such as mercury and greenhouse gases in the U.S (Dryzek, 2005). Additionally, non-point source pollution in both air and water continues to elude policy-makers as it remains a significant cause of environmental degradation throughout the world (Mazmanian and Kraft, 1999; Vig and Kraft, 2005). By all accounts, the second epoch of the environmental movement served as an intermediate stage with moderate advancements, but had an overall inability to create truly promising and fresh environmental management.

In its idealized form, the third epoch represents the final and most comprehensive stage of the modern environmental movement. It is a stage that is probably in its origins, but by no means in full gear (Mazmanian and Kraft, 1999) (Appendix A). The third epoch focuses explicitly on social infrastructure and society as an institution capable of creating positive environmental change (Mazmanian and Kraft, 1999). Newer concepts like sustainability, eco-centricism, community integration, and long term environmental planning in addition to older concepts like incentives, policy flexibility and government oversight all play a critical role in this third epoch of environmental management (Mazmanian and Kraft, 1999). The real potential of the epoch three strategy, however, lies in the use of human elements seldom found in government or markets; instruments of trust, reciprocity, community, participation, partnerships, leadership and adaptive management are just a few of the drivers at the heart of the epoch three approach (Mazmanian and Kraft, 1999; Dryzek, 2005; Ostrom, 1990).

Epoch three is no doubt difficult to conceptualize – if not for its abstract nature then for the excessive faith it places in human nature. Still, the third epoch is afoot and quickly gaining support from environmental decision makers. The Montreal Protocol, for example, stands out as a scenario where nations subdued their pride and agendas and coalesced to fight a common problem with minimal market incentives or government regulation (Vig and Kraft, 2005; Litfin, 1994). Instead, action was taken when nations throughout the world, with support from industry and citizens, utilized epoch three tools like trust, leadership and participation to reach an agreement on CFC abatement (Mazmanian and Kraft, 1999). The Montreal Protocol remains an exemplary case for using epoch three social tools to reach a multilateral agreement between diverse and self-interested parties on behalf of the greater good (Litfin, 1994).

The prospects for change under the third epoch of the environmental movement are promising, but questions linger like how, where and when will epoch three management be implemented? Why will this socially-oriented style be more successful than previous regulatory and market-based approaches? What does epoch three really look like and how will it come to be?

Objectives, Methods and Organization

The purpose of this research project is to examine whether agriculture, as an important player in environmental change, can be managed by humans in a manner which uses social infrastructure and epoch three tools to achieve environmental integrity in addition to other desirable factors such as economic profit and social equality. Management of agriculture in the New York City watershed system will function as the specific case for observing and evaluating how a socially-oriented management style can be formed and implemented – from initial idea to successful execution.

This study uses both primary and secondary sources to document agricultural management in the NYC watershed system as well as the events, people, and politics that were integral in establishing the management. Interviews were conducted with experts in the field of agricultural management and policy making in the NYC watershed system. A generalized interview can be found in appendix B. A total of ten interviews were conducted with interviewees coming from Cornell University, Cornell University

Cooperative Extension, the Watershed Agricultural Council, County Soil and Water Conservation Districts, the Natural Resource Conservation Service (USDA) and the New York City Department of Environmental Protection. These interviews, and other secondary resources, were critical in developing an understanding of agricultural management in the NYC watershed system, environmental stewardship in the watershed system, and discerning how and what social tools were used to achieve such.

Throughout the interviews and research, detailed attention was paid to social factors such as partnerships and relationships (e.g. between NYC and upstate agricultural entities), communication, trust and reciprocity, and how they manifested themselves in the management and decision making processes in the NYC watershed system. As will be demonstrated throughout this paper, particularly towards the latter segments, social tools such as those just mentioned were implemented in decision making and management. Partnerships between groups such as the Watershed Agricultural Council and the New York City Department of Environmental Protection helped to distribute workloads and build trust while widespread education and communication helped farmers, extension agencies and policy-makers to foster enthusiasm and self-sustaining management. Mutual and willing environmental stewardship was indeed facilitated in the New York City watershed system by social tools.

The paper is organized into five parts. First, a historical, scientific and political background of the NYC watershed system is provided, including how the Safe Drinking Water Act set forth rethinking of agricultural management in the watershed system. Second, the social dimensions and process of responding to and meeting this new federal legislation in the watershed system, with a particular focus on the Catskill/Delaware watershed, is described through stages of controversy, compromise and cooperation. Here, the events, politics, social evolution, and eventual formation of the NYC Watershed Agricultural Program are discussed from both a downstate and upstate perspective. Third, an overview of the present state of the New York City watershed system, again with particular attention paid to the Catskill/Delaware watershed, is given with regard to the Watershed Agricultural Program's effectiveness and ability to satisfy multiple parties and goals. Fourth, following discussion of the Watershed Agricultural Program and its successes and failures, the program is analyzed and juxtaposed with various environmental management schemes/epochs. Special attention is given to individual social tools, where they are used in the Watershed Agricultural Program and why they have been so important to the programs' success. Lastly, using the New York City watershed system and the Watershed Agricultural Program a foundation, the prospects for applying social tools to the larger agricultural arena are briefly considered.

Chapter 2 – Background: The Watershed System, Science, and Legislation

The New York City watershed system consists of 1,900 square miles within the southeast portion of New York State, north of New York City in parts of the Hudson River Valley and Catskill Mountains (NYC DEP, 2005). The system is divided into two watersheds: the Croton watershed to the east of the Hudson, and the Catskill/Delaware watershed to the west of the Hudson (Figure 2.1). Together, they deliver 1.3 billion gallons of unfiltered drinking water each day to nearly 9 million people in the City of New York, much of Westchester County and areas of Orange, Putnam and Ulster counties (WAC, 2006).

Figure 2.1 The New York City watershed system is located to the north of New York City. It contains two distinct watersheds: 1 – The Croton watershed which provides the City with 10 percent of its water and 2 – The Delaware/Catskill watershed which provides the City with 90 percent of its water (NYS-DOS, 2004).

The Croton watershed (east of the Hudson), located in parts of Dutchess, Putnam and Westchester counties as well as portions of Connecticut, is NYC's oldest running water reservoir system (Figure 2.2). The Croton system began providing water to the City in 1842 and was repaired and expanded upon in 1911. It currently provides 10 percent of the city's total drinking water (CWCWC, 2006).

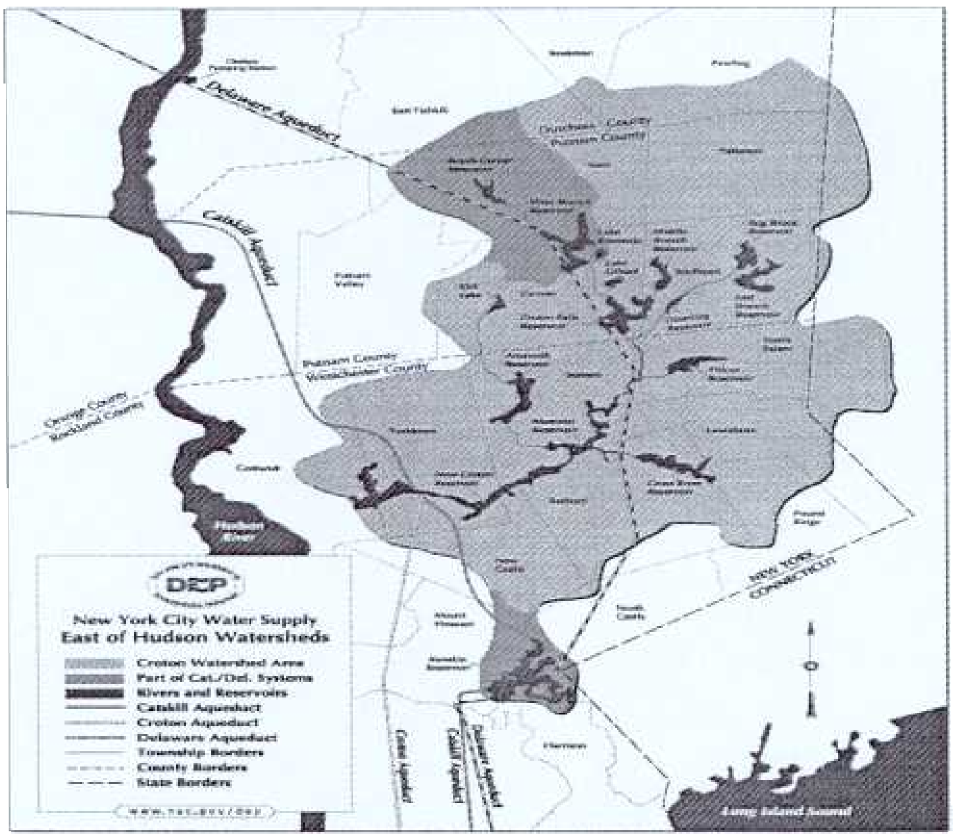

Figure 2.2 The Croton watershed covers, 380 square miles. The watershed is contained within Dutchess, Putnam and Westchester counties and parts of Connecticut. It has ten reservoirs and three controlled lakes as well as an aqueduct (NYCDEP, 2006).

The Catskill/Delaware watershed (west of the Hudson) is technically two separate watersheds, but the two are frequently lumped together for purposes of considering New York City's water supply conveniently (Figure 2.3). The Catskill/Delaware watershed is located in parts of Delaware, Greene, Ulster, Sullivan and Schoharie counties. The

Catskill component has been in place since 1907 and the Delaware since 1964; both were added in response to growing water demands (NYC DEP, 2005). The Catskill/Delaware watershed provides 90 percent of the city's total drinking water (CWCWC, 2006).

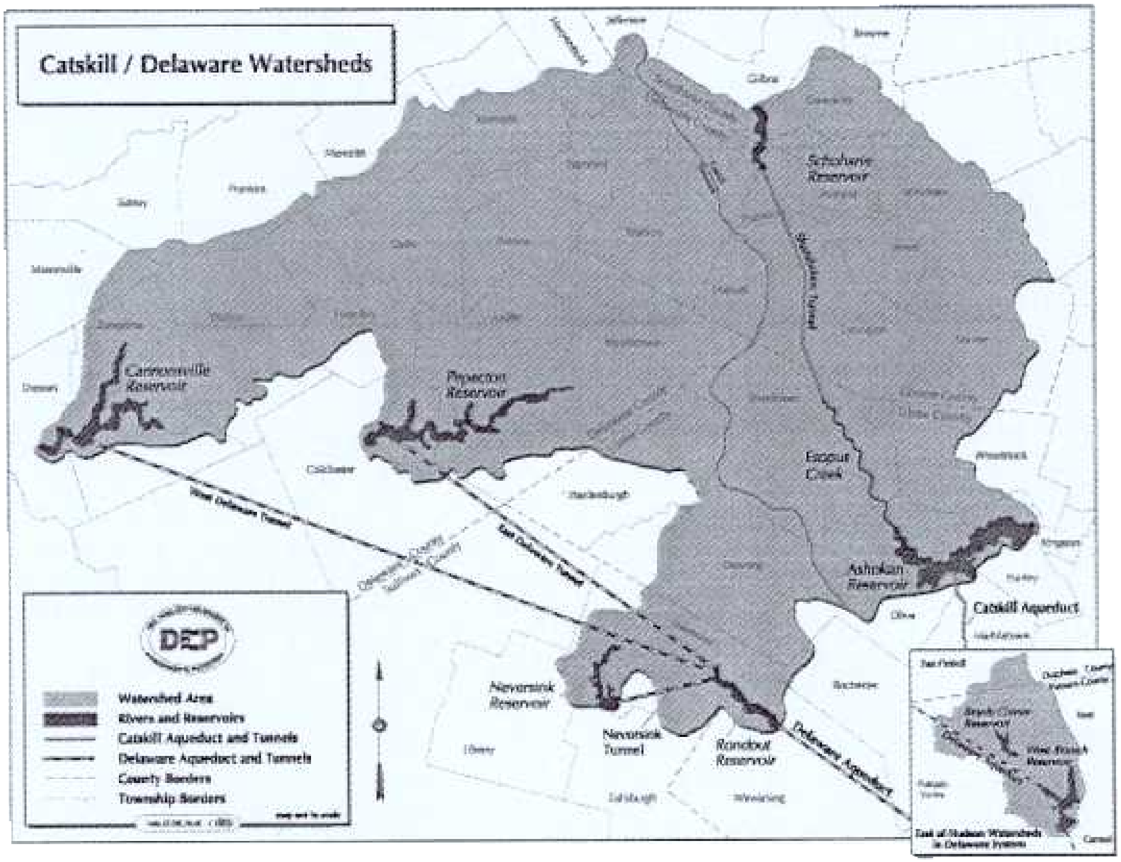

Figure 2.3 The Catskill/Delaware watershed covers 1,580 square miles, most of Delaware, Greene, Ulster counties and parts of other counties in New York State. It contains nine reservoirs and two aqueducts.

