

## **PRACTICES TO PROMOTE SUSTAINABLE WATER SOURCES**

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### **ABSTRACT**

Sustainability can be defined simply as the utilization of our water sources while ensuring that we do not impact the ability of future generations to use the same sources. Increasing development, population growth, and natural events such as climate change can have a significant effect on water quantity and quality. While drinking water providers strive to ensure that a plentiful supply of high-quality drinking water is available to its customers, continued development upstream of existing and planned future supplies can pose a pollution threat and affect the long-term sustainability of the supply. Many source water protection activities undertaken by public water suppliers and their watershed partners can be considered as practices to ensure the sustainable quality of those drinking water sources. Examples of current and innovative source water protection practices that contribute to ensuring source sustainability follow.

### **KEYWORDS**

source water protection, watershed protection, sustainability

### **INTRODUCTION**

From a water system perspective, sustainability can be defined simply as the utilization of our water sources while ensuring that we do not impact the ability of future generations to use the same sources. Increasing development, population growth, and natural events such as climate change can have a significant effect on water quantity and quality. While drinking water providers strive to ensure that a plentiful supply of high-quality drinking water is available to its customers, continued development upstream of existing and planned future supplies can pose a pollution threat and affect the long-term sustainability of the supply.

As economic prosperity continues to fuel development of lands that at one time may have buffered our sources of water supply, it is becoming increasingly apparent that nontraditional management techniques need to be considered to maintain high water quality and minimize future degradation of these sources. The renovation and revitalization of older urban areas may provide additional opportunities for use of new and innovative techniques and strategies to control and treat runoff while providing aesthetic benefits.

Balancing economic growth and development with water resources considerations is essential. Attention should be placed on the available quantity and quality of current sources to ensure their sustainability as a source of drinking water for the future. This means that we must protect our existing sources and prevent their future degradation as well as plan for protection of our future sources. Many source water protection activities undertaken by public water suppliers and their watershed partners can be considered as practices to ensure the sustainable quality of those drinking water sources.

The experience of those who have invested in wastewater treatment plant improvements to remove nutrients from their effluent shows that further significant investments will not provide a proportional amount of water quality benefit. Nonpoint sources of pollutants -runoff from urban areas, agriculture, and construction sites are principal sources of pollutants and become primary targets for additional control.

What is not sustainable? Nonpoint source discharges, especially from urban and agricultural land activities, are significant contributors to impairment of surface waters. And continued degradation of water quality may affect the long-term suitability of our drinking water sources. As point source discharges have been brought under control over the last three decades, it is broadly acknowledged that nonpoint sources of pollution play a dominant role in degrading surface water quality. The control of those nonpoint sources, particularly from urban and agricultural areas, is a significant area of concern for many drinking water suppliers.

What may be expected as land uses convert from agricultural or undeveloped to more urban uses? In the Chesapeake Bay watershed, located in Pennsylvania, Maryland, Virginia, and the District of Columbia, the U.S. Geological Survey has documented land-use change as the primary factor causing water-quality and habitat degradation. (<http://chesapeake.usgs.gov/landcover.html>) Current USGS data-gathering efforts are focused on documenting changes in land cover and land use that relate to sediment, nutrients, and toxics associated with urban / suburban and agricultural lands in the large watershed.

In Philadelphia, drinking water is withdrawn from the Delaware and Schuylkill Rivers. The Schuylkill River is a source that responds dramatically to frequent rainfall events. More than 30 years of water quality monitoring has provided data for an evaluation of observed water quality trends and correlation to changes in the watershed land cover. Recently, a build-out analysis was performed to predict water quality that may be expected resulting from 50 years of additional development in townships outside the city. There is concern that the level of development anticipated with its associated trend in water quality degradation will render the source unsuitable for consistently producing high quality water for drinking.

Water quality degradation can be cumulative, especially in reservoir settings where sediments, nutrients, and other pollutants may build up and contribute to more rapid eutrophication of the drinking water supply. Therefore, protection of water quality and management of land-based activities that have the potential to contaminate supplies are particularly important. Increasingly stringent regulations imposed on water treated for drinking require a more critical consideration of water source protection.

