

A WATER QUALITY TRADING FRAMEWORK FOR THE REEDY RIVER

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Abstract. The Reedy River flows through a relatively small watershed that is rapidly experiencing growth. The watershed is approximately 167,000 acres, but the upper portions of the river include the urban areas of the City of Greenville, Mauldin, and Simpsonville within Greenville County, South Carolina. The lower portions of the river flow through Laurens County as the Reedy joins the Saluda River to form Lake Greenwood. As the population and the economy of the Reedy River Watershed continue to expand, the demand on this river resource will continue to increase.

For a number of years the Reedy River has been under increasing pressure from various sources. Point source and non-point source effluent loads have increased considerably over the past decade, and the economic and social costs of degradation have not been quantified or assessed in relation to increased environmental stress placed on the river system.

Recent water quality challenges in the United States have stimulated sustained interest from policymakers to incorporate the use of non-traditional market mechanisms to lower costs of compliance and improve aquatic environments. This type of approach allows facilities with high pollution control costs to purchase lower cost pollution reduction from another source to meet their effluent reduction requirements. Water quality trading is conceptually similar to air emissions trading, but effluent trading has lagged in development. A few effluent trading programs were developed in the early 1980s and during the 1990s, but in recent years new interest has sparked conversations about policy changes that would improve the capabilities for local and state authorities to implement water quality trading programs.

In January of 2003 the United States Environmental Protection Agency issued rules through its water quality policy statement to encourage the trading of nutrients and sediments among point and non-point sources. Water

quality trading can provide greater flexibility and the potential to achieve levels of environmental benefits that would not otherwise be attained under a traditional command and control approach. When working with non-point source pollution problems, the USEPA is required to work with individual states and local agencies because of the provisions defined in the revision of the Clean Water Act in 1987.

From a state and local level further analysis is needed in order to assess the applicability of creating a water quality trading program for the Reedy River Watershed. This proposed paper will provide a conceptual framework for how a water quality trading program may be established within this watershed. Background research from other case study sites throughout the United States will be incorporated with specific data from the Reedy River Watershed to provide a detailed analysis of how a water quality trading program might be applied to the Reedy River Watershed.

Background and Related Work

Water Quality Trading Background

After learning from successful experiences with emission trading programs focused on reducing acid rain, the United States Environmental Protection Agency (USEPA) now actively supports the application of emission trading to water quality. This approach seems quite attractive because it could provide financial incentives for increased pollution control activities in unregulated sectors. Agriculture and urban runoff are major contributors to effluent load levels in many watersheds, but with a few exceptions these sources do not fall under regulatory guidelines because of political sensitivities and perceived monitoring difficulties (Crutchfield, 1994).

Vast improvements in water quality throughout the United States over the past three decades can be traced primarily to conventional regulation approaches and financial support given to point sources, municipalities, and traditional large pipe dischargers. Regulatory initiatives concerning surface water policy in the United States have been guided by the 1972 Federal Water Pollution Control Act, also known as the Clean Water Act (CWA). This act and amendments in 1977 and 1987 set the overarching principles and implementation mechanisms that direct the efforts to prevent water pollution. The USEPA has been granted a primary tool to regulate water pollution through the National Pollutant Discharge Elimination System (NPDES). The NPDES requires point sources to obtain state and USEPA approved permits of defined number of pollutant discharges. The USEPA and other federal agencies use a variety of subsidies and grants to mitigate point source (point source) and non-point source (non-point source) pollution that does not fall under the NPDES criteria.

Various pollutants that are associated with non-point source pollution include fecal bacteria, toxic organic compounds, heavy metals, suspended solids and sediments, phosphorus, nitrogen, and other oxygen-demanding organic material. Unlike point source pollution, which tends to be a steady discharge, non-point source pollution occurs during different times based on periods of rainfall or the melting of snow. If unchecked, these non-point source pollutants eventually reach our lakes, rivers, oceans, and even underground sources of drinking water as they seep into the ground. “Despite the expenditure of hundreds of billions of dollars over the last 30 years, the 1972 Clean Water Act goals of fishable and swimmable waters have not been achieved, largely because contaminants from diffuse [non-point] sources have not been controlled successfully” (National Research Council, 2001).