The collective watershed system is frequently cited as one of the largest and most efficient systems in the world. The watershed system's 19 reservoirs, three aqueducts and numerous controlled lakes can hold up to 580 billion gallons of water. Ninety five percent of the water is delivered via gravity (remaining is pumped) making water prices relatively cheap and stable (NYC DEP, 2006). Furthermore, there is much interconnectedness between the systems, which allows for flexibility in exchange of water – especially critical during times of drought (NYC DEP, 2005).

The watershed system is home to roughly one and half million people. As of 2005, the Catskill/Delaware watershed contained 279,909 people in an area more than four times the size of the Croton watershed (USCB, 2006). The Croton watershed on the other hand, had a population of 1,336,163 in 2005 – almost five times the amount of people in the Catskill/Delaware watershed (USCB, 2006). The population in the Catskill/Delaware has historically been significantly lower than the population in the Croton watershed (USCB, 2006)

The Croton watershed is closely connected with New York City as it is contained within a 60 mile radius from Manhattan (The Catskill/Delaware is 80 miles from the City at its closest point and extends as far as 125 miles from the City) (NYC DEP, 2005). The close proximity of the Croton watershed to NYC resulted in rapid development, suburbanization and population growth in the region as the City expanded over the last century.

Agriculture in the Croton watershed is virtually non-existent aside from Dutchess County. In 2002, the United States Department of Agriculture's National Agricultural Statistics Service cited Dutchess County as having 8,600 heads of cattle, producing 49,500,000 pounds of milk (2,800 milk cows), and using 8,400 acres of land for corn production (USDA NASS, 2002; NYS DAM, 2005). Although extremely pertinent to the City's water supply, agriculture in the Croton watershed and the entire watershed in general will seldom be discussed in this paper. This paper focuses centrally on the Catskill/Delaware watershed, NYC and the relationship between the two.

Located in the heart of the Catskill Mountains, the Catskill/Delaware watershed is a picturesque region with undisturbed forests, towering mountains and pure, fresh bodies of water. Private land accounts for 74 percent of the land in the watershed. For example, 70 percent of the land area in the watershed is occupied by forests of which 61 percent is privately owned (CGER, 2000). Public land owned by NYC and the State of New York composes the other 26 percent of land ownership in the Catskill/Delaware watershed (CGER, 2000) (Figure 2.4)

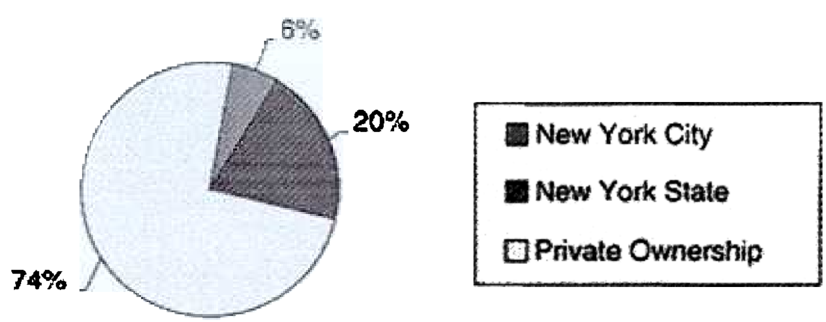

Figure 2.4 Land Ownership in the Catskill/Delaware watershed (CGER, 2000).

The watershed's economy depends heavily on natural resources and land use (CGER, 2000). Of particular importance for the region's economy and culture is agriculture. In 2000, there were 351 farms in the watershed 90 percent of which were dairy farms (Figure 2.5) (CGER, 2000). In 2002, there were 43,500 head of cattle, 271,500,000 pounds of milk produced (16,600 milk cows), and 9,600 acres used for corn production within the three counties most contained within the Catskill/Delaware watershed (Greene, Delaware and Ulster) (USDA NASS, 2002; NYS DAM, 2005).

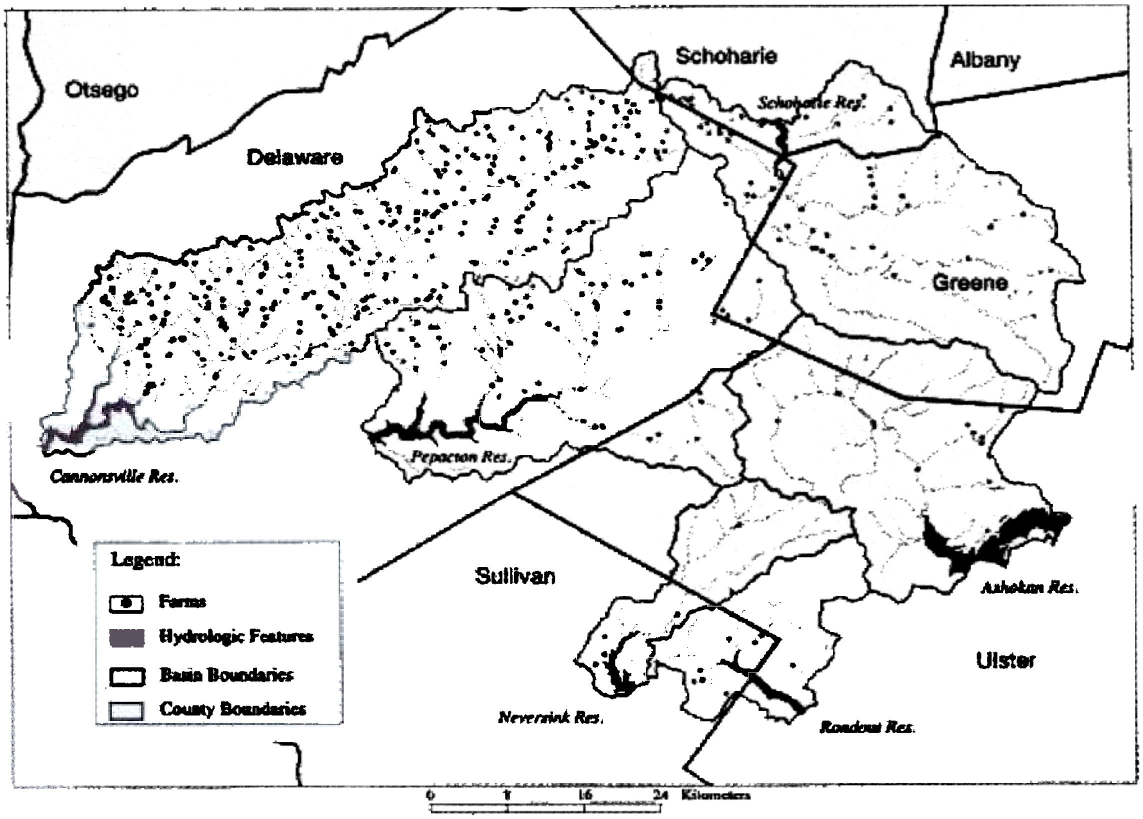

Figure 2.5 Location of farms in the Catskill/Delaware watershed (CGER, 2000)

These agricultural production numbers, however, are only a fraction of the total agriculture once present in the watershed. There were 50,616 head of cattle and 20,123 acres of land used for corn production in 1987 in the same three counties within the Catskill/Delaware watershed (USDA NASS, 1992). Over the last 15 to 20 years, the number of farms and farmer income in the region has decreased significantly. Several farms have gone out of business or begun to rely heavily on outside funding support (Gold, 1990; Interviewee, 2007). The Catskill/Delaware watershed is home to some of the lowest per capita incomes in New York State (Gold, 1990).

Currently, one and a half million people live upstream from NYC and use water from the NYC watershed for basic sustenance needs. Upstate use of the water, for better or worse has tremendous implications for the nine million people downstream in NYC. Today, there are several policies and management systems in place designed to uphold both the quality and quantity of fresh water resources accessible to upstream and downstream users.

The task of maintaining clean and ample water for all users within the NYC watershed system, however, has been a prolonged and challenging process. Since the early 1700s, an adversarial relationship has existed between upstate and downstate interests (Appendix C) (CGER, 2000). In the 1800s, upstate communities were disgruntled by the creation of reservoirs and the blockage of naturally flowing streams in the Croton watershed, and in the early 1900s, towns in Ulster County (Catskill/Delaware watershed) were flooded to make way for the Ashokan Reservoir (Gold, 1990; Koeppel, 2001). Throughout the 1900s, development of the Catskill/Delaware watershed was characterized by litigation and upstate discontent. In most cases, the City's right to alter landscapes and seize property was upheld (NYS DEP, 2006; Koeppel, 2001).

More recently, water quality and pollution issues have come to the forefront of water problems in the watershed system. The concern for water quality was elevated in the 1960s and 70s when the scientific community, as well as the public, became increasingly aware of water pollution issues ranging from pesticide poisoning to algae blooms throughout the United States (Ryther and Dunstan, 1971; Vig and Kraft, 2005). Long Island Sound, the Hudson River, and numerous watershed reservoirs, lakes and streams throughout the nation were to some degree aesthetically, functionally or biologically degraded during this time (USEPA, 2007; Vig and Kraft, 2005). In the U.S.

in 1961, nine percent of drinking water was classified as unhealthy and only 36 percent of fresh water was safe enough for fishing and swimming in 1971 (Showalter, 2002).

As public health, quality of life, and environmental concerns began to emerge throughout the nation, Congress took action by passing water quality legislation, focusing heavily on point source polluters such as the chemical industry, coal-fired power plants, and sewage plants. Among the most powerful laws was the Clean Water Act (1972). Congress designed the law with the intent of having the EPA regulate the worst visible polluters on a site-specific basis. Water improvements soon became evident. By 1983, two-thirds of U.S. waters were safe enough for fishing and swimming, and in 1974 only one percent of the drinking water was classified as very poor (Showalter, 2002).

The New York City watershed system, like the rest of the nation, enjoyed the mitigation of point source pollution throughout the 1970s and 80s. Since 1972, more than $2.6 million has been spent on cleaning up water in New York (Hudson River) and New Jersey (USEPA, 2007). Reducing pollution and water contamination from sewage has been the primary focus; 70 sewage plants, which treat 593 gallons of sewage daily, have been constructed in New York since the CWA was passed (USEPA, 2007). The results have been spectacular for the city. Beaches that were closed for consecutive decades opened, oxygen levels in the waters surrounding the City increased (manifesting in an increase of sea life) and harmful bacteria were drastically reduced (USEPA, 2007)

The success of the Clean Water Act strongly indicated the prevalent role of point source pollution in our nations' waters. Still, specific polluting agents and the degree to which each affected water quality remained relatively unclear. As point source polluters cleaned up their act and scientists learned more about water pollution dynamics throughout the 1970s and 1980s, it became clear that a significant proportion of pollution was coming from previously unrecognized and unregulated diffuse or non-point sources (Poe, 1995). Non-point source pollutants are pollutants that are not traceable to a specific emitter and for this reason they are frequently characterized by uncertainty and intractability.

Cultural eutrophication[1], or the anthropogenic addition of nutrients to bodies of water, demonstrates the complexity of non-point source pollution well. Scientists attribute cultural euthrophication to two common nutrients (pollutants in this case), nitrogen and phosphorus, which are frequently found in contemporary products like inorganic fertilizer (nitrogen) and household detergents (phosphorous) (Ryther and Dunstan, 1971). Agricultural practices such as concentrated animal feed operations were also believed to be playing a role (Poe, 1995). For example, animal cultivation produces an estimated 133 million tons of manure each year (USEPA, 1998). Aside from the harmful pathogens in animal feces, manure is wrought with nitrogen and phosphorus. When large groups of animals are raised in and around streams, which is often the case for feeding convenience, these nutrients leach into the water supply (Carpenter *et al.*, 1998).

