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# MEMORANDUM

TO: Lynn Gilleland, US EPA Region 1

FROM: Mark Nelson and Ellie Baker, Horsley & Witten, Inc.

CC: Doug Heath, US EPA Region 1
Paul Susca, NH DES

DATE: September 14, 2007

RE: Example Strategies for Surface Water Supply Protection
Work Assignment 4-18.1

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**OVERVIEW**

Horsley & Witten, Inc. (HW) was asked to review three highly effective state programs for the protection of surface drinking water sources and to assess the effectiveness and implementation challenges associated with these programs. Two programs, those for Massachusetts and New Jersey, were recommended by the New Hampshire Department of Environmental Services for consideration. These two states' source water protection programs are presented in this report, as well as the program for the City of New York Source Water Protection Program. HW was able to research and provide a basic evaluation of these three programs after performing preliminary research to identify relevant programs addressing the protection of surface water supplies. Many states focus primarily on protection of groundwater sources and are not relevant to this work. The New York City program was selected because of its innovative, comprehensive and highly effective approach to surface water supply protection.

HW provided a draft of this report to EPA and NH Department of Environmental Services (NH DES) on August 17, 2007 and received comments from both agencies. The last section of this memorandum provides detailed responses to some of the comments.

The three programs selected highlight various approaches to and challenges of protecting surface drinking water sources. In Massachusetts, the source water protection program is implemented primarily through the statewide drinking water regulations. These regulations incorporate three protection areas extending outward from the surface water and its contributing tributaries, and then define certain activities that are restricted within those areas. This essentially creates a series of setbacks for activities such as septic system leach fields, underground storage tanks, and sewer lines.

An earlier version of source water protection guidance issued by the state advised communities to adjust the width of the inner protection area based on slope. However, this approach was abandoned for a standard width approach when the delineation of the protection areas became a statewide regulatory requirement in 1997. The variable width approach was found to be too burdensome and data demanding on the state and local communities. Beyond the state regulations, guidance is provided for communities to develop their own surface water protection plans as well as a protection bylaw or ordinance that is at least as protective as the state regulations. Various community permitting triggers are used to ensure that each surface water supply in the state will have a protection plan, land use controls and a bylaw or ordinance in place over time.

The Source Water Protection Program in New Jersey is less developed than that of Massachusetts, and is still completing the assessment phase. The approach used by the state to delineate the source areas for river intakes, including intakes located along a single river system, is a case by case approach that links the susceptibility assessment for surface water supplies that have overlapping contributing areas. In New Jersey, as in the Massachusetts and New York City examples, all tributaries are included in the assessment area. The NJ Surface Water Quality Standards define a special category, Category One (C1) Waters, for high quality waters, including exceptional surface water supplies and their tributaries, and apply higher standards for those waters. Currently, it is unclear how many source water supplies are designated as C1 Waters. However, if proposed amendments to the definition of exceptional surface water supplies are adopted, additional reservoirs that serve drinking water to 2 million people will be protected under this designation. A far-reaching, 300-foot buffer was adopted in 2004 for all C1 Waters, but interestingly this buffer was instituted via the Stormwater Management Regulations and not the Source Water Protection Program. This buffer was a significant change from previous protections, and has received resistance, including lawsuits, from land owners and developers.

The New York City Watersheds example is presented here because there is a very tangible link between comprehensive watershed management and cost savings. The City has avoided the need to construct a very costly treatment facility for the larger of the two watershed systems, the Delaware/Catskill system. This example also highlights a program that uses a series of setbacks between the surface waters and specified activities to limit the susceptibility of the water supply. However, the program is also dependent upon a network of agreements and cooperative efforts with the state of New York, local municipalities and county governments, and voluntary programs to reach its success. Maintenance or restoration of vegetated buffers, as opposed to setbacks, is generally only achieved through targeted voluntary projects.

In practice, the surface water supplies in all three programs described herein are also protected by a handful of related regulatory programs that specifically call out special provisions for drinking water supplies. The most significant of these programs seems to be stormwater management programs. In all three case studies, the stormwater management program has a comprehensive program defining the standards of stormwater control to be used for projects discharging drinking water supplies. In the case of the New Jersey, the recently revised stormwater management program appears to be the primary control mechanism for source water

protection given that the state surface water protection program is still in the assessment phase. In addition, local communities can and are encouraged to implement more stringent requirements.

While these three programs, as discussed below, contain requirements that help protect the quality of surface water supplies, these do not seem to be well coordinated and fully integrated with the Drinking Water and SWAP programs in all cases, particularly in New Jersey. Future source water protection programs should be created specifically to bridge the gap and create a more unified approach to the protection of surface water supplies, particularly with relation to buffer zone protection.

Each of the three surface water protection programs is presented separately, using similar formats for each case study, as follows:

1. Introduction, including an overview of the Source Water Supply Protection Program and definitions of buffers or setback areas;
2. Pros and Cons of the Source Water Protection Program (or in the case of New Jersey, General Program Implementation Issues);
3. Complementary Programs, including stormwater management programs, wetlands protection programs, wastewater management programs; and
4. References.

## RESPONSES TO COMMENTS ON DRAFT MEMORANDUM

We received comments from Paul Susca, New Hampshire Department of Environmental Services, and Doug Heath, EPA, on August 21, 2007 and August 24, 2007, respectively. The following are HW's responses to the comments, which are shown in italics.

*MA: It might benefit from clarifying the fact that the restrictions in the setback areas apply under state rules only to the Metro Boston water supply sources, while the applicability of the restrictions for other water supply sources depend on whether the restrictions have been implemented by water suppliers (at least that's my understanding). Wasn't there a major study done by Rizzo Associates or somebody before the rules were adopted?*

The MA Surface Water Protection Areas (as defined in 310 CMR 22.02) do not apply only to the Metro Boston water supply sources, but rather apply statewide. The MA Watershed Protection Act (WsPA) applies buffer protection similar to that of the MA Surface Water Protection Areas, but only for the reservoirs in central Massachusetts that comprise the metropolitan Boston water supply sources. Text was added to clarify the difference between these two regulations and a section was added that describes the WsPA. The study that you mention was used in developing the WsPA regulations, which actually preceded the state-wide regulations by several years. The full reference for this study is provided below, but HW was not able to acquire this document.

Metropolitan District Commission, Massachusetts Water Resources Authority and Rizzo Associates Inc., *Watershed Protection Plan for the MDC/MWRA Water Supply Sources, Executive Summary*, June 1992.

*NJ: Why the extensive discussion of the SWAP? It doesn't provide protection. There's no corresponding description of MA's SWAP. Also, to address the central question that this memo is about, it should explain why NJ's program is considered particularly effective at protecting surface water supply sources. From reading the memo, it's not at all clear whether any of the 45 surface water supply sources are protected as C1 waters. How many are covered? What's the basis for including some water supply sources, if any, in this category?*

The discussion of the SWAP was included to describe how New Jersey delineates watersheds for complicated surface water supply systems, where some contributing watersheds may overlap other upstream water supply watersheds. We believed this to be helpful to New Hampshire in determining how far upstream protection should extend. Text has been added to the case study introduction to explain this.

A better discussion of C1 waters also has been provided, along with a description of proposed amendments to the surface water quality standards that would better clarify which surface water supplies are categorized as C1 waters and how many people are affected. It is currently unclear how many public surface water supplies are designated as C1, and this text was added to the case study.

*NYC: I was a little surprised to see this case included, since it isn't a state program. One point needs to be clarified: whose regulations establish the limiting distances? The state? The memo explains that the City and the municipalities can enforce the regulations, but it doesn't say who adopted them. How much does this program cost per year?*

The NYC Case Study was included, even though it is not a state program, due to the high level of protection that its program provides for the surface water supply and the level of cooperation involved with the State and local governments. The regulations that establish the limiting distances are included in the City's Watershed Rules and Regulations, which were approved by the State and incorporated into the Memorandum of Agreement (MOA), as described in Section 1.0 of the case study. Cost information also has been added to the case study.