This means that those sources must be protected to prevent cumulative and possible future degradation. Multiple and innovative strategies are needed to balance economic growth and development objectives with protection of drinking water supplies. While much attention is paid to the available quantity of these water sources, the quality of the source is just as important to ensure its sustainability as a source of drinking water for the future. Many source water protection activities undertaken by public water suppliers and their watershed partners can be considered as practices to ensure the sustainable quality of those drinking water sources.

An effective source water protection portfolio is likely to include a range of activities that are available to communities and water suppliers to protect drinking water sources. In some communities, the focused attention and funding accompanying the federal and state rules and requirements has provided a foundation for further source water protection actions.

### **SDWA AMENDMENTS**

Since the 1996 amendments to the Safe Drinking Water Act, protection of drinking water sources has become a focus of the EPA, state drinking water programs, public water suppliers, and water consumers. Providing safe water is a comprehensive and integrated endeavor, involving water protection and treatment from drinking water source to the consumer's tap. The required Source Water Assessment and Protection (SWAP) programs have, in some cases, inspired and empowered some water suppliers to initiate source water protection programs. Thanks to a few available funding mechanisms, some water suppliers have secured financial assistance and incentives for initiating and implementing new and innovative watershed protection activities.

The City of Philadelphia, PA, is a good example of a water supplier that has leveraged the requirements of the state's SWAP program and available EPA and state funding to provide water protection benefits through a wide range of educational, demonstration, restoration and water quality monitoring projects.

### **SOURCE WATER ASSESSMENT**

The prevalence of geographic information systems has enabled the straightforward delineation, identification, and evaluation of watershed protection areas. It has become much easier to communicate with drinking water customers, and watershed residents who may not be users of the drinking water system, that there is a need to protect the quality of the water source.

The foundation of effective source water protection is a high quality source water assessment. The assessment delineates the source of the public drinking water; identifies potential sources of contamination; determines the drinking water source's susceptibility or vulnerability to contamination; and makes the information available to the public and local decision makers.

While Source Water Assessments were most helpful in identifying threats from existing activities, it is very difficult to protect our drinking water sources from activities or entities that do not yet exist. However, vigilance is needed, and when a possible activity is identified in the planning stages, a methodology for evaluation and decision making as well as a public process of consideration is needed.

### **WATERSHED APPROACHES**

Most effective protection strategies are based on a watershed approach to managing the water supply. Source water protection requires the support of the community, as protection measures may involve voluntary actions, best management practices, or local zoning issues. To educate the community, the results of the assessments need to be publicized.

Drinking water protection actions must be linked with watershed protection actions to be most effective. Historically, water programs were developed to protect separate parts of the ecosystem or separate uses of its resources; however, this fragmented approach can be a barrier to public health protection. Rivers, streams, and ground water that are drinking water sources also have ecological value, and their functions cannot be separated. Therefore, it is important that our institutional programs work in harmony with each other.

## **PLANNING**

Consideration of a number of factors in the planning process will help utilities move toward more sustainable solutions. Evaluating the use of advanced technologies; incorporating stakeholders into the planning process; examining opportunities for optimizing and more efficient use of existing facilities; and incorporating reliability features are some factors that should be considered.

To adequately define management strategies, a watershed plan is usually developed. This plan should define the stakeholders, issues, constraints, alternative management programs, recommendations, and an implementation plan. It is important to start with a plan, so that goals and objectives are defined as the community evaluates the most effective organization for implementing the plan.

The second step in the process is to identify and develop the mechanisms that will be used to manage the area needing protection. Many different mechanisms are available for managing the protected area including the following: Watershed Districts, Legislation and Ordinances, Land Acquisition, Best Management Practices, and Collaboration.