The aforementioned contributors to cultural eutrophication are not common point source pollutants, but instead frequently come from multiple, unidentifiable sources such as private homes or farms to create non-point source pollution. However, knowing this much about pollution dynamics is not enough to paint a clear picture. Pollutants and the transportation mechanisms that lead to cultural eutrophication involve a complicated

[1] Cultural eutrophication leads to hypoxic conditions, the formation of dead zones, and harmful algae blooms, all of which have human health, environmental, and economic repercussions (Howarth *et al.*, 2002)

system (Howarth *et al.*, 2002). For example, nutrients can be deposited from the air (e.g. NOx), from point sources like sewage treatment plants, from non-point sources (e.g., suburban households and farms), or from naturally occurring sources (Howarth *et al.*, 2002). In fact, cultural eutrophication is frequently caused by some combination of all (Howarth *et al.*, 2002). Although scientists' initial perception of eutrophication as a non-point source problem caused primarily by agricultural practices and household detergents was for the most part accurate, it is important to recognize that in most water systems, pollutants are coming from a variety of sources and the picture is seldom simple.

As illustrated by the eutrophication example, non-point agricultural sources were targeted as a primary suspect in the water pollution that remained post-point source legislation. More non-point source research began to materialize in the 1980s and 1990s, including a National Water Quality Inventory study published in 1994 (Telaga, 1995). This study found, in addition to others, found agriculture to be the major cause of water impairment in the United States, indicating initial accusations had a basis (Telega, 1995).

Table 2.1 Agricultural Pollution in U.S. (Carpenter et al. 1998)

Agriculture is Primary Source of Nutrient Pollution in U.S. Waters

Figure 2: Nitrogen and Phosphorous Discharges to U.S. Surface Waters from Point and Nonpoint Sources (in thousands of metric tons per year)

SOURCE	NITROGEN	PHOSPHOROUS
Nonpoint sources		
Croplands	3,204	615
Pastures	292	95
Rangelands	778	242
Forests	1,035	495
Other rural lands	659	170
Other nonpoint sources	695	68
Total nonpoint discharges	6,663	1,658
Total point sources	1,495	330
Total discharge (point + nonpoint)	8,158	2,015
Nonpoint as a percentage of total	82%	84%

Source: Carpenter et al. 1998.

Much of the pollution stems from the nature of modern-day, green revolution initiated agricultural practices, such as use of external inputs such as pesticides, fertilizers, or other practices like large concentrated animal feed operations (Carpenter *et al.*, 1998). With all of the external nutrients and chemicals present in the environment, there is simply more potential for contamination of surface waters via runoff or leaching. For example, one pound of phosphorous, a common component of inorganic fertilizer, can grow 500 pounds of ecosystem-suffocating algae (Telega, 1995). Pesticides and soil erosion also contaminate drinking water as they lead to water turbidity and increases in the amount of chemicals, nutrients and bacteria in the water (Telega, 1995).

One of the most serious human health threats related to water quality is outbreaks from harmful bacteria such as *Cryptosporidium* or *Giardi* (Interviewee, 2007). These are found in livestock and livestock waste and moved about easily when deposited into water systems. In 1993, *Cryptosporidium* in the Milwaukee drinking water supply caused the largest waterborne disease outbreak in United States history (Interviewee, 2007; WDNR, 2003). While it is unlikely that agriculture was responsible for the Milwaukee outbreak, this outbreak led to the development of water quality concerns that would impact agriculture in the NYC watershed system (WDNR, 2003).

The public began to take notice of the severity of non-point source pollution, and Congress again responded with legislation, much of which attempted to address agriculturally related pollution. The Water Quality Act (1987) established the 319 program to help states mitigate non-point source pollution through guided requirements and funding. By 1998, $1,863,660 in 319 program money had been used to develop and promote New York's agriculture and reduce non-point source pollution (USEPA, 2002).

The Coastal Zone Act Reauthorization Amendments (1990) provided funding assistance for non-point source clean up and threatened to suspend states' funding opportunities should they fail to adhere to EPA water regulations (Poe, 1995). USDA administered programs targeting non-point source agricultural pollution were introduced and funded in each of the last four Farm Bills. The Environmental Quality Incentives Program (EQIP), for instance, was introduced in the 1996 Farm Bill. This is essentially a cost-sharing program whereby farmers in highly threatened watersheds are paid to implement management practices that reduce non-point source pollution. EQIP was appropriated $6. billion over six years in the 2002 Farm Bill (NRCS-USDA, 2006).

In terms of impact on the New York City watershed, the most significant federal legislation dealing with non-point source pollution was the Safe Drinking Water Act Amendments (1986). Under the SDWAA, the Surface Water Treatment Rule (SWTR was created in 1989 (NYC DEP, 2007). In general, the rule mandates that all water suppliers filter surface water unless the source water meets quality criteria and establishes a watershed management program. A central provision of the SWTR, which pertains directly to NYC watershed management, is three criteria for attaining filtration avoidance (NYC DEP, 2007):

1.) Objective Water Quality Criteria – Water constituents such as coliform, turbidity and disinfectant by-products must not exceed specific levels.
2. Operational Criteria – A system must comply with disinfection standards (used to kill *Giardia* and viruses); maintain minimal chlorine residual throughout the watershed; provide uninterrupted disinfection with

redundancy; and undergo an annual inspection by the primacy agency to review disinfection equipment.

3.) Watershed Control Criteria – Municipalities must create and maintain an effective watersheds management program that will minimize the potential for contamination from *Giardia* and other viruses.

The Safe Drinking Water Act Amendments, and particularly the Surface Water Treatment Rule, were targeted explicitly at limiting pathogens such as *Giardia* and *Cryptosporidum* (less significant at time of inception) and factors that would encourage the spread of pathogens and outbreaks (NYC DEP, 2007; Poe, 1995). An increased population of immuno-compromised citizens during the late 1980s was crucial in prompting the legislation (Intreviewee, 2007).

As the water supplier for nine million people, New York City had to intensify their investigation of how they might comply with the Surface Water Treatment Rule. Like other large U.S. cities, including Portland (Oregon), Boston and Seattle, New York City would eventually achieve a filtration avoidance determination and save an estimated 5-6 billion dollars (CGER, 2000; Interviewee, 2007). In reality, however, only the Catskill/Delaware component of the New York City watershed would be able to avoid construction of a filtration system and this would involve a lengthy process filled with controversy, cooperation, and numerous compromises. Three factors made filtration avoidance in the Catskill/Delaware watershed a realistic possibility: 1- the area is relatively under-populated; 2-the watershed is mostly rural wilderness – 70 percent forested lands; 3 – much of the land is publicly owned (Figure 2.4). The Croton watershed, due to its proximity to the City and general lack of the aforementioned characteristics, would not be able to attain filtration avoidance. The events, policies, science and people that brought the city to the current state of filtration avoidance are the focus for the remainder of the paper.

Chapter 3 Controversy: Responding to the Legislation

As the governing body responsible for making sure NYC's water system adhered to the new federal legislation, the New York City Department of Environmental Protection (NYC DEP) set out to take advantage of the SWTR provision that would allow them to avoid construction of an estimated $6 billion filtration system (with another $300 million in annual maintenance) in the Catskill/Delaware watershed (CGER, 2000). Their first step was to demonstrate that drinking water throughout the watershed met new standards introduced in the SWDAA. Secondly, and more challenging, for NYC to attain filtration avoidance under the SWTR, the DEP had to demonstrate a long-term commitment to maintaining and protecting water quality in the watershed (NYC DEP, 2007).

In September of 1990, the NYC DEP responded to this request by updating the NYC watershed rules and regulations, which were last updated in 1953 (NYC DEP, 1997). The newest edition of the NYC rules and regulations, officially titled the Discussion Draft (DD) of revisions, was filled with detailed language concerning the maintenance of water quality throughout the NYC watershed system. Agriculture, sewage treatment, hazardous and pathogenic wastes were all explicitly addressed in the DD and each received a specific set of pollution prevention guidelines (Walter and Walter, 1999; NYC DEP, 1997).

Rules and regulations pertaining to agriculture were both general (e.g. intentional acts of recklessness in the act of agriculture resulting in an increase in water pollution are strictly prohibited) and specific (e.g. exact standards for various activities like spreading manure and applying pesticides) (Interviewee, 2007; NPR, 1995). Among the most significant changes were stringent regulations that would limit development in the watershed, allow NYC to easily acquire land, and prohibit certain land use. For example, one set of regulations set "limiting distances" that prohibited the application of manure and fertilizer within a set distance from watercourses (Interviewee, 2007; Gold, 1990; NPR, 1995). The City also proposed accumulating as many as 240,000 acres of land at an estimated cost of $2.7 billion through both direct purchase and conservation easements of threatening land (e.g. land that could harbor or transmit microbes) in the Catskill/Delaware watershed (CGER, 2000). Agricultural land was targeted for both land acquisition and conservation easements (Gold, 1990; Interviewee, 2007; Walter and Walter, 1999). The NYC DEP would be in charge of enforcing the new rules and regulations (Interviewee, 2007; NYC DEP, 1997).

Compared with constructing a filtration plant, the regulatory plan made sense economically for NYC. Had a 6 billion dollar water filtration project been initiated instead of pursuing the filtration avoidance, each New Yorker could have expected a doubling in their water rates for a product that didn't taste as good (Gold, 1990; CGER, 2000). The City would have also had to pay about $300 million annually in maintenance costs (CGER, 2000). Conversely, with conservation easement assistance, regulatory enforcement, and other project expenses, the total cost under a regulatory approach would be 2-3 billion dollars lower than the cost of constructing a filtration plant, not to mention that costs could be spread over a few decades and New York City residents would not pay for pollution control (CGER, 2000).

While New York City was looking to achieve a filtration avoidance determination from the New York State Department of Health, upstate communities reacted to the new discussion draft. The initial response was one of confusion, anger and skepticism among both those involved in agriculture and those not (Interviewee, 2007; NPR, 1995; Gold, 1990). Town meetings were called in small farming communities like Walton (in Delaware County) where citizens voiced their discontent (Interviewee, 2007; CWC, 2005). Letters were sent to the NYC DEP demanding explanations and a revocation of the DD (Interviewee, 2007). Law suits were soon drafted by concerned citizens (CGER 2000; CWC, 2005). Farmers ridiculed the DD when they circulated a flyer showing a cow wearing a diaper – a kind of "is this what we have come to?" attitude (Gold, 1990; Interviewee, 1997). The public outcry also earned the attention of the media as the *New York Times* ran several columns documenting the upstate frustrations and National Public Radio addressed the issue with an on air discussion between various policy makers and stakeholders (this occurred a few years after the climax of controversy, however) (Gold, 1990; NPR, 1995). The DD was big news in a small upstate community setting. The livelihoods of many were at risk and people were expressing their discontent and frustration – particularly those with agricultural interests

The citizens of the Catskill/Delaware watershed had reasons to be upset. First, the new rules and regulations came with little warning. One interviewee recalled his first knowledge of the DD coming only days before the release when a meeting was called between the NYC DEP and his employer, the local Soil and Water Conservation District (Interviewee, 2007). The document was nearly finished and the DEP appeared to be looking more for an endorsement than a discussion (Interviewee, 2007). The atmosphere at the meeting was one of uncertainty and helplessness on the part of the SWCD. For this high standing individual in the field of NYC watershed agricultural management, there was no indication prior to the meeting that something as significant as the DD was in the works (Interviewee, 2007). Along the same lines, the fact that there was virtually no upstate input in the document left many disgruntled (Interviewee, 2007; Gold, 1990). It appeared as though the City would be pursing its goal of filtration avoidance unilaterally.