*General: I think some description of what enforcement activities have taken place in NJ, MA and NYC would help to clarify a State program's challenge of implementing land-use restrictions in NH. Are monetary fines ever levied by these programs? If so, what amounts were collected and did a successful outcome eventually take place? Did any aggrieved land owners succeed in appealing their cases? What state resources (legal, technical) are involved in enforcement? As you know, little actual protection may result from no or lax enforcement of complex land-use regulations.*

These questions would be very difficult to answer within the scope of this document. Enforcement is clearly an important tool in watershed management and source water protection. However, given the complexities of the case study examples and the varying levels of implementation between federal, state, city and local implementation, it would be very difficult to compile this detailed information about enforcement cases within the current scope of work.

Much of the enforcement in MA, for example, occurs at the local level, and is not necessarily tracked by any centralized entity. In NYC, the enforcement authority sits within the City of New York, but enforcement occurs throughout the over eight counties in the watershed. In each of these cases, the source water protection laws and regulations are not the sole tools for source water protection, so the question of enforcement would extend further to include stormwater management and wetland protection programs, among others. However, HW could certainly investigate this further in a future assignment.

# EXAMPLE SURFACE WATER SUPPLY PROTECTION STRATEGY – MASSACHUSETTS CASE STUDY

## 1.0 INTRODUCTION

The Commonwealth of Massachusetts is recognized nationally as a leader in drinking water protection (USEPA, 2001). Massachusetts was the first state to receive EPA approval of a Comprehensive Source Water Protection Program after Congress passed the federal Safe Drinking Water Act (SDWA) Amendments of 1996, which required every state to evaluate existing and potential threats to the quality of all its public water supply sources and to develop a Source Water Assessment and Protection (SWAP) Program (MADEP, 1999). More than 85 percent of the population in Massachusetts receives its water from systems with some form of source water protection in place (USEPA, 2001).

The Massachusetts Department of Environmental Protection (MADEP) is the agency responsible for source water protection. The Drinking Water Regulations of the State Environmental Code (310 CMR 22.00) include source water protection regulations for the entire State. In addition, the Watershed Protection Act (WsPA) Regulations (350 CMR 11.00) regulate land use and activities only within critical watersheds of water supply for the Metro Boston area. This case study pertains primarily to the state-wide approach to source water protection, but the WsPA will also be described in Section 3.1.

The Drinking Water Regulations designate buffer zones for Class A surface waters, which are waters designated as a source of public water supply and their tributaries (surface waters are classified by the Massachusetts Surface Water Quality Standards, 314 CMR 4.00). There are 201 Class A surface water sources in 111 communities in Massachusetts. Class B waters are designated as habitat for fish, other wildlife, and for primary and secondary contact recreation; however, they may also be suitable for public water supplies after appropriate treatment. There are twelve Class B river sources in Massachusetts, mostly located in urban areas. Class B surface waters have not had state-designated source protection areas assigned to date (MADEP, 1999).

### 1.1 Buffer Zones

Definitions for surface water protection buffer zones A, B, and C were incorporated into the Massachusetts Drinking Water Regulations in 1997. The descriptions for each zone are included below and illustrated in Figure 1.

**Surface Water Protection Areas (310 CMR 22.02)**

**Zone A -** (a) The land area between the surface water source and the upper boundary of the bank;
(b) The land area within a 400 foot lateral distance from the upper boundary of the bank of a Class A surface water source, as defined in 314 CMR 4.05(3)(a); and

(c) The land area within a 200 foot lateral distance from the upper boundary of the bank of a tributary or associated surface water body.

**Zone B -** The land area within one-half mile of the upper boundary of the bank of a Class A surface water source, or edge of watershed, whichever is less. However, Zone B shall always include the land area within a 400 foot lateral distance from the upper boundary of the bank of the Class A surface water source.

**Zone C -** The land area not designated as Zone A or B within the watershed of a Class A surface water source.

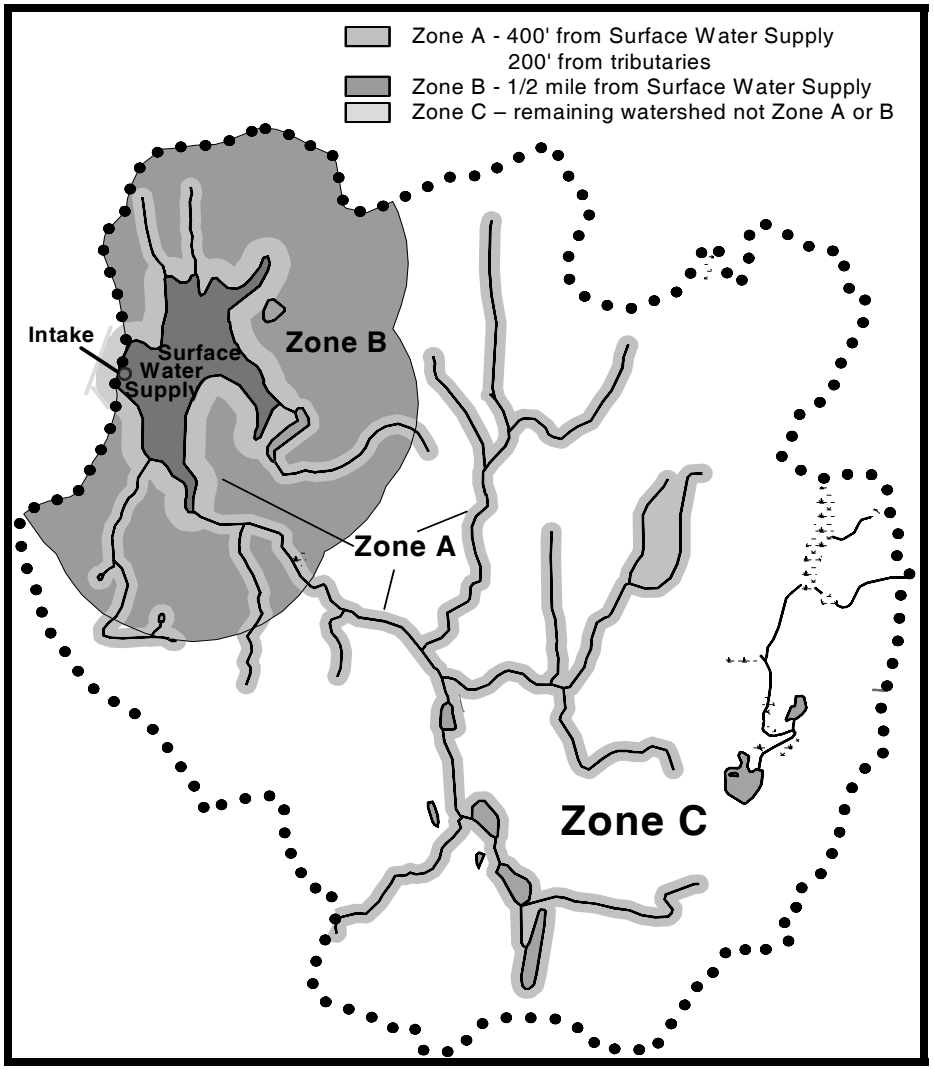


**Figure 1. Surface Water Supply Protection Zones (MADEP, 1996)**

In 1990, before the current regulations, MADEP issued guidance for the minimum information needed in a Watershed Resource Protection Plan for those water suppliers seeking approval for a filtration waiver under the original EPA Safe Drinking Water Act of 1986 (MADEP, 1990). This guidance contained definitions for Zones A, B, and C similar to those listed above; except that the delineation of a Zone A extended 400 feet from the 100-year floodplain elevation rather than the bank of all Class A surface waters, and an additional setback of a half mile was applied

for high-slope areas 15 percent or greater. When MADEP staff were formulating the current regulations, these more variable and site-specific aspects of the Zone A definition were considered for incorporation. However, delineation of a Zone A as described in the 1990 guidance is more time and data intensive, which was acceptable when only required on a small scale for the few suppliers seeking filtration waivers. The current regulations are much more far-reaching, and thus, the MADEP determined that such a definition for Zone A would be too burdensome on the State to delineate for each surface water supply (Romero, 2007).