## **WATERSHED ORGANIZATIONS**

Watershed organizations, such as formal districts or committees, are geographically based governing groups formed to protect or manage the water resources within the basin. A watershed organization's purpose is to beneficially manage the resources of a watershed, perhaps with a specific focus such as water supply or environmental protection. One of the primary responsibilities of a watershed organization is to develop a watershed plan that defines the goals, objectives, and strategies to manage the resources within the watershed.

A good example of a watershed organization is the Watershed Committee of the Ozarks (WCO). The group began in 1983 as a broad-based coalition of community stakeholders with various interests in protecting the water sources of the City of Springfield, Missouri -- two reservoirs, a river, a spring and 5 deep wells. Over time, the group evolved into a quasi-governmental organization, with representatives from City Utilities, the city of Springfield and Greene County. Representatives from neighboring Webster County and members of the stakeholder community were added. Initially the group was charged with promoting educational efforts, but the scope of their program grew over time. Many additional elements were incorporated into the program.

The identified priorities include the improvement of agricultural practices; cost-sharing on Best Management Practices (BMPs); sediment & detention basins; land acquisition in sensitive areas; septic tank regulations in Greene County dealing with lateral fields, septic tank contractor certification, and

biannual inspection of septic tanks; building regulations in the James River basin; state legislation on landfills; state legislation of toxic waste disposal; emergency response for spills; water wells drilled by certified drillers; urban runoff management; public education & awareness programs; studies on pollution sources and controls; and a monitoring program for groundwater.

Additionally, the WCO was successful in obtaining several grants to assist in funding the various aspects of their program. The Committee drew heavily on the analytical capabilities of the water utility to determine the need for projects and to provide the laboratory data to substantiate their conclusions. Having the analytical data available was very important when addressing groups unfamiliar with the causes and effects of pollution and eutrophication.

## **LEGISLATION AND ORDINANCES**

Some states and communities have enacted separate legislation requiring the protection of water sources. The legislation can designate the responsibility for protecting a water source to an existing entity or require creation of a new entity with the legal ability to enforce the requirements of the legislation. Generally, the responsible entity has the power to review and approve proposed development within the protected area. Without this power, it is much more challenging to affect land uses and behaviors that may protect the water resources.

Many communities manage their source water protection areas through City or County ordinances. These are appropriate for managing protection areas within corporate boundaries. And neighboring jurisdictions may adopt the same ordinance to accomplish regional protection.

An ordinance should have language specifying allowable and prohibited land uses within the source water protection zone. For example, many source water protection ordinances limit or forbid the storage of hazardous materials and place restrictions on the location of businesses that use these materials within the overlay district. An ordinance should also include procedures for review of proposed projects within a source water protection district to verify that the project is consistent with the ultimate goal of the ordinance. This might include requiring applicants to submit geotechnical and hydrological analyses to determine the potential impacts to water quality and the submission of spill control plans for businesses performing potentially contaminating activities. Finally, language explaining the mechanisms for enforcement of the requirements of the ordinance, including the civil and criminal penalties that may apply for failure to obey, should be included.

## **LAND ACQUISITION**

Land acquisition is the ultimate strategy for controlling activities in a watershed. Ownership of an entire watershed is typically a very expensive option, and its use has the potential to generate considerable ill will from land owners whose properties are affected by the program. Those water suppliers who own their watersheds are eyed enviously by others who must rely on other methods to reach their water quality objectives.

Limiting use of watershed lands can also be accomplished through permanent easements that prevent potentially harmful development while allowing those land uses that will not adversely impact water supply sources. This is practiced in San Antonio, Texas, New York City, and Contra Costa, California.

Florida has used this strategy as well; the SWFWMD, for example, has ongoing efforts to acquire land which meets the objectives of the Water Management Lands Trust Fund through both the Save Our Rivers (SOR) program, and Florida Forever, a successor program to Preservation 2000 (P2000). District-acquired lands to-date have included swamps and flood conveyance corridors, areas adjacent to District or public land holdings, and lands having a unique water management function such as groundwater recharge or areas essential to protect water supplies.