The City may have felt upstate input was not necessary. After all, there was a century's worth of precedence to demonstrate the City could have its way when it came to managing the watershed system (Appendix C) (CGER, 2000). From administering previous rules and regulations to flooding Catskill towns to create reservoirs, the City had long held jurisdiction over the watershed. Action without upstate representation had been the norm since 1905 when the New York State legislature gave NYC the right to act outside of its municipality (CGER, 2000). Communities had come to accept the circumstances, but not without litigation, contention, and defiance, all of which still exist to this day (Gold, 1990; CWC, 2005; CGER, 2000). The tumultuous history had fostered a great deal of mistrust of the City among upstate communities. The adversarial atmosphere in the wake of the DD release was likely fueled by history (Interviewee, 2007).

The past was the least of citizen concerns, however, as the new rules and regulations had the potential to really harm the upstate economy. Rules prohibiting discharge from animal feedlots and spreading of fertilizer/manure within 100 feet of a stream would severely limit how and where agriculture was practiced (Gold, 1990; Interviewee, 2007). In Delaware County, where a majority of agriculture in the watershed was located, there were 310 dairy farms in operation at the time of the DD release (CGER, 2000; Gold, 1990). It was estimated that 200 of these farms were within a specified distance from a body of water and would be affected by the rules (Gold, 1990; Interviewee, 2007). Additionally, the proposed rules would have eliminated 35 percent of cropland (Interviewee, 2007). In what is a mostly impoverished area, the financial losses threatening the farmers were overwhelming and as many voiced, unfair (CWC, 2005; Interviewee, 2007, Walter and Walter, 1999).

Regulations were another factor leading to an angry upstate agricultural community, causing frustration and tension among players in watershed management (Interviewees, 2007; CWC, 2005). Nobody likes to be told they have to conform to a set of rules – especially independent-minded farmers with their years of accumulated experience. Regulations often irritate those in business as they represent big government interfering with their independence and the workings of the free market (Mazmanian and Kraft, 1999). It was no different in Delaware County in 1990, when the release of the DD triggered upstate animosity towards the City. Additionally, there were complaints that the old rules and regulations were rarely implemented; they served more as an image for downstate responsibility and initiative than anything substantive (Interviewee, 2007; Gold, 1999).

Perhaps the most significant cause for upstate irritation was that many in the agriculture community felt they were being unfairly accused of polluting New York City's drinking water (Interviewee, 2007; Gold, 1990). Farmers had long been taking responsibility for their actions and monitoring their local environment – they simply did not see their role in the problem. There were reasonable arguments to back up these claims as well. For example, nutrient and pathogen counts had increased prior to the release of the DD, but the number of farms in the Catskill/Delaware watershed had actually decreased (Gold, 1990; Interviewee, 2007). Additionally, if upstate farmers were responsible, it was New York City that wanted the clean up, so they ought to pay the bill

The 1990 version of the rules and regulations was never approved. Still, the NYC DEP was granted a one year filtration waiver from the New York State Department of Health, the primary agency in charge of granting avoidance at this point in time (NYC DEP, 2005). Controversy still lingered in the Catskill/Delaware watershed as fears continued to mount over how exactly the City would mitigate water pollution. Soon after in 1991, in response to the filtration avoidance determination a group of 30 upstate towns aligned in opposition to the City and any attempt to enforce regulations (CGER, 2000). Known as the Coalition of Watershed Towns (CWT), they requested that NYC compensate upstate towns, farmers and others who would be negatively impacted through assistance payments and cost-sharing (CGER, 2000). The CWT echoed concerns of the past associated with the DD – suppression of economic development, a decrease in property values and infringement of property rights (Interviewee, 2007; CWC, 2005). Caught in legal action pursued by the CWT, the NYC DEP was unable to carry out any real enforcement of their regulations. It soon became clear, from the City's point of view, that achieving long term filtration avoidance would not be easily accomplished (CGER, 2000).

Even with the discontented upstate population, many city officials remained adamant that top-down control was the proper management scheme for keeping pollution out of the City's water supply and avoiding long-term filtration (Interviewee, 2007).

However, some higher ranking city officials, including Albert F. Appleton, the NYC DEP commissioner at the time, began to think differently (Interviewee, 2007; AHTF, 1991. Numerous logistical and legal roadblocks lay ahead of the City; law suits from the CWT, dissatisfaction from the New York State Department of Health relating to the DD, and the overall reluctance from upstate farmers and non-farmers alike to cooperate all accounted for a bleak outlook (CGER, 2000; NYC DEP 2005). If substantial reductions of agricultural pollution were to be made and in turn long-term filtration avoidance achieved, there needed to be serious changes with regards to the management and thinking on the part of New York City.

Chapter 4 Compromise: The Ad Hoc Task Force on Agriculture

Beginning in December 1990, just months after the initial release of the Discussion Draft, numerous upstate and downstate stakeholders convened to discuss at depth the state of agricultural management in the New York City watershed. Ignited by an inability to formulate a mutually agreed upon management plan, in addition to the lingering controversy, both sides were encouraged to seek compromise on behalf of all (Interviewees, 2007; AHTF, 1991; WAC, 2007). Filtration avoidance, urgency and cost minimization remained primary concerns for the City (Interviewees, 2007). Upstate concerns continued to fall on justice, financial buoyancy and representation (Interviewees, 2007). All of the stakeholders who convened over the next year would have resolution, cooperation and efficient agricultural management at the forefront of their agendas. They eventually became known as the Ad Hoc Task Force on Agriculture and New York City Watershed Regulations

Brought together by the New York State Department of Agriculture and Markets, the Ad Hoc Task Force consisted of primary stakeholders and policy professionals (the policy group) and scientific/technical support members (AHTF, 1991). The NYC DEP (including Commissioner Albert F. Appleton), watershed farmers, New York State Department of Environmental Conservation, upstate county Farm Bureaus, New York State Soil and Water Committee, upstate County Supervisors, the New York State Department of Health, Cornell University (various departments) and Extension, and the USDA were all represented by either the policy group or technical members on the Ad Hoc Task Force (Appendix D). The Ad Hoc Task Force policy group consisted of members who would administer any agricultural regulations, those affected by the regulations, and organizations that might be involved with contributing and facilitating regulations (AHTF, 1991). The Ad Hoc Task Force technical support group was made up of experts in natural and agricultural sciences and members of organizations that serve to assist farmers and educate about agricultural practices and technologies (AHTF, 1991 Other interest groups were represented at the Task Force as well, including the Citizens Campaign for the Environment, Hudson Valley Farm Credit, Dairylea Cooperative, Inc. and the Hudson River Valley Greenway Council. The Ad Hoc Task Force was temporary, held no legal authority and was strictly advisory in nature (AHTF, 1991).

The undertaking at hand for the Ad Hoc Task Force was to create a management system that would both protect New York City's water supply and sustain long term viability of agriculture in the watershed (AHTF, 1991). More specifically, the Ad Hoc Task Force had three goals including (AHTF, 1991):

1 – To improve mutual understanding of the laws and public policies that shape the City's watershed program.

2 – To improve mutual understanding of the characteristics of farm operations and of the technology and art of farm management that are available to address the influences of farm practices on drinking water quality.

3 – To explore ways in which the City may work in partnership with farmers and the networks of agricultural support institutions to encourage a sustainable farm economy in the watersheds, yet achieve the City's water quality objectives.

The policy group component functioned as the main decision making body of the Ad Hoc Task Force. They would overview and analyze various strategies for agricultural management in the watershed and all members would have opportunities to debate and contribute (AHTF, 1991; Interviewees, 2007).

The technical support team served to make presentations to the policy group component of the Ad Hoc Task Force and build a foundation of knowledge that would hopefully help in the decision making process (AHTF, 1991). Secondly, the technical support team would serve as a source of information and expertise to compare and contrast various policy alternatives (AHTF, 1991). Science would be at the immediate disposal of the policy makers – an aspect of decision making that would no doubt add an element of credibility and objectivity necessary to legitimize the policy groups' decisions (AHTF, 1991; Interviewees, 2007).

The Ad Hoc Task Force met regularly between December, 1990, and September, 1991 (AHTF, 1991). On December 31, 1991, the Ad Hoc Task Force released their Policy Group Recommendations which contained four major developments with landmark implications for environmental and agricultural stewardship in the watershed.

1 – First and foremost, the City decided to withdraw agricultural regulations proposed under the Discussion Draft. However, to protect against reckless, irresponsible and purposefully polluting farming, which would undoubtedly threaten the City's drinking water supply, a general prohibition of such actions remained in place. Aside from this, no agriculturally related regulations would be in effect in the New York City watershed system – effective immediately and pertaining to all agriculture within the City's jurisdiction (East and West of the Hudson) (AHTF, 1991).

The City's withdrawal was fueled principally by a consensus from DEP officials that agriculture was a preferred land use to alternative uses such as development. In fact, agriculture was viewed as a practice, which if practiced in a sustainable and judicious manner, could result in significant long-term environmental benefits (AHTF, 1991). It was because of this rationale that maintaining and upholding a maximum amount of agriculture became a priority for the City (NYC DEP, 2005). Regulations that had the potential to financially sink agriculture in the region no longer aligned with the City's objectives (AHTF, 1991; Interviewees, 2007; WAC, 2007).

Withdrawal of the agricultural regulations was also influenced by the fact that the regulatory approach was problem-laden. There were numerous reasons as to why regulations needed to be avoided; dissatisfaction from upstate communities, downstate legal difficulties, an inability to entice farmers to be stewards of the land and financial concerns (Interviewees, 2007). With an opportunity for ample input from all interested parties, the Ad Hoc Task Force policy group displayed an unwillingness to use regulations as means for agricultural management in the watershed.

2 – The City's withdrawal of the rules and regulations was paved by the development of a mutually agreed upon alternative to regulatory agricultural management; a voluntary Watershed Agricultural Program (WAP) (initially called the Whole Farm Program) with 100 percent cost sharing (AHTF, 1991; Interviewees, 2007). Using monetary incentives paid for mostly by New York City, the WAP would invite individual farmers to volunteer their farms and land to undergo changes intended to improve local and regional water quality, farm profitability and sustainability (AHTF, 1991). Under the new philosophy of maintaining agriculture in the watershed it was the

target of both New York City and the Ad Hoc Task Force that under this voluntary approach not a single upstate farm would be put out of business. To ensure achievement of the goal, farmers would not have to pay for any planning, implementation, maintenance or operation of improvement projects (AHTF, 1991; Interviewees, 2007).

As discussed by the Ad Hoc Task Force, the voluntary approach had numerous upsides. The regulations were a set of rigid standards to be applied uniformly throughout the watershed (AHTF, 1991). Even under ideal circumstances where all regulations were met by all farmers, there would only be action enough from farmers to meet the regulations – not enough to go above and beyond the regulations and achieve a superior form of agriculturally and environmentally sustainable management (Intreviewees, 2007; Dryzek, 2005). Further, because the voluntary approach focuses on the peculiarities of individual farms, direct and focused conservation efforts can be made to minimize pollution on each farm (AHTF, 1991; Interviewees, 2007; Walter and Walter, 1999).

The benefits of the voluntary approach were apparent for both upstate agricultural interests and downstate water quality interests. Farmers would be receiving financial assistance to improve their farms' ability to conserve and protect the surrounding environment – something that in the long-run would benefit the production, profitability and general livelihoods of their farms and communities (AHTF, 1991; Interviewees, 2007). Additionally, there was no pressure to participate in the voluntary program. In New York City, where filtration avoidance and cost of achieving such remained a major priority, it looked as though a voluntary approach with high farmer participation could create both environmental improvements with a relatively minimized financial commitment (AHTF, 1991; Interviewees, 2007). Compared to the alternatives of regulations or constructing a filtration plant, a voluntary approach looked as though it was capable of bringing the most bang for the buck.

The WAP would manifest itself in phases. The first phase would entail offering the program to a limited group of farmers to test the efficiency and effectiveness of the program. This was thought to be optimal as a trained staff of some 550-plus people in addition to monetary resources would be needed to execute the program on a large enough scale to cover the Catskill/Delaware watershed (AHTF, 1991). This trial period would also be used to build partnerships, trust, and communication networks among the various entities that would be interacting in the program. The first phase would be used to work out the kinks and build a movement that could potentially persuade farmers to enthusiastically jump on board with the program. The second phase is essentially large scale implementation of the WAP (Interviewees, 2007; WAC, 2005; AHTF, 1991).