## 1.2 Requirements for Surface Water Supplies and their Buffer Zones

The Drinking Water Regulations include requirements to protect surface water supplies Zones A, B, and C[1] from contamination (310 CMR 22.20B). Certain practices are prohibited in any surface water source or tributary, such as swimming, fishing, boating, and herbicide applications. The regulations also preclude some new or expanded land uses within Zone A, including all underground storage tanks, aboveground storage tanks holding hazardous liquid material, and treatment or disposal works. Cemeteries and livestock activities are prohibited land uses within 100 feet of the bank of a surface water source or tributary. Also, the following requirements pertain specifically to on-site subsurface sewage disposal systems:

- All such disposal systems within Zones A, B, and C shall be in compliance with the requirements of Title V (310 CMR 15.00, discussed below);
- All sewer lines are prohibited, except as required to eliminate existing or potential pollution to the water supply, or where the crossing of tributaries is necessary to construct a public sewer system;
- Within 1,000 feet of surface water supplies and tributaries, all pumping stations shall have standby power and high water alarms. An emergency contingency plan must be developed by the owner of the wastewater treatment facility and submitted to the MADEP for approval; and
- Beyond 1,000 feet, and within Zones B or C of the surface water supply, the MADEP may in specific circumstances require additional controls when deemed necessary for protection of public health.

In addition to establishing the State requirements, MADEP offers guidance for suppliers and local officials to provide additional protection for source waters. The MADEP has issued SWAP reports that not only identify potential threats but also recommend additional strategies and provide technical support that help suppliers and officials protect drinking water locally. In addition, the MADEP issued a guidance document entitled "Developing a Local Surface Water Supply Protection Plan," which outlines the minimum components that should be included in a local protection plan, provides a step-by-step approach to water supply protection planning, and gives examples of local protection options, including regulatory controls (MADEP, 2000). Direct land purchase and conservation easements are encouraged, with emphasis on lands within a Zone A or other vulnerable areas, such as where there are, or could be, high impact land uses within Zones B and C. Development of these plans, and approval by MADEP, is tied to certain

[1] Note: These buffer zones are essentially "setbacks" as defined in our previous memorandums. The drinking water protection regulations do not define the composition of the buffer zones in terms of slope, soils, vegetation, or other natural feature, nor does it vary the buffer zone width in response to those attributes.

grant and loan programs or permits, as discussed below, as well as requirements enforced as part of a five-year review cycle. By 1999, only six sources had a Surface Water Protection Plan, but as of August 2007, plans have been submitted and approved by MADEP for 100 sources (Romero, 2007).

### 1.3 Program Implementation and Enforcement

For effective program implementation, collaboration between suppliers and local officials is essential. The Drinking Water Regulations required public surface water suppliers to document to the MADEP by the end of calendar year 2001 that they had established a protocol that provides them with an *opportunity* to review and comment on proposed new or expanded land uses or activities within the watershed. This is not a requirement that the suppliers must review every project; the purpose is to address the protection gaps that can exist when suppliers do not participate in the review process and when local permitting authorities, such as zoning boards and conservation commissions, are not aware of the locations of drinking water sources or their Zones A, B & C (MADEP, 2007).

State guidance for suppliers recommends that they look for and review proposed projects within their watersheds, especially within the Zone A, that would disturb soils and vegetation, particularly on steep slopes; clear forests; create large impermeable surfaces; store chemicals, fertilizers, pesticides, road salting/sanding materials, hazardous materials; conduct sand & gravel excavations; create animal feeding or grazing areas, junkyards; propose restricted land uses; and other activities that have the potential to impact drinking water sources. MADEP created a "Sample Water Supply Protection Checklist" (January 2001) to help coordinate the local review of projects proposed in water supply protection areas (MADEP, 2007).

The Drinking Water Regulations state that enforcement responsibilities lie mainly with the local public water system. The supplier is required to conduct regular and thorough inspections of Zones A, B, and C to determine and enforce compliance with the regulations. Prompt enforcement actions against violating individuals or businesses are required, and the supplier must report all such actions to the MADEP. MADEP may take enforcement actions against the public suppliers that fail to carry out these responsibilities, or may enforce directly against individual violators.

## 2.0 PROS AND CONS OF THE PROGRAM

### 2.1 Local Involvement

Beyond the state-implemented MA Drinking Water Regulations, the success of the source water protection program largely depends on implementation on the local level by the towns and public water suppliers, with the State providing mostly guidance and support. Local support for this program has been strong, with more Local Surface Water Supply Protection Plans approved each year. The State guidance on creating the plans and getting local bylaws in place has been well-utilized by many towns. While many towns have bylaws in place, not too many are in compliance with regulations yet. However, all towns with surface source water supplies will eventually have approved by-laws and land use controls as suppliers undergo their five-year

reviews with MADEP or when they trigger a review by either increasing withdrawals or utilizing a new source (Romero, 2007).

## 2.2 Economics of Source Protection

Local Surface Water Supply Protection Plans are promoted not only as a way for suppliers to more efficiently protect their water sources, but also as possible cost savings. By creating a local plan, a water supplier could qualify for water quality credits and possible avoidance of monitoring requirements. For example, an approved protection plan is required to obtain disinfection log credit from the Department under the Surface Water Treatment Rule. Suppliers have obtained up to a 0.5 log credit for having an approved plan. Obtaining this additional log credit may also mean that suppliers can reduce the scope of treatment plants and the amount of disinfection chemicals used (MADEP, 2007). Currently, 10 sources meet the criteria for a Surface Water Treatment Rule Waiver (Romero, 2007).

Additionally, 1,447 sources, including both groundwater and surface water, met the source protection criteria of MADEP's Monitoring Waiver Program (MADEP, 1999). In a 3-year compliance cycle, local water systems saved approximately $22 million by receiving waivers from monitoring costs (National Safety Council, 2004). Newburyport, a small city on the north coast of Massachusetts, estimates that they save at least a couple thousand dollars each year from the monitoring waivers (Colby, 2007).

MADEP also has a Source Water Protection Technical Assistance Grant Program that provides grant funding for projects with public water systems that have an approved watershed protection plan; however, the state has not had a round of funding for a few years, and it is unknown when the next one will be available (MADEP, 2007). Other grant programs award extra points to communities that have an approved plan in place, such as the land acquisition grant program and the state revolving fund. Another example is the Massachusetts Department of Agriculture, which gives priority to farmers seeking grants for projects in an area where an approved protection plan is in place (Romero, 2007).

Finally, MADEP has been working with the insurance companies in the State that cover 75% of the municipalities that depend on surface water supplies. These insurance companies have agreed to give a reduction in premiums for those towns that have an approved surface water protection plan and/or local bylaws in place. Insurance companies see these towns as proactive and posing a lower risk than other communities. It is anticipated that this premium reduction program will be available in the near future (Romero, 2007).

## 2.3 Compliance Issues

According to the Surface Water Division of MADEP (Romero, 2007), the largest road block to implementing an effective source protection program, whether for surface water or groundwater, is when the contributing watershed or even the source itself is physically located in a different community than the end user. One town has no authority over another, and there is an inherent lack of motivation for one community to implement buffer protection by-laws to protect another town's water supply. Two examples of this situation occur in Taunton and New Bedford, which

both depend on drinking water reservoirs that are located in smaller, surrounding towns. In these situations, the communities need to work together and determine mutually beneficial solutions. The town of Rehoboth, MA, on the other hand, is a good example of a small town that has implemented good local land use controls through an approved bylaw to provide protection for a surface water supply located within its own borders but serving a neighboring town in Rhode Island. The watershed protection approach used for the large reservoir supplies that provide drinking water for the metropolitan Boston area is an example of one area being required to protect another area's surface water supply. This situation is described below in Section 3.1.

## 3.0 COMPLEMENTARY PROGRAMS IN THE STATE

### 3.1 Watershed Protection Act

The Watershed Protection Act (WsPA) was enacted in 1994 and only applies to the surface water supplies serving the 47 communities, 2.2 million people, and 5,500 industrial users in the metropolitan Boston area. The water supply system is comprised of the Quabbin Reservoir, the Ware River, and the Wachusett Reservoir, as shown in Figure 2. The Department of Conservation and Recreation (MADCR) is responsible for collection and safe storage of the source water, for protection of reservoir water quality, and for management of the watersheds, while the Massachusetts Water Resources Authority (MWRA) is responsible for drinking water treatment and distribution (MADCR, 2007).