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In January of 2003 the United States Environmental Protection Agency issued rules through its water quality policy statement to encourage the trading of nutrients and

sediments among point and non-point sources. The policy states that its purpose is “to encourage states, interstates agencies and tribes to develop and implement water quality trading programs for nutrients, sediments, and other pollutants where opportunities exist to achieve water quality improvements at reduced costs” (USEPA, 2004). In that document the USEPA states that market-based approaches like water quality trading provide greater flexibility and have the potential to achieve levels of environmental benefits that would not otherwise be attained under a traditional command and control approach. The policy focuses on the idea that different sources within a watershed may face significantly different costs to control the same pollutant. When working with non-point source pollution problems, the USEPA is required to work with individual states and local agencies because of the provisions defined in the revision of the Clean Water Act in 1987. The law leaves non-point source control planning to the states and local agencies because of local environmental and economic considerations. “The actual site-specific selection of particular management practices to control non-point source pollution (called “Best Management Practices”) will involve local environmental and economic considerations, as well as considerations of effectiveness and acceptability of the practice (USEPA 1984a)” (Portney, 2000).

Phosphorous Loads and the Reedy River

In recent years Lake Greenwood, at the mouth of the Reedy River, has been threatened by excessive nutrient loading, intense algae blooms, and extensive oxygen depletion in the bottom waters. A South Carolina Department of Natural Resources Study completed this year found that total phosphorus loading to the lake was greatly affected by the amount of phosphorus contributed by the Saluda River (74%) and the concentration of phosphorus from the Reedy River (0.11% mg/L, 22% higher than Saluda). Concentrations flowing into Lake Greenwood exceeded the South Carolina standard for piedmont lakes (0.06 mg/L) more than 68% of the time from the Reedy River Arm (McKellar, Bulak, and Taylor, 2008).

Water quality has improved over the past 30 years in the Saluda-Reedy Watershed as a result of the Clean Water Act (Hargett, Hargett, and Springs, 2005). But, the most recent water quality assessment for the Saluda-Reedy Watershed indicated that several locations in Lake Greenwood did not meet standards for Aquatic Life Use Support (SCDHEC, 2004). Three locations within the lake appeared on the 2006 list of impaired waters in relation to excessive total phosphorus concentrations (SCDHEC, 2006).

A substantial reduction of phosphorus loading from both the Reedy River and the Saluda River is necessary in order to realize a lake-wide improvement in water quality. A 50% load reduction in both rivers would greatly reduce the phosphorus concentrations throughout the lake, especially in the Upper Reedy Arm. This type of reduction could decrease the extent of extreme hypoxia and the risk of severe algae blooms by about 31% throughout a given year (McKellar, Bulak, and Taylor, 2008).

Research Design

Establishing a water quality trading program within the Saluda-Reedy Watershed may provide the framework to enable a 50% reduction of phosphorus loads. But, how would the framework be constructed? What would be the most important factors of creating a successful water quality trading program within this basin? The research design for this study was arranged in a way that focused on economic and institutional failures of water quality trading programs. Economic failure issues that were identified in the literature included: the setting of an optimal nutrient cap, property rights issues (initial distribution of credits), current available and readily accessible information, positive and negative externalities generated from a trading program, and the transaction costs of creating a trading program. Institutional failure issues, many of which relate to the establishment and maintenance of a market framework, were identified included: the setting of a cap (TMDL), the assigning of property rights concerning current transactions that focused on risk and liability issues, information that dealt with the starting point (baseline) for trades between point and non-point sources, and the role of monitoring and verification to identify positive and negative externalities and minimize transactions costs.