3 – The third major development that came out of the Ad Hoc Task Force Policy Group Recommendations was the proposed mechanism for voluntary agricultural management; Whole Farm Planning with reliance on Best Management Practices (BMPs). Formulated under Section 319 of the 1987 Federal Clean Water Act, BMPs are farming structures or techniques that minimize agricultural pollution (AHTF, 1991 USEPA, 2002). For example, buffer strips such as long grass along waterways or time adjusted application of manure/fertilizer are both considered BMPs (Interviewees, 2007; Cestti *et al.*, 2003; Sharpley *et al.*, 2001).

As each farm within the watershed has a unique set up within its surrounding environment, BMPs and farm management plans need to be flexible enough to suit each farms' situation. This is where Whole Farm Planning becomes especially crucial. Whole

Farm Planning, as briefly outlined in the previous (WAP) section, uses localized expertise and agricultural infrastructures to develop appropriate BMPs and farm management for each farmer that volunteers for the Watershed Agricultural Program (Interviewees, 2007; AHTF, 1991 Whole Farm Planning is a step by step process which begins with and is centrally focused on farmers (Table 4.1) (AHTF, 1991

Table 4.1 Eleven steps of Whole Farm Planning (CGER, 2000)

Step	Description
1	Identify farm mission, objectives, business plan, and resources, both short-term and long-term.
2	Inventory and analyze water, soil, air, plant, and animal resource information.
3	Determine the priority water quality (and other) issues for the farm.
4	Identify practices (BMPs) to address the priority water quality (and other) issues.
5	Evaluate the effects of these practices on water quality (and other) issues from Step 3.
6	Identify adequate alternatives that satisfy the WAP's water quality criteria.
7	Quantify the economic and management effects of the alternative practices.
8	Select and integrate the practices to be included in the Whole Farm Plan. Submit the plan to the Soil and Water Conservation District and the WAC for approval.
9	Develop tactical plans to ensure successful implementation of the approved Whole Farm Plan.
10	Implement the Whole Farm Plan.
11	Assist, monitor, and evaluate implementation of the Whole Farm Plan and evaluate progress toward addressing the priority issues.

Once a farmer volunteers for the program, a County Project Team is assigned to the farm, including members from the Soil Conservation Service, Cornell Cooperative Extension and the county Soil and Water Conservation District (AHTF, 1991 These members will first survey the farms' resources including soils, crops, buildings, livestock and capital and then conduct an economic analysis involving the farms business objectives and economic opportunities (AHTF, 1991; Interviewees, 2007). Upon attaining a comprehensive picture of the farm, the County Project Team will identify potential BMPs and the economic/environmental repercussions they might have. Then, in coordination with the farmer, the County Project Team will select the most appropriate BMPs and formulate a schedule for implementation. The Whole Farm Plan would not be official until both the farmer and the Soil and Water Conservation District and Cornell Cooperation Boards gave approval (AHTF, 1991).

4 – The fourth and final development was the establishment of a communication and support network led by an institution that would oversee progress, evaluate whole farm plans, and continually provide support and suggestions (AHTF, 1991; Interviewees, 2007). The lead institution would be the Watershed Agricultural Council (WAC) and it would be composed of local, state and City governmental agencies as well as farm community members. The WAC would replace the Ad Hoc Task Force as a permanent and dynamic group capable of evaluating and altering any component of the WAP.

As mentioned before, the Whole Farm Program would involve farmers and County Project Teams, but there would be other entities in the program integral to successful agricultural management (Appendix E) (Table 4.2) (AHTF, 1991 Interviewees, 2007). County Project Teams would report to and get valuable scientific and legal information from respective organizations such as the USDA-Soil and Conservation Service, the Cornell Water Resources Institute and the New York State Department of Environmental Conservation. These organizations would in turn maintain communications with the Whole Farm Program administrator, who would in turn relay progress with various projects to the New York State Soil and Water Conservation Committee. The NYSSWCC would keep in contact with the NYC DEP to form the final leg of this communication line. Because such a long, bureaucratic line of people, agencies and committees can result in the loss of valuable information in translation as well as slow and inefficient functioning, it was necessary to create the WAC to serve as a central hub connecting all parties (AHTF, 1991).

Table 4.2 List of players in Whole Farm Planning and respective roles (CGER, 2000)

Organization/Party	Role
Farmer	The focus of the Watershed Agricultural Program. Participation is voluntary.
NYC Department of Environmental Protection	A source of major funding and technical and administrative support to the WAP. One NYC DEP staff member is a member of the WAC.
NYS Department of Environmental Conservation	Ex officio member of the WAC, providing technical expertise on nonpoint source pollution control measures.
USDA Natural Resources Conservation Service	A source of technical and scientific expertise for the WAP. Its role in the watershed predates the WAP.
Soil and Water Conservation Districts	Grassroots organizations created by individual counties to supply technical expertise to farmers on conserving soil/water.
Cornell Cooperative Extension	Technical and managerial expertise to farmers as part of New York State's land grant university, Cornell University.
Cornell University	Original research focusing on water resources and pollution prevention in the New York City watershed.

As dictated by the Ad Hoc Task Force, the commissioner of the NYC DEP would chair the WAC and membership on the council should include seven to ten farmers proportionately representing the agricultural distribution across the Catskill/Delaware watershed, members from agri-business, NYS DEC, USDA-SCS, NYS DOH, Cornell Cooperative Extension, Soil and Water Conservation Districts and other interested entities. The WAC would be all-inclusive to ensure that no comments or concerns went unnoticed (AHTF, 1991).

The foresight of the Ad Hoc Task Force in assessing the potential situations that might arise from the voluntary Whole Farm Program was impeccable (Interviewees, 2007; NPR, 1995). Conflict, lack of participation, scientific and technical uncertainty, and an ever-changing socioeconomic setting would remain staples of agricultural management in the Catskill/Delaware watershed – all of which would need to be sorted out should successful management take place (Interviewees, 2007; WAC, 2005). Armed with these general notions, the Ad Hoc Task Force assigned certain tasks to the WAC to complete, which they hoped would stabilize and facilitate the Whole Farm Program. For example, the WAC would monitor progress of education and training for professionals and future farmers, they would review individual Whole Farm Plans as developed by County Project Teams, and they would encourage farmers to participate through various outreach and education programs (AHTF, 1991; Interviewees, 2007).

Upon concluding the Ad Hoc Task Force on Agriculture and New York City Watershed Regulations discussions in the autumn of 1991, there was a consensus among all policy group members that the primary goal and the three sub-goals had been met and would continue to be met (AHTF, 1991 Withdrawal of agricultural regulations, the establishment of the WAP and the WAC were keys to meeting these goals. Compromise among stakeholders was achieved through a year long period of detailed discussions, creative thinking and trust building (Interviewees, 2007; Walter and Walter, 1999; WAC, 2005). The mood was positive and it looked as though all parties would get what they wanted, but success was not guaranteed as there were several months and years worth of work left.

Chapter 5 – Cooperation: Implementation of the Watershed Agricultural Program

In 1992, the phase one pilot program of the Watershed Agricultural Program voluntary management scheme commenced. Ten farms from throughout the Catskill/Delaware watershed signed up, County Project Teams were organized and communication efforts between the various cooperating agriculture entities intensified (AHTF, 1991; Interviewees, 2007). Each farm was evaluated and BMPs were selected for optimum management of soil erosion, animal waste, nutrients, domestic animal pathogens and pests and pesticides (AHTF, 2007). Whole Farm Plans were approved, implementation was carried out by the County Project Team and respective farmers, and the City stepped in to pay the bill.

The phase one pilot program was a success in that all of the farms implemented BMPs and in turn reduced local and regional water pollution in the Catskill/Delaware watershed. More importantly, however, the first phase of the Watershed Agricultural Program was an achievement because it was during this time when staff and outreach agents were trained, farmer support built, and the Whole Farm Planning process adjusted and re-packaged to improve efficiency (WAC, 2005; Interviewees, 2007). The stage was set for the second phase of the Watershed Agricultural Program. Substantive improvements to the water quality and the entire environmental integrity of the watershed were imminent.

The WAC was brought together for the first time in 1993. A permanent office was established in Walton in the heart of the upstate watershed agriculture community.

Meetings would take place about four times a year or when the NYC DEP commissioner saw it necessary to meet (AHTF, 1991; WAC, 2005).

In 1994, the second phase of the Watershed Agricultural Program began with a goal of having 85 percent of large farms in the Catskill watershed enrolled in the program by 1997 (this goal was actually established by the Ad Hoc Task Force in 1991) (AHTF, 1991 Through vigorous outreach from Cornell Cooperative Extension, farmer-to-farmer communication, and general word-of-mouth, this goal was met. Today, there is 95 percent participation in the watershed and the Watershed Agricultural Program expanded in 2002 to include smaller farms and farms in the Croton watershed (WAC, 2005; Interviewees, 2007).

Throughout the second phase of the Watershed Agricultural Program, the voluntary approach escalated in influence and ability. Farmers were signing up to participate at extraordinary rates – the idea of the City paying for personal farm improvements was simply too enticing (Interviewees, 2007; WAC, 2005). But it went deeper than receiving easy money from the City. Farmers began to see the correlation between environmental quality and profitability and ideas of agricultural stewardship began to permeate the culture (Interviewees, 2007). Farmers started to take more active measures as environmental stewards; action beyond that fostered by participation in the Whole Farm Program (Interviewees, 2007). Farmers would attend information sessions and meetings that were not mandatory to go over various BMPs and other environmentally relevant material (Interviewees, 2007). For example, the Farmer Education Program, which is designed to inform farmers about various environmental aspects of agricultural production, educated 600 participants between its inception in the mid 90s and 2006 (NYC DEP, 2006). Farmers watched after agriculture in the community and farmer-to-farmer dialogue relating to WAP management became commonplace – those with careful and conscious practices were praised while those with some less than perfect practices were encouraged to sign up for the WAP or make some other kind of positive move toward environmental protection (Interviewees, 2007.

Growth in the information base shared by the County Project Teams, educators and agency officials contributed to the success of the WAP as well. As experience grew with farm visits and completed Whole Farm Plans, these outreach members learned how to best relate and communicate with farmers, allay farmer concerns and highlight the perks of the program that would be of the most interest (Interviewees, 2007). Also, new research-based knowledge from Cornell University and elsewhere played a role in the ongoing improvement of the Whole Farm Program. Information on the functioning of harmful animal/human pathogens, nutrient loading and BMPs was specifically developed through state and federal funding (Interviewees, 2007). Research findings were disseminated through outreach efforts to farmers and eventually applied (Interviwees, 2007).

The relationships that eroded during the controversy stage following the release of the Discussion Draft were rebuilt and strengthened during the second phase of the WAP (WAC, 2005; Interviewees, 2007). The City was rewarded for its financial commitment, patience and trust in the upstate agricultural community with farmer respect and enthusiasm for the WAP. The WAC brought local, state, and City officials and farmers together to meet with one another and facilitated the resolution of conflicts. Although the values of the members were sometimes unaligned, there were elements of respect and cooperation between the parties which allowed them to reciprocate ideas and make decisions reasonably and justly. The partnerships and relationships existing in the New York City watershed system have been and will continue to be integral to continued agricultural and environmental success (Interviewees, 2007; NPR, 1995).

The Watershed Agricultural Program has had its setbacks, however. Although participation within the watershed is at an all time high, the number of farms and total amount of agricultural output from the region has decreased (Interviewees, 2007). In 2006, there were fewer farms in the entire watershed than there were in 2000 (Interviewees, 2007; NYC DEP, 2006). The cause of this decline is hardly attributable to the WAP and is likely the result of outside socioeconomic factors (Interviewees, 2007). Still, as determined by the Ad Hoc Task Force, agriculture is a more favorable use of land in the watershed than commercial or residential development (AHTF, 1991). The decreased presence of agriculture in the watershed has opened up land for development, but the USDA and NYC DEP have stepped in to acquire valuable water-boarding land (NYC DEP, 2006; Walter and Walter, 1999). Approximately 355,050 acres of land have been solicited in the Catskill/Delaware watershed since land acquirement began in 1997 (NYC DEP, 2006).