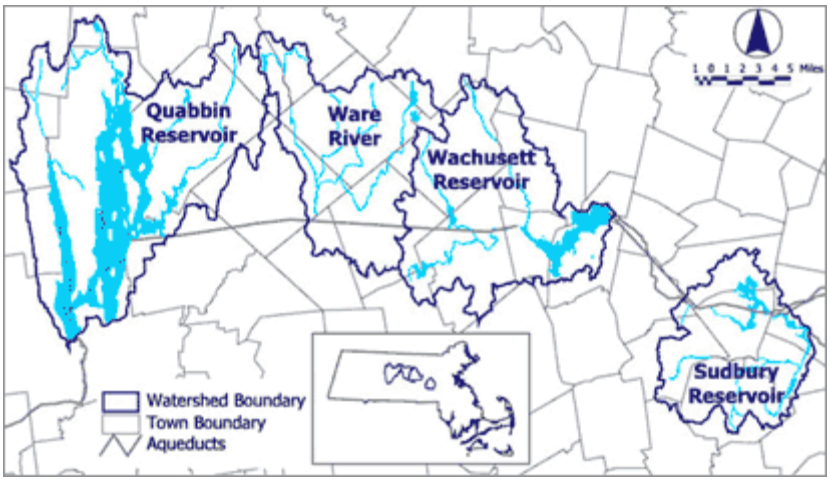


**Figure 2. The Quabbin Reservoir, Ware River, and Wachusett Reservoir are the active water supply sources for the Metro Boston area. The Sudbury Reservoir is the emergency backup supply (MADCR, 2007).**

The MA Watershed Protection Regulations (350 CMR 11), promulgated pursuant to the WsPA and implemented by MADCR, define two protection zones within the regulated watersheds: the Primary Protection Zone and the Secondary Protection Zone. The Primary Protection Zone is the area within 400 feet of the reservoirs and 200 feet of upstream tributaries and surface waters. No alteration is allowed with the Primary Protection Zone. The Secondary Protection Zone encompasses the area between 200 and 400 feet of tributaries and surface waters, as well as land within floodplains, over some aquifers, and within bordering vegetated wetlands (as defined in

the MA Wetland Protection Act – see Section 3.2). Certain activities are prohibited within the Secondary Protection Zone, including the following: storage, disposal, and use of toxic or hazardous materials; alteration of BVW; dense development; and others (MADCR, 2007). There are some exemptions to the WsPA for existing structures and minor changes, but an application is required regardless. The protection zones are depicted in Figure 3.

**Figure 3. Watershed Protection Act Protection Zones (MADCR, 2007)**

The MADEP Surface Water Protection Areas (310 CMR 22.02) and associated buffer zones and restrictions do apply to these watersheds as well, but the more stringent WsPA protection zones and restrictions supersede them as applicable.

## 3.2 Wetland Protection

The Massachusetts Wetland Protection Act (WPA) (MGL c. 131, s. 40) and its regulations (310 CMR 10.00) are significant tools in source water protection and watershed management. One of the eight WPA main interests is the protection of public and private water supply. All activity within wetlands and within a buffer zone of 100 feet is subject to review by local conservation commissions and MADEP for its potential effect on wetland resources (including waterways). The WPA protects water supplies by minimizing the effects of, or preventing altogether, development in wetlands and streams that may be tributary to or near water supplies. In addition, communities can adopt local bylaws that are more restrictive than the state regulations.

## 3.3 Other State Programs

Massachusetts has many additional programs that work in concert with the Drinking Water Regulations and the WPA to help protect surface water supply sources. Some of these key programs are described below:

**Rivers Protection Act**
In 1996, the State Legislature passed the Massachusetts Rivers Protection Act. This law amended the Wetland Protection Act to provide additional protection to rivers by regulating

activities within a new wetland resource area called the Riverfront Area. The Riverfront Area is 200 feet wide, measured from the mean annual high water line on either side of the river and runs parallel to the river; in densely populated cities, the Riverfront Area is only 25 feet. The regulations preclude disturbance within the Riverfront Area for new development projects unless the applicant demonstrates no significant adverse impact to the area and that there is no practicable alternative to the project. If some impact is unavoidable and no alternatives exist, impacts must be minimized and mitigated for; at a minimum, a 100-foot wide area of undisturbed vegetation must be provided. If other wetland resources are located within the Riverfront Area, whichever are the stricter standards are applied. The Rivers Protection Act, like the WPA, is implemented through local Conservation Commissions, with oversight and appeals handled by MADEP.

**Stormwater**

Stormwater runoff is typically collected and carried away from roadways and structures to a discharge point; most discharges are into natural waters and can threaten water supplies. In 1997, MADEP developed a Stormwater Policy, with supporting Management Manual and Stormwater Technical Handbook, which require performance standards for stormwater and provide site planning and technical information about stormwater management techniques. The Stormwater Policy applies to industrial, commercial, institutional, large residential subdivisions, and roadway projects. The MA Stormwater Policy applies to projects that fall under the jurisdiction of the WPA, as amended by the RPA, and may be incorporated by reference into local regulations. Standard 6 of the Policy requires enhanced treatment of stormwater in the Zone A of a surface water supply source. In addition, the use of certain best management practices (BMPs) is limited in a Zone A, and emergency shut down and containment measures are required.

**Surface Water Discharges**

MADEP regulates and enforces surface water discharges, in conjunction with the USEPA NPDES Program, through state programs such as their Surface Water Quality Standards, Groundwater Quality Standards, Surface Water Discharge Permit Program, and Groundwater Discharge Permit Program. Discharges greater than 10,000 gallons/day require a permit and adequate treatment to prevent violations of water quality standards. These programs protect water supplies primarily through prohibiting new direct discharges to surface water supplies and conditioning other discharges through the permit program (City of Cambridge, 2003).

**Septic Systems**

Title 5 of the Massachusetts State Environmental Code (310 CMR 15.00) is a regulation that requires proper siting, construction, and maintenance of all on-site wastewater disposal systems. On-site systems that are not properly located and maintained can endanger drinking water supplies. Enforcement authority and implementation responsibility lies with local Boards of Health. The regulation also specifies minimum setback distances from water supply areas; new septic systems are not allowed within the Zone A of a surface water supply source. DEP also regulates nitrate loading from septic systems in watersheds of nitrogen-sensitive embayments, requiring innovative/alternative on-site systems that have a higher nitrogen removal capability. In addition, a local Board of Health may establish supplementary or more rigorous requirements within its town through local regulations.

**Hazardous Materials**

The MADEP's Bureau of Waste Site Cleanup employs the Massachusetts Contingency Plan (MCP, 310 CMR 40), which identifies the emergency response and notification requirements for any release of hazardous materials above defined reportable quantities. The MCP also determines the procedure for listing and setting priorities for suspected or known spill sites, as well as requiring a multi-phase site remediation process for contaminated areas. When a spill occurs within a water supply Zone A, the MCP stipulates more stringent cleanup requirements and timeframes (Cambridge, 2003). Also, the Department of Agricultural Resources regulates any activities associated with pesticide use. The Standards, Requirements, and Procedures for the Application of Pesticides (333 CMR 13) incorporate the surface water protection zones. Aerial applications of liquid pesticides are not allowed in a Zone A to the source water (not including upstream tributaries), and aerial applications of granular pesticides are not permitted within 250 feet of the source water. In addition, the Board of Fire Prevention Regulations on Tanks and Containers (527 CMR 9) requires that any underground storage tank in a Zone A or B must be double-walled tanks with interstitial monitoring systems.

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# EXAMPLE SURFACE WATER SUPPLY PROTECTION STRATEGY – NEW JERSEY CASE STUDY

## 1.0 INTRODUCTION

The New Jersey Department of Environmental Protection (NJDEP) is the agency responsible for source water assessment and protection, through their Bureau of Safe Drinking Water. New Jersey's Safe Drinking Water Act Regulations define the types of surface water systems regulated by the State of New Jersey. Community water supplies generally supply a residential population. At the end of 1997, there were 612 active public water systems in New Jersey serving a mostly residential population. Approximately 87% of New Jersey's population is served by community water systems, which together use forty-five surface water intakes. These intakes draw water from rivers, lakes, and reservoirs, comprising approximately 3,000 square miles of drainage area in central and northern New Jersey (NJDEP, 1999). This case study first explores how the NJDEP Division of Water Supply assesses the State's surface water supplies, including a discussion on delineating watersheds for complicated water systems, and then, describes the complementary programs that provide surface water supply protection.