The purchase of selected or critical watershed lands can be a complement to other programs or regulation. The Trust for Public Land published a report in 2004, “Building Green Infrastructure, Land Conservation as a Watershed protection Strategy,” that featured examples of successful land acquisition programs from Austin, Texas; Charlotte, North Carolina; Banegat Bay, New Jersey; and Indian River Lagoon, Florida. The priorities they used ranged from identified water quality and quantity source protections to other benefits, including the availability of the land for purchase, as follows:

- Protection of surface drinking water sources.
- Avoidance of nonpoint source pollution.
- Protection of baseflow, wellhead and recharge zones.
- Preservation of critical and sensitive habitat.
- Restoration of natural hydrology and upland / wetland linkages.
- Importance to preserving historical or cultural resources or quality of life.
- Importance of land for recreation.
- Protection of threatened and endangered species.
- Important for other management goals.
- Contiguity of a parcel with other acquired parcels.
- Willingness of a landowner to sell.

Source water protection is particularly important with growing populations and development. For those not able to purchase large areas of their watersheds, complementary and cooperative efforts are quite acceptable and can be very effective.

## **COLLABORATION**

Virtually all source water protection plans involve outreach to the residents of the protection area. Many communities are not able to implement watershed districts or solely use ordinances described above. The primary method for these communities to manage their protection areas is through outreach and education of other communities, residents, and businesses in their watershed. These can effective programs and achieve many positive controls on development and activities within the protection area. The key is to build public support and understanding of the importance of protecting the drinking water supply from potential contaminant sources.

Typically, collaboration results in the formation of a steering committee or other formal group that works together to define goals, objectives, and standards for development and land use to protect water supplies. These steering committees also typically work together to develop ordinances for each participating entity to adopt that will protect their supply sources. Many

communities use collaboration as their primary management strategy, including Springfield, Missouri, and their Watershed Committee of the Ozarks.

### **PULLING IT ALL TOGETHER**

Even those communities that are able to implement watershed districts or ordinances use public outreach and education to build awareness. Outreach and education are important throughout the development of the watershed district or ordinance. Involving the community can help define the goals of the watershed district or ordinance and will build support for the regulations. Once the district or ordinance are in place, public outreach, education, and involvement help to ensure the management practices are implemented and identify where regulations are not being followed. As discussed above, virtually all management strategies involve collaboration.

This paper focuses on the management aspects of source water protection which involves preventing pollution of the groundwater, lakes, rivers, and streams that serve as sources of drinking water for local communities. It focuses on the legal and voluntary mechanisms that can be used to prevent or influence the location of developments that may adversely impact water supply facilities. Effective long term management and sustainability of the drinking water resource requires consideration of not only upstream or up-gradient activities that might affect the quality and quantity of the drinking water source, but also recognition of the downstream water users and other demands on the drinking water source.

Sustainable source water quality requires protection of actual or potential supplies; maintaining the quality of existing sources; enhancing or improving quality where needed; and continued analysis tools to support these objectives

### **REFERENCES**

1. American Water Works Association, *Water Resources Planning Manual, M50*, 2001.
2. Interlandi, Sebastian A. and Christopher S. Crockett, *Recent water quality trends in the Schuylkill River, Pennsylvania, USA: a preliminary assessment of the relative influences of climate, river discharge, and suburban development*, 2002.
3. Kenel, Pamela P., *Water Supply Planning for Sustainability*, 2004.
4. National Council for Science and the Environment, *Water for a Sustainable and Secure Future: A report of the Fourth National Conference on Science, Policy, and the Environment*, 2004.
5. National Research Council, "Watershed Management for Potable Water Supply, Assessing the New York City Strategy," National Academy Press, 2000.
6. Trust for Public Land, *Building Green Infrastructure, Land Conservation as a Watershed Protection Strategy*, 2004.
7. Trust for Public Land, *Protecting the Source – Land Conservation and the Future of America's Drinking Water*, 1997.
8. Witherspoon, John T., *A Comprehensive Source Water Protection Program for the Springfield, Missouri Water Supplies*, 2002.