Another major shortcoming of the WAP is that empirical data relating to the impact of individual BMPs on water quality is hard to come by (Interviewee, 2007; CGER, 2000). This is likely due to the diffuse nature of BMPs (similar to pollution) and the amount of work that would be required to say something conclusive about the BMPs (even though 35,000 water samples are taken each year) (Interviewee, 2007; NYC DEP 2006). Instead, success under the WAP is often measured in terms of participation and implementation (e.g. 95 percent participation, x amount of dollars spent). The relevance of these data is unquestionable, but empirical data would likely go a long ways in justifying the WAP. More of a focus should be placed on evaluating BMPs so that improvements can be made.

Further challenges exist for the Watershed Agricultural Program. According to the NYS DEC (2004), 25 percent of rivers and streams in the Delaware Basin (Delaware, Sullivan counties) were stressed or threatened by agriculturally-related pollution (Appendix F). Agriculture remains a primary polluter in the Catskill/Delaware watershed – evidence that the WAP is not a cure all (Interviewee, 2007). Still, although agriculture is a major player in water pollution in the NYC watershed system, and in particular the Catskill/Delaware watershed, significant mitigation has occurred as a result of the WAP (improvements to be discussed shortly). Furthermore, there are many possibilities for expanding the WAP and reducing agriculture's negative effect on water quality. For example, there could be continued program expansion to large and small farms alike or creation and implementation of new BMPs (Interviewees, 2007). Moreover, although participation in the WAP totals 95 percent, only 68 percent of Whole Farm Plans have been fully implemented by farmers (NYC DEP, 2006).

Lastly, there are legitimate concerns surrounding who exactly is receiving support from the WAP. The poorest farmers have the most to gain from signing up to participate in the program as they likely benefit from on-farm improvements that might otherwise be difficult to afford (Interviewees, 2007). However, poorer farmers often run smaller farms and in turn impact water quality less. Conversely, larger farms are generally more financially stable, yet they are more capable of impacting water pollution; perhaps not with the financial assets to address pollution. Also, if there are farmers who have long been environmental stewards or become so without the WAP or financial assistance, how can support be shown for these individuals? How can we ensure they continue their environmentally-friendly tendencies when the worst polluters receive funding? The WAC needs to address questions regarding justice and equality (e.g. farmer income, location, prioritizing) and how to ensure the best stewards are rewarded for their efforts.

New York City's quest to achieve filtration avoidance has remained burdensome as well. In 1993, the City filed for a filtration avoidance waiver in response to the expiration of the previous one-year filtration waiver. The City filed with the EPA, which had replaced the NYS Department of Health as the primary SDWA administrative agency in the NYC watershed in 1992 (NYC DEP, 2005). Included in the City's proposal was a clear statement that agriculture would not be regulated, plans to attain 10,000 acres within the Catskill/Delaware watershed through acquisition, and the methodology for reducing non-agriculture pollution within the watershed (CGER, 2000). The EPA granted a 5-year waiver on the filtration system for the Catskill/Delaware watershed (NYC DEP, 2005).

Although avoidance was again granted, obstacles remained in the City's path to achieving long-term filtration avoidance. Uncertainty and skepticism surrounded the non-agriculture regulations/policies and tensions again rose between upstate and downstate interests (CGER, 2000). In 1995, Governor Pataki convened state, city, local upstate, federal, and environmental representatives to address the unrest and sort out the rules and regulations before the 1997 filtration avoidance renewal process (CGER, 2000).

The parties involved reached an agreement on par with the accomplishments of the Ad Hoc Task Force. The City renewed its rules and regulations and would be allowed to implement the critically important land acquisition provision; imperative to the agreement was a commitment from upstate interests that litigation would cease. In 1997, the Memorandum of Agreement (MOA) was signed by numerous upstate and downstate players (CGER, 2000). With regards to water quality, the health and safety of New York City residents looked to be in good hands. The MOA was estimated to cost $1.5 billion over the next ten years (CGER 2000, Pg. 27). It established NYC's right to acquire land through "willing buyer/willing seller agreements," provided financial assistance for voluntary conservation efforts and upheld less strenuous limiting distances relating to development. In 1997, the EPA granted the Catskill/Delaware watershed another 5-year filtration waiver (CGER, 2000).

Meanwhile to the East of the Hudson in the Croton watershed, water turbidity and aesthetic standards have been continually violated and the EPA demanded that a filtration system be installed. Construction of the Croton watershed filtration system began in 2006 (USEPA, 2006; CWCWC, 2006).

Today, agricultural management in the Catskill/Delaware watershed stands out as exceptional. The WAP has installed 3,600 BMPs on roughly 330 farms throughout the watershed at a cost of $25 million since 1992 (NYC DEP, 2006) (Table 5.1). In 2005, for instance, 134 BMPs were installed on small farms at a cost of $384,344 (NYC DEP, 2006). More than 165 miles of farm stream buffer systems have been put into place (NYC DEP, 2006).

The monetary investment from the City appears to have created environmental improvements in at least part of the Catskill/Delaware watershed. Phosphorus loads in one basin within the watershed were reduced from 750 kg annually to less than 250 kg. The removal of one dairy herd from a stream resulted in a 50 percent decrease in the amount of coliform bacteria in a nearby stream (NYC DEP, 2006). Turbidity caused by soil erosion was reduced in two of the watersheds major reservoirs (Neversink and Cannonsville) (NYC DEP, 2006). Citizens report increased aesthetics and species successes as well as decreased outbreaks of eutrophication (Interviewees, 2007). As long as water quality within the watershed continues to meet state and federal standards and improvements, filtration avoidance should remain attainable and citizens of both New York City and upstate New York satisfied.

As one of the largest unfiltered watersheds in the U.S. capable of delivering enough water for nine million people daily, the Catskill/Delaware watershed serves an outstanding example for maintaining quality water efficiently and inexpensively. It stands as a great civic achievement and attempts at emulating the watershed's success are frequently made within the United States and throughout the world.

Table 5.1 Results of the WAP in the Catskill/Delaware Watershed (NYC DEP, 2006)

Farms Participating	330 farms/ 95 percent
Number of BMPs Implemented	3,600
Money Spent on BMPs	$25 million
Land Acquired	355,050 acres

Chapter 6 – Analysis of the Watershed Agricultural Program: Using Social Tools in the NYC Watershed

An element of environmental stewardship in Catskill/Delaware watershed agriculture existed long before the Safe Drinking Water Act or before New York City loosely regulated farmers. Farmers, and the entire upstate community for that matter, have always had a great deal of pride in the naturally serene and untainted surroundings they call home (Interviewees, 2007). Still, with increasing concerns over drinking water in the U.S. and the passage of federal legislation, a new era of quantitative and substantive environmental improvements had to be ushered in.

A regulatory approach was initially adopted as a method for bringing about water quality improvements in the New York City watershed system. The prospects for this tactic were promising on paper. With regulations, if there is sufficient manpower, funds to police the regulations and the threat of fines is serious enough to stimulate clean up, standards will be met and improvements will occur (Mazmanian and Kraft, 1999; Dryzek, 2005). Based on past successes of the regulatory approach in improving water quality (Clean Water Act and previous Safe Drinking Water Acts), there was reason to believe a regulatory approach taken on this scale and applied to agriculture could work (Vig and Kraft, 2005).

However, when the NYC DEP Discussion Draft was released, certain realities about the regulatory approach and its application in a local agricultural setting became apparent. Regulations like all environmental management policies, excel at protecting the greater good, but by no means satisfy everyone. There are numerous problems associated with a regulatory approach including high amounts of litigation, slow bureaucracy and high implementation costs associated with the non-point nature of agricultural pollution (Mazmanian and Kraft, 1999). Regulatory action requires accumulating support (e.g. support for the DD) because regulations are executed through representative governments. As demonstrated in the early stages after the release of the DD, this is often time-consuming and burdensome. Moreover, there is a taxing adversarial component because regulations have winners (New York City) and losers (upstate farmers) (Mazmanian and Kraft, 1999). This obviously complicates matters by bringing politics and personal agendas into decision making. Another weakness is government's top-down execution of regulations; many believe the collective environmental consciousness necessary for real agricultural improvements can only come from the bottom-up (Mazmanian and Kraft, 1999). The last key weakness of regulations is that government regulations are risky because they do not utilize human incentive but rather operate through coercion; they collapse without continuous government intervention (Dryzek, 2005). Environmental management should be self-sustaining. Management is most commonsensical and efficient when people are motivated to be stewards, not when governments are pulling strings or using coercion.

With the regulatory approach destined for failure in watershed agriculture, policy makers from upstate and downstate New York convened as the Ad Hoc Task Force on Agriculture and New York City Watershed Regulations. Discussions here opened up new and alternative thinking that would reveal options beyond the regulatory approach. Market based incentives and socially-oriented management were being looked at seriously as tools that could create a new kind of environmental stewardship in the Catskill/Delaware watershed.

A voluntary incentive-based approach, the Watershed Agricultural Program, was adopted with the goal of enticing farmers through financial payments to improve their management. The incentives would instill citizen action and enthusiasm rarely seen with top-down regulations (Interviewee, 2007; NPR, 1995). The new program would work with individual farms on a county and regional level. This type of flexibility would work wonderfully to create options, minimize city-farmer tensions, and make improvements that would be superior to a one-size-fits-all regulation mentality (Mazmanian and Kraft, 1999; Dryzek, 2005). The Watershed Agricultural Program would also create balances on each side of the upstate-downstate economic equation that worked (CGER, 2000; Interviewees, 2007).

New York City provided incentives, localization of management and on-site farm flexibility would all be integral in creating a consensus among the Ad Hoc Task Force. These factors also demonstrated long term planning sufficient to make significant water quality improvements and in turn open the door for the City's attainment of a filtration avoidance determination. The role of money and incentives in the outcome is indelible. But still, there were aspects of the WAP rooted deeper than money that truly allowed the program to take hold with the farmers of the Catskill/Delaware watershed (Interviewee, 2007; Walter and Walter, 1999). These epoch three, or socially-oriented environmental management factors were present throughout the Ad Hoc Task Force and perpetuated over the implementation stage of the WAP. Factors such as participation, reciprocity and trust, leadership and scientific involvement all created a tight knit, well-oiled mechanism for stimulating real environmental stewardship with the watershed's agriculturalists (Pretty and Ward, 2001; Ostrom, 1990).

The remainder of this chapter will be devoted to analyzing where and how specific socially-oriented management tools were used to create and maintain environmental stewardship in agriculture in the Catskill/Delaware watershed.

Partnerships: Partnerships and interdependency between various watershed entities has driven much of the success of the Watershed Agricultural Program. Partnerships such as those formed between farmers and County Project Teams in creating Whole Farm Plans do not jeopardize farmers, but instead have numerous benefits which lead to significant water quality improvements. The formation of Whole Farm Plans requires collective action and thorough consideration prior to taking action – the result is often synergistic (Interviewees, 2007). Each side brings valuable knowledge and information to the table to make Whole Farm Plans far more efficient and effective than they would be in a non-partnership setting. The partnership between the Watershed Agricultural Council and the NYC DEP has also been critical. The cooperation between these two parties is absolutely necessary as the NYC DEP depends on the WAC to implement and facilitate the WAP, but the WAC also depends heavily on NYC DEP advice, suggestions and of course, funding (Interviewees, 2007). The partnership between scientific research (e.g. Cornell University) and outreach agencies like Cornell Cooperative Extension and County Soil and Water Conservation Districts is a tight partnership that has been around longer than the WAP. Since the WAP began, however, these two groups have worked together to continually inform farmers about the most relevant and up-to-date agricultural practices and BMPs (Interviewees, 2007).

Partnerships are incredibly valuable because they introduce a set of features that would not be present if management were performed by a single group. Partnerships spread the workload across all of the partners so that no single party is burdened with the task of making goals a reality (Mazmanian and Kraft, 1990). All parties have a stake in the outcome, so each party will take on their fair share and see to it progress is made – the key here is making incentives to get each of the diverse parties involved (Ostrom, 1990). Distributing the workload makes one party less stressed, other parties more interested in the outcome, and the whole process more efficient. Partnerships also increase the diversity of thought and creative capacity found in management (Pretty and Ward, 2001 Mazmanian and Kraft, 1999). By bringing in a number of people and parties that all think a little different and have different, but associated agendas, there becomes a vastly larger bank of options for creating the best situation possible.