This case study is included for two primary reasons:

1. It exemplifies an interesting approach to source water delineation when upstream and downstream contributing areas overlap, and
2. It exemplifies the importance and effectiveness of stormwater management as a primary mechanism for protecting surface water supply sources.

### 1.1 New Jersey's Source Water Watershed Delineation Method

After Congress passed the federal Safe Drinking Water Act (SDWA) Amendments of 1996, the NJDEP Division of Water Supply developed a Source Water Assessment Program (SWAP). This program does not include protection measures for buffers at this time, but does assess the overall susceptibility of the water supply.

One of the first steps in the SWAP includes the delineation of the source waters (watershed) for surface water intakes. This can be extremely complicated, and SWAP staff handled the complexities on a case-by-case basis. The source water assessment area for a water supply contains the entire drainage area that flows past the intake, including all tributaries to their headwaters. The USGS Hydrologic Unit Code (HUC) 14 was used as the basis for defining the watershed. This is straight forward when only one source water delineation was needed for a single intake. SWAP staff considered delineating a separate source area for all raw water transfers, assigning each with separate susceptibility ratings. However, when intakes or transfer points were also within the upstream watershed of a downstream intake, they were not delineated separately; instead, these upstream intakes received the susceptibility ratings of the associated downstream source area.

Water supplies from large drainage basins crossing state borders and influenced by tidal waters, such as intakes from the Delaware River, also required special consideration for the SWAPs. The delineations were broken into more manageable zones using surface water time of travel based on a USGS report on source water assessment (USGS and EPA, 1999). The report contains time of travel information for large Public Water Systems in the United States, including two intakes in New Jersey on the Delaware River.

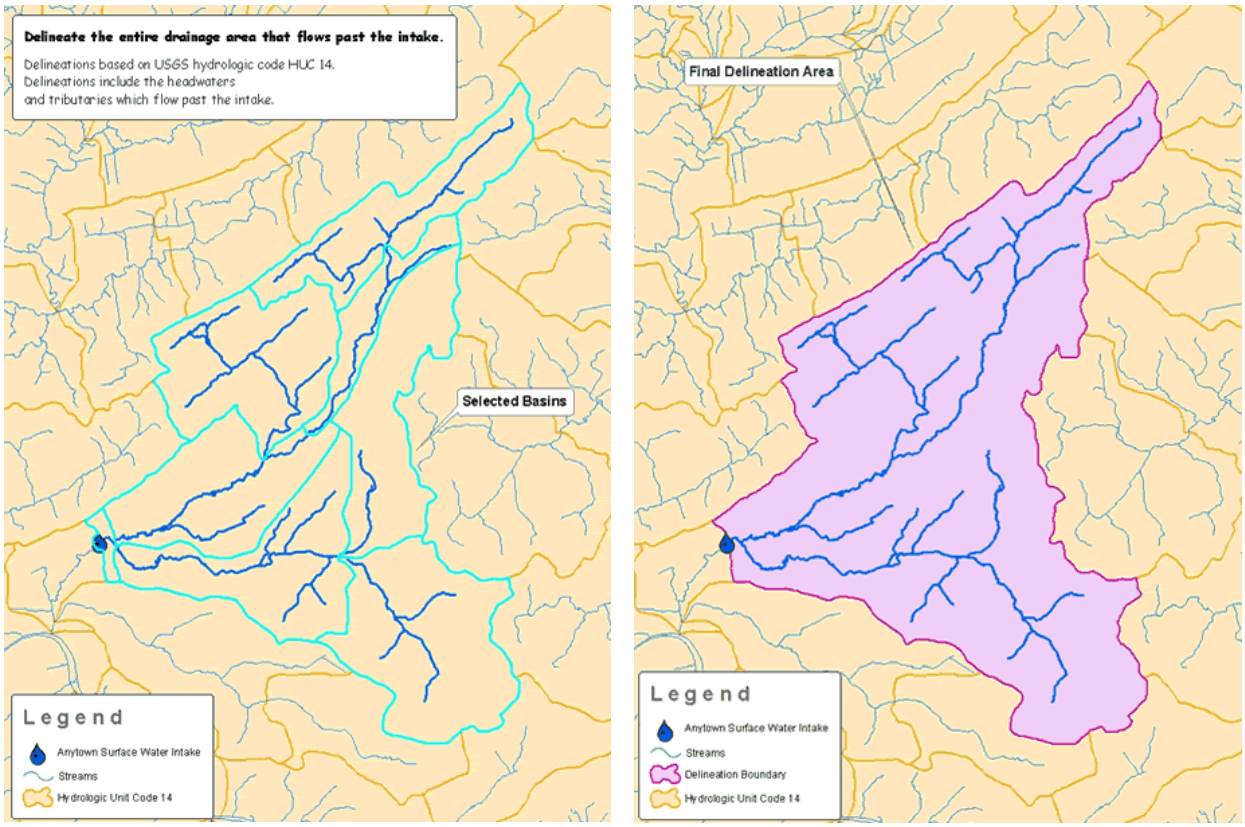


**Figure 1. Delineation of Source Area for Susceptibility Assessments (NJDEP, 2005)**

Originally, the New Jersey SWAP (1999) also required that a 5-year groundwater flow zone be added to each source water delineation to account for base flow to streams. However, in February 2001, USGS examined the utility of adding the 5-year groundwater buffer zone. Their analysis indicated that while the concept was scientifically sound, no clear benefit existed from including the groundwater buffer zone for the purposes of assigning a susceptibility rating to surface water intakes. In addition, in most cases, this 5-year contribution area was already contained within the overland drainage area. Therefore, NJDEP removed the groundwater buffer zones from their assessments.

After the delineation of the source areas, potential sources of contamination were identified and evaluated, and the susceptibility of the water supply was assessed. The susceptibility of a drinking water source is based on two factors: *sensitivity* of the drinking water source to

contamination from land use activities and the *intensity* of use of the contaminants within the delineated area (NJDEP, 1999):

Susceptibility = Sensitivity + Intensity of contaminant use/occurrence

The results from the SWAPs will ultimately be used to educate the public, and will be incorporated into the NJDEP's Watershed Management Program efforts. In addition, the NJDEP will integrate the assessments into other pollution control efforts, such as the NJ Pollution Discharge Elimination Program, total maximum daily load determinations (TMDL), and estuary restoration programs.

## 2.0 SOURCE WATER PROTECTION ISSUES

As a part of the SDWA Amendments in 1996, the USEPA had a goal that by 2005, 60 percent of the population would be served by community water systems that receive their water from systems with Source Water Protection Programs. These protection programs are not bound by a statutory requirement, but states are encouraged to pursue to the development of such programs. To date, New Jersey has not yet expanded the SWAP to include official source water protection. Therefore, source water protection is essentially provided through related complementary programs, primarily the stormwater management program, as described below, and local initiatives.

## 3.0 COMPLEMENTARY PROGRAMS IN THE STATE

Other NJDEP programs, aside from the Source Water Assessment Program, regulate potential impacts to surface waters, including activities in certain buffer and transition areas. These programs help to protect the quality of surface water supplies in the state.

### 3.1 Freshwater Wetland Protection

In 1987, the New Jersey legislature passed the Freshwater Wetlands Protection Act to "preserve the purity and integrity of freshwater wetlands from unnecessary and undesirable disturbance." Before this time, only coastal wetlands were protected by state law. The Freshwater Wetlands Protection Act was most recently updated in 2003. The Freshwater Wetlands Protection Act Rules (NJDEP, 2003) define and regulate buffer areas around certain wetlands that are referred to as "transition areas." These transition areas may vary from 150 feet to zero feet, depending on the quality of the wetland resource. Freshwater wetlands are divided into three classifications based on resource value as determined by the NJDEP: exceptional, intermediate, and ordinary resource value with transition areas of 150, 50 and 0 feet, respectively. Within these transition areas, activities such as excavation, filling, erection of structures, paving, and clearcutting of vegetation are not allowed unless a transition area waiver is granted.

### 3.2 Surface Water Quality Standards

The NJDEP Surface Water Quality Standards (SWQS) establish the designated uses to be achieved and specify the water quality criteria necessary to protect the State's surface waters

(N.J.A.C. 7:9B-1.15). The most protective tier of protection is assigned to waterbodies that qualify as Outstanding Resource Waters (ORW), which include fresh waterbodies in preserved open space (FW1 or nondegradation waters) and waters in the Pinelands National Reserve (PL). No discharges or increases in runoff are allowed in FW1 waters, and PL waters are maintained in their natural state (NJDEP, 2007a). Approximately 20% (3,720 miles) of the State's surface waters are currently designated as ORW (Mallepalle, 2007). Category One (C1) Waters are designated waters that "have been identified for protection from degradation in water quality characteristics because of their clarity, color, scenic setting, and other characteristics of aesthetic value, exceptional ecological significance, exceptional recreational significance, exceptional water supply significance, or exceptional fisheries resources" (NJDEP, 2006). Exceptional water supply significance is determined by the SWQS Program based on a variety of factors, including recommendations from the Division of Water Supply. Approximately 20% (3,846 miles) of the State's surface waters are currently designated as C1 (Mallepalle, 2007). The number of surface water supplies currently designated as C1 is currently unclear. Category Two (C2) Waters are all other surface waters, including those used for public water supply after appropriate treatment, such as conventional filtration and disinfection. These categories are also used in the Stormwater Management Rules, as described in Section 3.3 below.

The NJDEP reviews the SWQS on an annual basis to reevaluate the designations to ensure the protection of high quality waters and to restore impaired waters (Mallepalle, 2007). NJDEP has recently (May 2007) proposed amendments to the SWQS definitions and designations, adding 910 miles of waterways to the C1 Category. Among the proposed changes is a description of the "exceptional water supply significance" portion of the C1 definition as including "*water supply systems that serve a population greater than 100,000, including any reservoirs and their natural tributaries from the source to the reservoir.*" This definition change enables the NJDEP to propose upgrading an additional seven (7) reservoirs and their associated tributaries to C1, further protecting water quality for these systems, which serve drinking water to almost two million people (NJDEP, 2007a).

## 3.3 Stormwater Management

The most significant buffer protection for surface waters is provided by the NJDEP's Stormwater Management Rules, revised in 2004 (N.J.A.C. 7:8). These Rules establish the required components of regional and municipal stormwater management plans, as well as the stormwater management design and performance standards for new development (NJDEP, 2007c). They also set forth the definition and requirements of buffer zones for C1 waters, referred to as Special Water Resource Protection Areas (SWRPAs).

### 3.3.1 Special Water Resource Protection Areas (SWRPAs)

The Stormwater Rules designate SWRPAs along all C1 waters and all of the perennial and/or intermittent streams that drain into C1 waters (N.J.A.C. 7:8-5.5(h)). Much like the source areas delineated for SWAPs, the headwaters for C1 waters are identified using USGS Quadrangle Maps and County Soil Surveys within the associated HUC 14. The Rules designate SWRPAs as 300-ft buffers on each side of the waterway, measured perpendicular to the waterway from the

top of bank outwards, or from the centerline of the waterway where the bank is not defined (NJDEP, 2004).

### 3.3.2 Requirements for SWRPAs

SWRPAs are established to protect the designated uses of established C1 waters, which include exceptional water supplies, and have four central functions, including the protection of the following: habitat, nonpoint source pollutant reduction, temperature modification, and channel integrity. These buffer areas are required to consist of "existing vegetation or vegetation allowed to follow natural succession." Stormwater must be discharged outside of the SWRPA, but may flow through the buffer area as long as it meets the Standard for Off-Site Stability in the "Standards for Soil Erosion and Sediment Control in New Jersey," as established under the Soil Erosion and Sediment Control Act (N.J.A.C. 2:90-1.3). Exceptions for these requirements are allowed for previously developed or disturbed areas (e.g., parking, lawn, etc.) within the SWRPA, as well as for stormwater discharges that cannot meet the Off-Site Stability Standard mentioned above. These exceptions may only be allowed if the applicant can demonstrate that "the functional value and overall condition of the SWRPA will be maintained to the maximum extent practicable." NJDEP has issued a guidance on Functional Value Analysis (NJDEP, 2007b) to help applicants determine if the four central functions of the SWRPA are maintained or not. No exceptions are allowed that reduce the SWRPA to less than 150 feet.

If encroachments are allowed within the SWRPA per the exceptions described above, the applicant must provide a conservation easement on the remainder of the SWRPA. In addition, any loss in functional value must be mitigated as described in the guidance (NJDEP, 2007b). Native mitigation plantings are required at a 2:1 ratio for disturbed areas.

### 3.3.3 Program Implementation and Enforcement

The Stormwater Rules are implemented through the NJDEP's Division of Land Use Regulation (DLUR) permit programs, (Stream Encroachment, Freshwater Wetlands, CAFRA, Waterfront Development and Coastal Wetlands). Though some exemptions may apply, the Rules are generally triggered by any project that is considered a "major development." "Major development" is defined as one that proposes 0.25 acres of "new" impervious surface and/or 1 acre of disturbance overall, whichever is more stringent (NJDEP, 2007c). The Rules are also implemented at the local level through the Municipal Land Use Law (MLUL) and the Residential Site Improvement Standards (RSIS). Through the RSIS (as defined by the NJ Department of Community Affairs), the Stormwater Rules are activated whenever a municipality requires stormwater runoff control from a site application that comes before a local board.

In addition to the SWRPA requirements, the NJDEP offers guidance and a model bylaw for municipalities interested in more stringent buffer requirements (Passaic River Coalition et al., 2005) by creating three different Riparian Buffer Conservation Zones (RBCZs) based on the surface water categories defined above. Local authorities have the ability to include a variety of buffer regulations, as long as the minimum requirements of the SWRPAs are met. The model bylaw suggests that Riparian Buffer Conservation Zones (RBCZs) can be delineated as follows (Passaic River Coalition et al., 2005):

1. In the case of C1 Waters, the RBCZ shall equal the Special Water Resource Protection Area, as defined above.

2. For areas adjacent to surface water bodies designated C2 Waters for Trout Production, the RBCZ shall extend out 150 feet. Where steep slopes (in excess of 10 percent) are located within the designated widths, the RBCZ shall be extended to include the entire distance of this sloped area.

3. For areas adjacent to other C2 Waters, the RBCZ shall extend 75 feet. Where steep slopes (in excess of 15 percent) are located within the designated widths, the RBCZ shall be extended to include the entire distance of this sloped area to a maximum of 300 feet.

4. For areas adjacent to surface water bodies for which the Floodway (100-year Floodplain) has been delineated, the RBCZ shall cover the entire Floodway area, or the area described above, whichever area has the greatest extent.

The local bylaw can also define permitted and non-permitted land use requirements, performance standards, and guidance for a RBCZ Management Plan, giving a great deal of implementation and enforcement authority to the local municipality.

### 3.3.4 Implementation Challenges

Three years after the revisions to the Stormwater Rules were first implemented, the Program Coordinator has seen a large improvement in the protection of resources due to the far-reaching effect of the Rules; however, the program experienced some "growing pains" during this period (Blick, 2007). The major problem, particularly in the first year, was that designers and contractors were not aware of how the revisions affected their projects and designs. Stormwater Management Program staff anticipated this issue and performed a significant amount of outreach, but more education would have been helpful. In addition, the revisions became very controversial since they represented such a great departure from the previous regulations and general approach to managing stormwater in the state. This significant change has resulted in some on-going lawsuits.

Recommendations for other states interested in implemented major revisions to similar regulations include the following (Blick, 2007):

1. Before revisions go into effect, plan and conduct as much outreach as possible;
2. Coordinate the revisions with all other relevant regulations that may be affected; and
3. Try to prepare for all possible resulting scenarios in order to anticipate questions and/or problems.

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# EXAMPLE SURFACE WATER SUPPLY PROTECTION STRATEGY – NEW YORK CITY CASE STUDY

## 1.0 INTRODUCTION

New York City has the largest unfiltered surface water supply in the world. More than 1.3 billion gallons of water per day serve eight million residents in New York City itself, one million more consumers in four upstate counties, and hundreds of thousands of commuters and tourists. The New York City Water Supply System has a watershed of 1,969 square miles, covering eight counties north and west of the City: Westchester, Putnam, Dutchess, Delaware, Greene, Schoharie, Sullivan, and Ulster. The system includes 19 reservoirs and three controlled lakes, which together have a storage capacity of 580 billion gallons. These water supplies are located in two areas: the Catskill/Delaware system and the Croton system (see Figure 1).