Trust and reciprocity: Resulting from many of these WAP partnerships has been an increased sense of trust and reciprocity between the various parties. However, elements of trust and reciprocity were present prior to development of the WAP, which may have been a significant reason why the WAP was adopted by the Ad Hoc Task Force. The relationship between extension agents/outreach members and farmers stands out as particularly important in this regard (Interviewees, 2007). These two groups are extremely tight knit and their relationship has evolved to be considerably trust-laden over the last half century of working together. The Ad Hoc Task Force made an extremely clever move by utilizing this healthy pre-existing relationship as the primary mechanism to attract farmers and ultimately implement the WAP (Interviewees, 2007). Because farmers and outreach agents have equally important roles and depend on one another to achieve their goals, they have learned to rely on each other

By using the extension agent-farmer relationship as the foundation of the WAP it was possible to build additional partnerships and trust. After completing the first phase of the WAP for instance and seeing how effective a voluntary approach could be, the NYC DEP had enough trust in the upstate agricultural groups to enter the second phase and increase the funding (WAC, 2005). The NYC DEP and the WAC trust one another to carry out their roles in the WAP and understand that without the other, the voluntary approach would struggle (Interviewees, 2007).

Trust and reciprocity are valuable tools in the WAP because they build confidence and motivation in the various interacting groups (Ostrom, 1990). Groups become adapted to the idea that they are a needed and integral part of the WAP and begin to pull their weight as they expect their counterparts to do. Sanctions are given when one group does not do its' part and praise given when one group goes above and beyond the call of duty to help out the whole group (Ostrom, 1990). Trust and reciprocity also serve to stabilize and continually strengthen environmental management. With decades of trust and reciprocity built among cooperative groups a kind of social capital compiles which allows the groups to tackle increasingly complex and challenging problems (Pretty and Ward, 2001).

Communication: Communication and connectivity are important to the success of the WAP as well. The communication chain outlined in appendix E maintains networks and keeps information flowing between groups. The most relevant information is passed between nodes on the chain to give each group exactly what it needs to carry out its role and not clutter the network with unnecessary information. But still, it is easy to imagine how valuable information could become lost or misinterpreted in this process.

To prevent against this the WAC acts as a focal point where information is condensed and viewed from a big-picture perspective (Interviewee, 2007; AHTF, 1991). The WAC is truly important in keeping the WAP on track and various groups connected.

Consistent communication between all parties lays all of the information out on the table for everyone. This adds a component of accountability to the WAP and all of the partnerships because each group is obliged to share information, discuss plans and justify decision making (Dryzek, 2005). For instance, when the County Project Teams and farmers share Whole Farm Plans with the WAC for analysis the County Project Teams will be held responsible if the plan is for some reason missing an economic evaluation of the farm or fails to justify why a particular BMP should be implemented (Interviewees, 2007). Along the same lines, communication adds transparency, so the WAC and other decision making groups can see the whole picture and adjust the Whole Farm Plans or peculiarities of the WAP according.

Education: Farmer education programs have helped to propel the WAP to success because they are win-win for farmers and environmental managers (Interviewee, 2007). For example, Cornell Cooperative Extension can put on an education session to teach about calf health and how to treat and prevent sickness. Sick cattle can be carriers for harmful waterborne pathogens such *Giardia;*, improving calf health and minimizing this pathogen would benefit water quality (Interviewee, 2007). At the same time, farmers obviously do not want their calves to be sick as this poses a threat to profit. Healthy calves benefit everyone. Programs like this are very common and they are almost always well attended and well received. Educational programs are not a one time deal for farmers either. Information constantly evolves, farmers come and go (e.g. new generations of farmers) and there are a large number of agricultural management issues to cover – the need for education programs will continue (Interviewee, 2007).

Educational programs also offer farmers the power and freedom to make environmentally conscious decisions on the farm, without outside assistance. The fact of the matter is County Project Teams and extension agents are not always there to help. Self-motivation and a proactive attitude on the part of farmers will sustain environmental stewardship in agriculture (Pretty and Ward, 2001; Ostrom, 1990). Educational programs help farmers grasp how important their decisions and actions are in maintaining water quality (Interviewees, 2007). They become interested in updating their knowledge with fresh information and embrace the challenges that come with creatively managing a farm to benefit both self and community (Mazmanian and Kraft, 1999; Interviewee, 2007)

Science: Science is deeply engrained in the Watershed Agricultural Program. Monitoring water quality, designing and upgrading BMPs, putting on educational programs, and making management decisions – science has played an influential role throughout the management development and implementation process (Interviewee, 2007). Scientific information was used to convince the Ad Hoc Task Force that agriculture is a superior use of land as compared to development – a considerable factor in the withdrawal of the agricultural regulations (Interviewee, 2007). Many of the BMPs in practice in the Catskill/Delaware watershed today were first tested and evaluated in scientific field studies (Interviewees, 2007).

Science may not always be thought of as particularly social in nature, but it has a place in society that is very important for decision making. Science is often taken to be truthful, objective and credible by members of society and decision makers in particular

(Dryzek, 2005). By incorporating science into policies and justifying polices with the help of science, those elements of credibility and objectivity are in turn qualities of the policies (Interviewees, 2007). Science is critical to legitimizing policies and keeping management fresh and up-to-date. Through the Ad Hoc Task Force's reliance upon and utilization of science to make decisions and create the WAP the potential for success was enhanced.

Chapter 7 Conclusions and Broader Applications

Creating and maintaining environmental stewardship in agriculture in the NYC watershed system has been assisted by many of the aforementioned social tools and some social tools not discussed. Socially-oriented management is powerful because it uses so many characteristics desired in modern environmental management; accountability, incentives, choice, transparency, credibility, trust and reciprocity, objectivity, self-sustaining motivation, distribution of workload, flexibility and participation.

The WAP has been a success for the most part as it has allowed NYC to attain filtration avoidance and agriculture to remain relatively viable in the watershed. Much of the success is a result of the socially-oriented tools which have driven and maintained the WAP. However, credit must given to the tremendous role of money and external incentives from the City. Without this help it is unlikely that the voluntary approach would have taken off as it did. Further, attaining filtration avoidance and improving water quality in the Catskill/Watershed system involves a lot of factors outside of the agricultural realm. Industrial and commercial water pollution, for example, has been mitigated through regulation. The management of environmental pollution in the NYC watershed system is undoubtedly diverse and complicated.

With that said, it is undeniable that the Catskill/Delaware watershed successfully uses socially-oriented management to create environmental stewardship in agriculture. How might a socially-oriented form of management be applied on a broader scale throughout the world? How might it fit in an agricultural setting?

As the human population nears seven billion and exploitation of natural resources continues to escalate, agriculture, the foundation of our civilization, will come under increasing pressure. We will push agriculture and the environment it exists within to meet our needs. Because of finite resources, and an environment which responds to our actions, the likely outcome will be environmental degradation and subsequent negative repercussions on humans. In fact, agriculture related environmental problems are already ubiquitous.

Global climate change and air pollution are impacted significantly by modern energy-intensive agriculture; 95% of NH_3, 81% of N_2O, 70% of CH_4, and 21% of CO_2 emissions come from agricultural practices (Isermann, 1994). Nutrient pollution relating to dependence on external inputs severely degrades water resources worldwide. In 2004 the Untied Nations Environment Programme reported that 146 areas throughout the world's oceans were too hypoxic to support marine life and that the amount of oxygen-depleted water has tripled over the last 30 years (McGinn, 1999). According to the EPA, non-point source pollution from animal feeding operations remains the number one cause of impairment to water quality in New York State (USEPA, 1998 and 2002). Biodiversity in valuable tropical regions such as Brazil is succumbing to deforestation as people move into rainforests to practice agriculture. Fertile soil, a key component to successful farming, is quickly becoming a rarity. Approximately 75 billion tons of topsoil is eroded each year much of which is a result of conventional agriculture practices (Wilkinson and McElroy, 2007). In 2004, the World Health Organization estimated there were 3.7 billion malnourished people worldwide – a testament to how critical our present situation with agriculture, the environment, health and management has become (WHO, 2006).

A facet of agriculturally related environmental degradation which stands out is that so many of the aforementioned problems have earned the attention of environmentalists, farmers, researchers and policy-makers, yet they remain unsolved and ongoing. There are properties of modern agriculture which may predispose it to cause environmental degradation and/or an ability to elude attempts at mitigation – particularly the types of efforts that would be found in the first (regulation) and second (market incentives) epochs

One property, for example, is that farms are ubiquitous throughout rural settings, but most are relatively small. This type of set up lends itself to non-point source pollution. When a single farm applies fertilizer, or emits green house gases, the pollution is nearly negligible. However, as pollutants from several farms add up and enter a larger pool, resources can become seriously degraded. Managing non-point source pollution is a nightmare (Mazmanian and Kraft, 1999). Pollutants are seldom traceable to a polluter; enforcement of regulations is unfeasible on such a large scale; and creating monetary incentives is often expensive.

Another property of agriculture is that it is historically unregulated. Farmers are independent, free-spirited and naturally close with the environment. Regulations in a nation like the U.S. which takes liberties very seriously are a last resort to solving problem. Further, because of their close association with the land, farmers are skeptical of government regulations or outside suggestions that tell them how to best treat their land as they obviously have a respectable amount of environmental knowledge. All together, agriculture has been particularly successful at avoiding regulations.

A third property of agriculture which emphasizes why it is capable of causing environmental harm is the simple fact, that agriculture is tightly engrained with the environment. For better or worse, whenever farming is practiced the surrounding land is impacted. This is especially obvious in conventional agriculture which relies heavily upon external inputs (e.g. synthetic fertilizers, pesticides) and other practices (e.g monocultures, frequent tillage) (Pimentel *et al.*, 2005). As reliance on these modern practices increases there are direct negative impacts on the surrounding land, air and water

Agriculture can cause environmental harm as well as elude attempts at mitigation of this harm, and there are reasons as to why this might be. Still, it can not be overstated how essential agriculture is to human civilization. Agriculture is by no means a hindrance in the global effort to create sustainable lifestyles and clean, healthy environments. There are simply better and worse ways to conduct agriculture with regards to maintaining environmental integrity. For example, certain types of sustainable farming provide vital ecosystem services such as enhancing biodiversity and returning organic material and nutrients to the soil (Pimentel *et al.*, 2005).

An idealized form of agriculture would meet humans' sustenance needs, maintain or even enhance environmental integrity, and uphold values of social and ethical responsibility. Social infrastructures and tools may be critical in achieving this idealized state of agriculture or something close to it

Socially-oriented environmental management may be too abstract and complicated to implement. The whole process is over-socialized and places too much faith in participation and collective action (Dryzek, 2005). Americans for example, do a poor job of participating (e.g. voter turnout) and are attached to the idea of (individual) private property. What's more, widespread participation (democracy) may be less efficient and slower than a representative form of decision making and management. Further, building the kind of social infrastructure necessary for social management to work can be difficult and incentives may be needed to stimulate action (Pretty and Ward, 2001; Mazmanian and Kraft, 1999). Lastly, it is necessary to be realistic and consider just how much of a role money played in the context of NYC watershed management and the WAP. Would the WAP be as successful, if not for the money? Could it work with just social-oriented tools? If so, who would pay for improvements? The fact of the matter is that socially-oriented tools are likely weak if not completely ineffective on their own – they are probably strongest in conjunction with other policy tools.

At the same time, there are reasons to believe agriculture would be suitable for a socially-oriented management style. Agriculture is a very localized and community-oriented practice. A community managing its own resources is capable of adapting to local change and learning from these changes better than any outside force (Pretty and Ward, 2001 Incentives and self-motivation can be fostered through continuing educational programs and participation and trust also plays a central role in small farming communities. Agriculture may be predisposed to socially-oriented environmental management, but steps need to be taken to glean what real prospects the management style holds. As evidenced by agricultural management in the NYC watershed system, the WAP and hundreds of situations similar to it throughout the world, there is reason to be excited by the potential for socially-oriented management to be applied on a larger scale within the agricultural arena.