The reservoir systems were designed and constructed with various interconnections to incorporate flexibility by allowing exchange of water from one to another. This feature mitigates localized droughts and takes advantage of excess water in any of the three watersheds (NYCDEP, 2007). However, the reason that the New York City system is considered leading edge is due to the unique watershed protection program enacted in 1997. This program allows the larger Catskill/Delaware Watershed to continue to avoid filtration treatment requirements, while the Croton System, the older, smaller and more vulnerable of the two systems, will be treated by a filtration treatment plant (scheduled to be online in 2012) in conjunction with watershed management protections (Williams, 2007). The following paragraphs outline the regulatory background that has led to the current system.

The Safe Drinking Water Act (SDWA) amendments of 1986 required the U.S. Environmental Protection Agency (EPA) to develop criteria that would require filtration for public surface water supplies, and so the EPA issued the Surface Water Treatment Rule (SWTR) in 1989. This Rule required that all public water supply systems utilizing unfiltered surface water sources needed to either provide filtration or meet a series of water quality, operational and watershed control criteria referred to as the filtration avoidance criteria.

Following the enactment of the SWTR, New York City's Department of Environmental Protection (NYCDEP) prepared a comprehensive watershed protection plan and applied for a waiver from the filtration rule several years in a row. While the EPA determined each time that the City's program did indeed meet the SWTR criteria for filtration avoidance, they expressed numerous concerns about the City's ability to continue to meet the criteria in the future. Two critical parts of the watershed protection program that NYCDEP described in 1993 were a land acquisition program and implementation of revised watershed regulations. NYCDEP was unable to proceed with those key program elements due to the objections of residents in the watershed who were concerned about the impact that those programs might have on the character and economic viability of their communities.

**Figure 1. New York City's Water Supply System (NYCDEP, 2007)**

In 1995, negotiations among the City, the State, the US EPA, representatives of local counties and towns in the watersheds, and residents reached a general agreement that would allow the City to implement the watershed protection program while protecting the economic viability of watershed communities. A Memorandum of Agreement (MOA) between the stakeholders listed above was signed in 1997. This MOA is a groundbreaking agreement that not only ensures the protection of water quality but also makes certain that the City bears the cost of any measures that are above and beyond what current State and/or federal law requires, rather than the residents, businesses, and landowners of the watershed (NYCDEP, 2007).

Through this MOA, the State issued a land acquisition permit that allows the City to purchase land in the watershed, approved a revision to the NYCDEP Watershed Rules and Regulations (the Regulations) governing certain aspects of land use in the watershed, including those discussed below, and provided for a significant funding supplement to the City's existing watershed protection program for economic-environmental partnership programs with upstate communities.

This case study describes the setbacks implemented through the Regulations, as well as the other related aspects of the Regulations and other programs that aid in the protection of the NYC water supply. This case study was included because it exemplifies a more holistic integrated approach to water supply protection and provides an example of how communities can come to an agreement on implementing watershed management. In addition, it provides a valuable comparison of cost savings from not needing to construct a treatment plant versus the costs of watershed management.

## 1.1 Limiting Distances

The revised NYCDEP Regulations identify important restrictions for specific land uses and activities within the direct vicinity of the edge of the water supply. These are referred to as "limiting distances," which are defined as "the shortest horizontal distance from the nearest point of a structure or object to the edge, margin or steep bank forming the ordinary high water mark of a watercourse, wetland, reservoir, reservoir stem or controlled lake or to the contour line coinciding with the reservoir spillway elevation" (NYCDEP, 1997). When the City was first formulating the revisions to the regulations, NYCDEP staff considered incorporating variable limiting distances based on site specific criteria such as slope and soil. However, they decided that implementing variable limiting distances would be too large of an undertaking for the entire watershed, given the burden of data collection, documentation, and implementation. The 1997 regulations were already such a significant change from the regulations previously in place that the City decided to keep the limiting distances relatively simple (Warne, 2007).

It is important to be clear that the limiting distances used for the NYC watershed system are essentially setbacks and are not vegetated buffers (NYCDEP, 1997; NRC, 2000)[1]. There is no requirement that the area within the limiting distance be maintained as natural vegetation or be

[1] Note: These limiting distances are essentially "setbacks" as defined in our previous memorandums. The NYCDEP Regulations do not define the composition of the buffer zones in terms of slope, soils, vegetation, or other natural feature, nor does it vary the buffer zone width specifically in response to those attributes.

revegetated. Efforts to maintain or reestablish vegetated buffers along water ways and wetlands are generally implemented through local voluntary projects, or may be required by individual municipalities within the watersheds under local municipal laws.

## 1.2 Requirements within Surface Water Supplies and the Associated Limiting Distances

The majority of development cases that the NYCDEP reviews with regard to limiting distances involve proposals to create new impervious surfaces and the location of septic systems (Warne, 2007). Table 1 below provides examples of the required limited distances for these and other activities.

**Table 1. Example of Limiting Distances Required in the NYC Watersheds**

| Limiting Distance | | Prohibitions |
|---|---|---|
| **Watercourse or Wetland** | **Reservoir, reservoir stem or controlled lake** | |
| 100 ft | 300 ft | Impervious Surfaces Prohibited<br>*(There are some exceptions for new single-family homes, agricultural activities, and proposed development in designated village centers)* |
| 100 ft | 300 ft | Absorption field for a new conventional septic system prohibited |
| 250 ft | 500 ft | New conventional septic system<br>*(Provided that the greater limiting distance for raised systems does not preclude construction on the subject lot or lots of the use proposed by the applicant.)* |
| 250 ft | 1000 ft | Solid waste disposal areas |
| 100 ft | 500 ft | New storage tanks for hazardous materials, including petroleum products |
| 250 ft | 1000 ft | Application of pesticides, without prior review and approval of the Department |

Also defined in the regulations are additional restrictions for activities anywhere in the watershed, such as siting wastewater treatment plants, storing radioactive or pathogenic materials. For any activity where an exception to the regulations is requested, a stormwater pollution prevention plan is required. (NYCDEP, 1997)

### 1.3 Program Implementation and Enforcement

While they work closely with other groups and agencies, the NYCDEP is the primary agency responsible for funding and implementing all aspects of the Watershed Protection Program. In addition, as defined in Section 18-51 of the Regulations, the NYCDEP has complete enforcement authority for the regulations throughout the designated watersheds, despite the fact that the watersheds are outside the City borders. The Regulations do allow for a local government of a town, city, village or county to apply to the Department for certification of a local program to enforce specific provisions of these Regulations. The NYCDEP did a pilot program with one municipality in the watershed in which the local government enforced certain portions of the Regulations, but the outcome of the study was neither positive nor negative for either party. To date, no municipalities have applied for enforcement authority and the NYCDEP continues to maintain this responsibility (Warne, 2007).

## 2.0 PROS AND CONS OF THE PROGRAM

### 2.1 Local Involvement

From the beginning, an essential aspect of New York City's Watershed Protection Program has been collaborating with the many stakeholders, including local governments within the eight-county watershed and other external non-profit and governmental groups. These partnership efforts are helping to protect water quality while also improving the economic welfare of the watershed communities. Some of these partners help the program in other capacities, such as providing oversight, advice, public education, and enhanced communication. Some of the most involved watershed organizations in the program, and designated as parties to the MOA, include the following: Watershed Agricultural Council, Catskill Watershed Corporation, and Watershed Protection and Partnership Council (NYCDEP, 2007).

### 2.2 Economics of Source Protection

New York City's Watershed Protection Program has been quite expensive to implement, averaging approximately $100 million per year over the past 15 years (Warne, 2007). However, the program has proven worthwhile with even greater cost savings that are realized in many different ways. For example, cost savings are provided by reduced construction costs. While the City is currently building a filtration plant for the smaller Croton water supply (10% of the City's water) at an estimated cost of $2.1 billion (Williams, 2007), the other 90% of the water supplied from the Catskill/Delaware water systems remains unfiltered due to the watershed regulations that help preserve the upstate areas. Thus, the regulations prevent the need for an extremely expensive Catskill/Delaware filtration plant (NYCDEP, 2007). One cost estimate for a filtration facility for the Catskill/Delaware system is $6 to $8 billion dollars, with an annual operating cost of $200-$300 million (Peck, 2004).

Another large costs savings is found in the operating costs for the water supply system, which are less than more conventional systems. This is due to the fact that approximately 95% of the total NYC water supply can be delivered to the consumer by gravity, leaving only about 5% of

the water that is regularly pumped to maintain desired pressure. As a result, operating costs are low and relatively insensitive to any fluctuations in the cost of power (NYCDEP, 2007).

### 2.3 Compliance Issues

The New York City Water Supply Protection regulations have been quite effective over the past ten years (Warne, 2007). The City is currently going through a revision process to keep the regulations up-to-date with New York State stormwater standards on the sizing and location of best management practices, but no changes are proposed for any of the limiting distances. Even though the limiting distances may vary based on regulated activity, the regulations have not caused much confusion since most projects fall under only two categories (impervious surfaces and septic systems). To date, there has been little field research to determine if the current limiting distances are appropriate or not, but this could be something to assess in the future. While the NYCDEP program is mostly straightforward, some disputes have arisen about the delineation of the water resource from which the limiting distances are based. Recommendations from the Bureau of Water Supply Chief of Staff (Warne, 2007) for successfully implementing a source water protection program using similar setbacks include the following:

- Conduct a few years of outreach before implementing the new regulations;
- Gain feedback from all stakeholders as a part of the regulation development process to deal with major concerns upfront; and
- Tie regulations to available science so that there is solid research to reference when there are disputes.

Finally, a source water protection program should try to do what NYCDEP was never able to – mobilize the actual water consumers to participate in the process (Warne, 2007).

## 3.0 COMPLEMENTARY PROGRAMS

The NYCDEP's watershed protection program is very extensive, including a variety of programs that protect the quality of their reservoirs in very different ways. A few of these that are most relevant to New Hampshire are briefly described below.

### 3.1 Stormwater Management Program

The City's Stormwater Management Program has a focus on treating the "first flush," which is the rainfall occurring during the first portion of a storm event that has been shown to carry the majority of the stormwater pollutants. In addition to meeting the State's stormwater requirements, projects proposed in the watershed of a phosphorus- or coliform-restricted reservoir system must also capture and treat the 2-year storm event. These restricted categories are designated by the NYCDEP.

The Stormwater Management Program also includes the Stormwater Retrofit Program. This is administered by the Catskill Watershed Corporation (CWC) and was set up to support the design, construction and maintenance of stormwater best management practices (BMPs) that address existing sources of stormwater runoff in the Catskill/Delaware watershed to minimize

existing erosion and/or pollution as much as feasible. The Stormwater Retrofit Program provides a 75% cost-share for the retrofitting of existing sites to treat stormwater runoff. As of June, 2003, the program has provided over $3,863,000 through 35 municipal and public school projects (NYCDEP, 2007).

### 3.2 Sand and Salt Storage

The Watershed Regulations set specific standards for the storage of more than 1,000 pounds of road de-icing materials, and the NYCDEP provided funds for the construction of new storage structures to prevent leaching and runoff at the site. This program, administered by the CWC, financed the design, construction, and installation of new storage facilities either where existing facilities did not comply with the Regulations or where upgrades to existing facilities were otherwise needed to protect water quality. The resulting structures belong to the towns where they are located and not to the City. Sites were selected and prioritized based on water quality problems and storage needs (NYCDEP, 2007).

### 3.3 Watershed Agricultural Program (WAP)

The Watershed Agricultural Program is "a partnership between watershed farmers and New York City that balances pollution prevention, economic viability, and public health concerns" (NYCDEP, 2007). The main goal of this voluntary partnership between the City and participating farmers is to reduce nonpoint sources of various agriculture-related pollution, particularly waterborne pathogens, nutrients and sediment. To achieve this, the program tailors BMPs to each specific circumstance. The program promotes the conventional BMPs, such as filter strips and drainage diversions, that have been proven in the field, literally, but it also has the flexibility to employ and evaluate more innovative BMPs. This helps to increase the number of alternatives available to address agricultural water pollution concerns. The program also evaluates and integrates the economic needs of each farm into its Whole Farm Plan to ensure its long-term viability.

While the City funds this program, it is administered by the Watershed Agricultural Council (WAC), whose board is comprised of farmers, agri-business representatives and the NYCDEP Commissioner. Since the Program began in 1991, the City and WAC have leveraged funds from other sources, such as the USDA, the EPA and the Army Corps of Engineers. One of the original objectives of the program was to develop and implement pollution prevention plans on 85% of the commercial farms in the Catskill and Delaware watersheds. To date, this program has exceeded that goal and has approved Whole Farm Plans on 240 (92.6%) of the 259 commercial farms in the watershed. Since 1992, the program has implemented over 2,000 BMPs at a cost of $15.8 million on 210 farms (NYCDEP, 2007).

### 3.4 Stream Management Program

Streams in the watershed have historically been managed by landowners and a variety of governmental agencies that each have their own objectives and use different management practices. The Catskill Mountain streams are the source of 90% of the City's water supply, and thus the City is very concerned about ongoing stream preservation and protection. As a part of

the Stream Management Program, the NYCDEP encourages long-term stewardship of Catskill Mountain steams and floodplains by establishing partnerships with the regions' Soil and Water Conservation Districts, landowners and other local agencies and municipalities. The Stream Management Program addresses important issues such as streambank and bed erosion, compromised water quality, flood hazard risks and fisheries habitat degradation and works to restore stream system stability and ecological integrity.

Since 1995, this program, in conjunction with the county Soil and Water Conservation Districts, has developed management plans, restoration projects, and protection projects in priority watershed sub-basins. NYCDEP and its partners have also conducted education and training workshops for regional stream managers and community participants. Databases have been created as a support tool to help local officials make informed stream management decisions, develop project design specifications, and evaluate programs (NYCDEP, 2007).

### 3.5 Watershed Forestry Program

Forests cover more than three-quarters of the New York City water supply watersheds, most privately owned and managed by thousands of individual landowners. In partnership with forest landowners, loggers and the forestry industry, NYCDEP supports a voluntary Watershed Forestry Program. Well-managed forests are not only a preferred open space land use for watershed protection, but they are also a working landscape that supports the rural upstate economy.

The Watershed Forestry Program began as a grass-roots effort during the mid-1990s and was formally established as a voluntary pollution prevention partnership between New York City and the upstate forestry community in September 1997. NYCDEP funds and administers the Forestry Program by contracting with the locally-based WAC, which implements the program in tandem with the Watershed Agricultural Program, the Whole Farm Easement Program and the City- and federally-funded Conservation Reserve Enhancement Program. Key aspects of the program include the following: forest management planning, BMP implementation, logger training, research, demonstration & education, economic development (NYCDEP, 2007).

### 3.6 Land Acquisition Program

The City purchases susceptible lands within the watershed to help protect and enhance the quality of its water supply. Acquisition of sensitive areas near watercourses, whether through purchase or with conservation easements, can prevent new sources of pollution that would most likely occur if the area were to be developed. The City has committed $250 million to acquire vacant land or conservation easements in the watershed in areas that contain streams, wetlands, floodplains and other land that is critical to maintaining high water quality. The watershed has been split into several Priority Areas, based on proximity to reservoirs, reservoir intakes, and the City's distribution system. As of May 2003, over 600 landowners had agreed to sell more than 45,000 acres of land, either in fee or easement, to the City or the WAC (NYCDEP, 2007).

### 3.7 Waterfowl Management Program

The NYCDEP launched the Waterfowl Management Program in 1992 to measure the amount of bacterial pollution that waterfowl species contribute to the City's reservoirs and to correct the problem through management practices. NYCDEP wildlife biologists inventory all species of waterfowl on a regular basis to estimate population levels. They then compare that data to reservoir water quality data to determine if a relationship exists between the wildlife and higher fecal coliform bacteria levels. Seasonal spikes in fecal coliform bacteria appeared to be attributable to from migrating waterfowl, so NYCDEP developed a management program to eliminate birds such as geese, gulls, cormorants and ducks from select reservoirs using non-lethal measures. Biologists use motorboats, hovercraft, pyrotechnics, and bird distress tapes to chase the birds from the water. These federally- and State-approved techniques have been effective and have been critical to the City's ability to continue to meet federal requirements for drinking water quality (NYCDEP, 2007).

## 4.0 REFERENCES


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