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Appendix A

Three Environmental Epochs and Key Attributes (Mazmanian and Kraft, 1999)

Table 1.1
From environmental protection to sustainable communities

	Regulating for environmental protection, 1970–1990	Efficiency-based regulatory reform and flexibility, 1980–1990s	Toward sustainable communities, 1990–on
Problem identification and policy objectives	• pollution caused primarily by callous and unthinking business and industry • establish as national priority the curtailment of air, water, and land pollution caused by industry and other human activity	• managing pollution through market-based and collaborative mechanisms • subject environmental regulations to cost-effectiveness test • internalize pollution costs • pursue economically optimal use of resources and energy • introduce pollution prevention • add policies on toxic waste and chemicals as national priorities	• bringing into harmony human and natural systems on a sustainable basis • balance long-term societal and natural system needs through system design and management • rediscover/emphasis on • halt diminution of biodiversity • embrace an eco-centric ethic
Implementation philosophy	• develop the administrative and regulatory legal infrastructure to ensure compliance with federal and state regulations	• shift to state and local level for initiative in compliance and enforcement	• develop new mechanisms and institutions that balance the needs of human and natural systems, both within the U.S. and around the globe
Points of intervention	• end of the production pipeline • end of the waste stream • at the point of local, state, and federal governmental activity	• create market mechanisms for protection of the environment • the market-place, which serves as the arbiter of product viability • provide education and training at several points along the cradle-to-grave path of materials and resource use	• societal-level needs assessment and goal prioritization • industry-level attention to product design, materials selection, and environmental strategic planning • individual behavior and lifestyle choices
Policy approaches and "tools"	• policy managed by Washington, D.C. • command-and-control regulation • substantial federal technology R&D • generous federal funding of health and pollution prevention projects	• policy managed more by states and affected communities • federal role shifts to facilitation and oversight • introduction of incentive-based approaches (taxes, fees, emissions trading) for business and industry • creation of emissions-trading markets	• comprehensive future visioning • regional planning based on sustainability guidelines • Total Quality Environmental (TQEM) and life-cycle analysis practice in industry • various experiments with new approaches

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nform on and data anag ent needs	• company-level emissions • waste stream contents and tracking • human health effects • environmental compliance accounting in industry	• costing out environmental harms and benefits of reduc pollution • provision of readily accessil emissions data, e.g., througl Toxics Release Inventory an right-to-know programs • professional protocols for environmental accounting i industry • ecosystem mapping	• sustainability criteria and indicators • eco-human support system thresholds • region/community-global interaction effects (e.g., regarding CO_2 emissions and depletion of ozone layer) • utilization of ecological footprint analysis • use of material and energy "flow-through" inventories and accounting • computer modeling of human-natural systems interactions
Predominant political/institutiona	• rule of law • adversarial relations • zero-sum politics	• alternative dispute resolution techniques • greater stakeholder and publi participation, especially at the state and local levels • reliance on the market place	• public/private partnerships • local/regional collaborations • community capacity building and consensus building
	• focus on national regulatory agencies and enforcement mechanisms		• mechanisms created t enforce "collective"
Key events and public actions	• Santa Barbara oil spill • Earth Day • passage of the 1970 CAA and 1972 CWA • passage of National Environmental Policy Act • creation of the Environmental Protection Agency	• Carter administration focus on cost of environmental regulation • election of President Ronald Reagan • Love Canal, Bhopal • RCRA and SARA • growth in state and local environmental policy capacity	• attention to global issues of sustainability • Brundtland report, *Our Common Future* • Earth Summit (UNCED) • collective international action—Montreal Protocol on CFCs, international accords on global warming

Appendix B

General outline of interview format

– What is your occupation? How many years have you been in it?

2 – Describe your relationship with agriculture and/or the Hudson River basin from a personal as well as a professional standpoint.

3 – When did you first learn about agricultural pollution in the Hudson River basin?

4 – To what degree was it presented as a problem? For whom?

5 – What was the sense of urgency?

6 – The City of New York (DEP) maintains the right to oversee and regulate upstate watersheds. In 1991 it released a discussion draft of rules and regulations that would have impacted agriculture among other businesses and lives in the Catskill/Delaware watershed. This was done to avoid a $5-8 billion filtration system that would be necessary otherwise under the Safe Drinking Water Act. When did you learn about the city's proposal? What was your reaction to this?

7 – Did you feel that the discussion draft and related policies were based on sound science?

8 – Did you feel that all parties were being equally represented in the decision making process? Were all parties treated justly in the discussion draft?

9 – How would you describe the relationship between upstate and downstate New York during this time? Were there elements of trust and open communication?

10 – A task force composed of a variety of stakeholders was created by the state of New York to address the agricultural dimensions of the new rules and regulations. Its main objectives were to give all parties an outlet to convey their opinions on the topic and to eventually create a policy all parties could agree on. Were you involved with this task force? Did you know of its existence while policies were being formulated? Did you voice your opinion to the task force or to a representative on the task force?

11 – Did you feel that all are parties were being equally represented during the task force process? Why or why not?

12 – Who were the leaders during the Ad Hoc Task Force discussions? What made them leaders? Who were the resistors?

13 – How were the scientific claims with the Task Force different from the claims before/without the Task Force (when NYC first proposed regulations)? Did you feel the science was sound?

14 – How would you describe the relationship between upstate and downstate New York during the Ad Hoc Task Force? Were the two sides on good or bad and terms? What role did trust and open communication play during the Ad Hoc Task Force?

15 – Do you feel that the Ad Hoc Task Force accomplished what it set out to do – represent all stakeholders evenly and create a policy all stakeholders could agree on? Why or why not?
16 – What did you feel were the main differences in communication, decision making and the general process of dealing with agricultural pollution in the Catskill/Delaware watershed prior to the ad hoc task force and after the task force?

17 – Is more scientific research needed to improve some dimension of the policies? How important is it that scientific findings be shared with the upstate agricultural community?

18 – Are you happy with the policies in place? Do you get the impression others feel the same?

Appendix C

Chronology of NYC Population and Watershed Events (CGER, 2000)

NYC Pop.	Year	Event
60,000	1800	
	1811	Commissioners Plan for New York City—future growth envisioned
	1819	Albert Giblin patents the silent valveless wastewater preventor (flush toilet) in Great Britain
	1825	Erie Canal opened
200,000	1830	
	1832	Cholera epidemic strikes New York City and other cities
	1834	NYC Board of Water Commissioners established by state legislature
	1835	Great Fire burns much of New York City
	1837	Croton River Dam and 41-mile aqueduct begun
	1842	First water reaches New York City from Croton River—celebrations
	1858	Central Park opened—including reservoir
	1866	New York State Metropolitan Health Act
1 million	1878	
	1893	Completion of New Croton River aqueduct
	1898	Consolidation of "Greater New York City"—five boroughs
3.5 million	1905	State Legislature gives New York City power to regulate upstate watershed land
4.6 million	1911	New Croton River system completed—10 percent of present New York City system
	1925	Interstate compact re Delaware River allocation—only ratified by New York
	1927	Catskill Mountain system completed—40 percent of present New York City system
	1931	*New Jersey v. New York* (283 U. S. 336) New York City is authorized to withdraw up to 440 mgd from Delaware River headwaters
7.5 million	1936	Delaware River system begun
	1953	*New Jersey v. New York* (347 U. S. 995)—NYC authorized to divert up to 800 mgd from the Delaware headwaters subject to maintaining minimum downstream flows. River Master appointed. New York City Watershed Regulations published
7.7 million	1961	Delaware River Basin Interstate Compact adopted (four states and U. S.)—Delaware River Basin Commission established
	1964	Delaware River system completed—50 percent of present New York City system
	1964-65	Northeast Drought
7.9 million	1970	
7.3 million	1990	
	1997	Watershed Management Agreement signed

Appendix D

Policy Group and Technical/Scientific Group at Ad Hoc Task Force (ADTF, 1991)

Acknowledgments

The Task Force's recommendations were a collaborative effort involving the following individuals and organizations:

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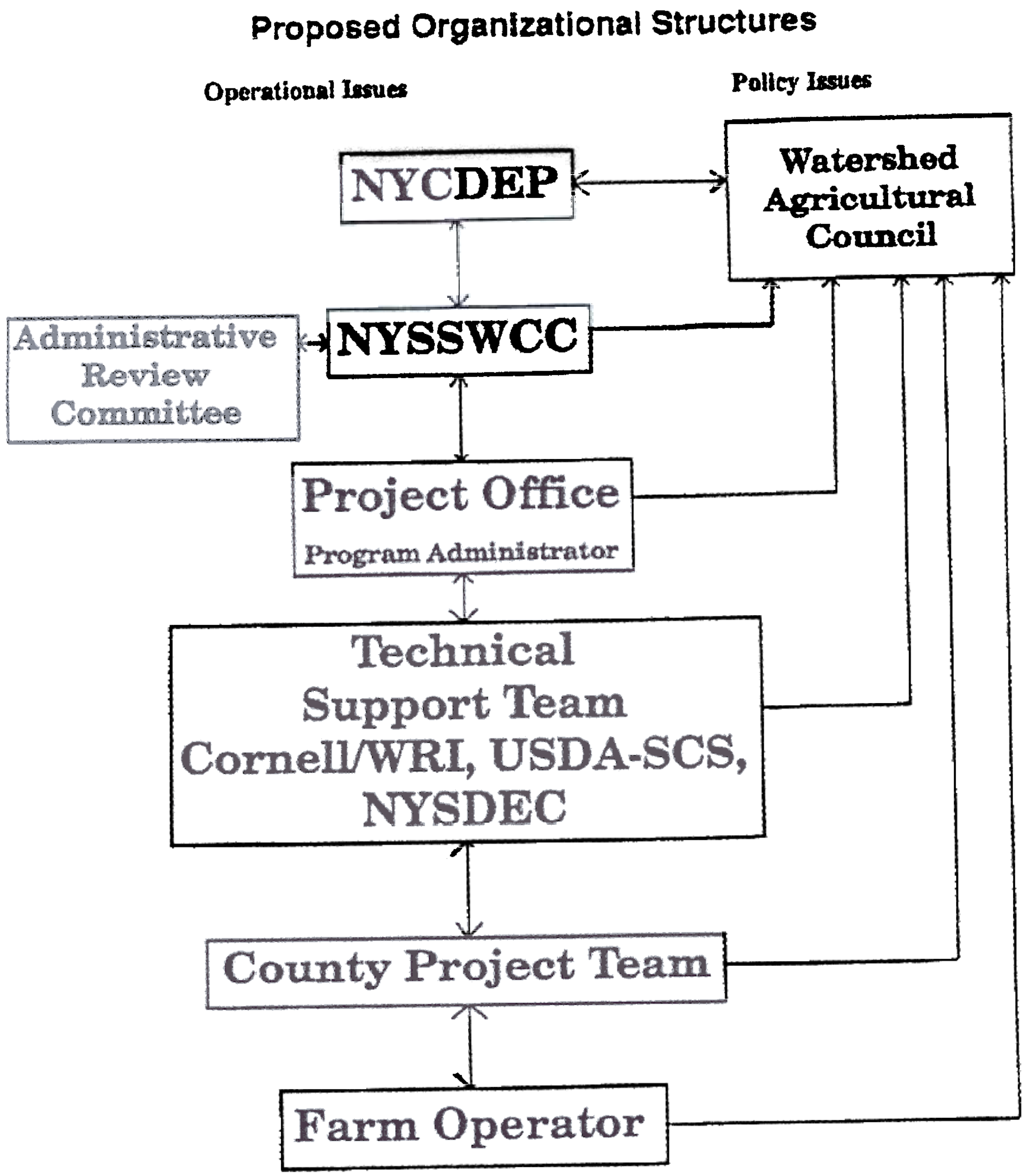
Appendix E

Organizational Flow Chart for Watershed Entities (AHTF, 1991)



Appendix F

Delaware River Basin Water Body Impairment as of 2004 (NYS DEC, 2004)