Information for this study was collected from four water quality trading programs: Cherry Creek WQT Program in Colorado, Tar-Pamlico River WQT Program in North Carolina, Lower Boise River WQT Program in Idaho, and Neuse River WQT Program in North Carolina. Face-to-face interviews took place with state and federal environmental officials, professionals and private technical consultants contracted by trading programs, representatives of trading program organizations, and other stakeholder group representatives during the month of April 2007. Two local stakeholder meetings were observed: the Lower Boise River Watershed Council (April 12, 2007) and the Tar-Pamlico Association Meeting (April 25, 2007). Both of these meetings included representatives from point

sources, non-point sources, government, and environmental organizations.

Conclusions from Case Studies

The four case studies in this research analysis identified some of the key economic and institutional impediments constraining water quality trading programs that promote point source to non-point source water quality trades. The case studies analyzed revealed distinctive environmental water quality stressors and human settlement pressures with market and institutional constraints. All four watersheds have experienced some extreme form of nutrient related environmental degradation episode or series of hazardous events over the course of several years. Vast fish kills within each basin have been the most dramatic and profound focusing events to date. Two programs identified phosphorus as the watershed limiting nutrient to be traded: Cherry Creek and Lower Boise. The Tar-Pamlico program focused both on phosphorus and nitrogen, and the Neuse program dealt exclusively with nitrogen. Differences between the case studies were revealed in the many methods of program administration, structure for trading, and performance of different trading strategies. These differences can be explained through a distinct set of factors that include trading drivers like regulatory TMDLs or other caps on nutrient loads, local culture and politics, investment and development influence from federal, state, and local government agencies, and the creation and development of water quality trading organizational bodies.

Only one of the four programs has experienced at least one point to non-point source trade. The Cherry Creek Program has processed two trades that have included the incorporation of a restored wetland site and a constructed wetland site. The stakeholders involved in the trades vividly described the laborious process of applying for, negotiating, assessing, and monitoring credits. The application, negotiation, and assessment of the credits took place over the course of a year, and the monitoring for the trades is still taking place to date. These types of transaction costs are a major deterrent for trading programs.

Transaction costs occur at every stage of the trading process, but the four trading programs handled these costs differently. The time spent on permit negotiation, the search for trading partners, administrative expenditures, transparent communication between permittees and government agencies, regulatory staff time, and monitoring and verification initiatives have been handled in accordance to the structure of the program. In both the Neuse program and the Tar-Pamlico program the state of North Carolina shouldered

most of the transaction costs through the North Carolina Agricultural Cost Share Program (for the Tar-Pamlico) and through the North Carolina Ecosystem Enhancement Program (for the Neuse). The control and oversight for environmental accountability in North Carolina for these two programs is attained at the expense of higher staff costs for agencies. In the Cherry Creek and Lower Boise programs the transaction costs were mainly shouldered by the point sources that were required to meet certain discharge allocations based on their NPDES permits.

The key economic issue that makes water quality trading appealing is the efficiency that is created when one discharge source is able to more cost-effectively reduce its outputs compared to another source. Without this guideline then the program is not financially viable. It is necessary that economic considerations are incorporated into performance assessments of trading programs in order for the programs to be considered viable tools to achieve water quality standards. Types of economic barriers related to high transaction costs, lack of defined property rights, or a lack of good scientific information prevent equitable and efficient negotiations from occurring. Negotiations do not occur because the lack of economic information increases the risk in relation to the return on investment to the point source, non-point source, or to both parties.

There are also several political constraints that were observed in the case studies presented that dealt with the institutional settings affecting the performance of the programs. Institutional impediments that were identified by the literature were also revealed in the cases, and are directly related to the economic impediments. The inability for government agencies to set caps, the inability to assign property rights, the lack of good information, the inability for the government entity to account for positive and negative externalities, and the inability to efficiently manage transaction costs were all institutional failures highlighted in the case studies.

One of the institutional impediment examples within the cases dealt with the effective implementation of the programs. The Cherry Creek Authority was given a statutory mandate by the State of Colorado to provide for the use of trading within the basin. The North Carolina programs were provided with state regulations and nutrient limiting caps in order to direct trading initiatives. Therefore, from an institutional setting everything was in place to direct trades based on water quality regulation. But, as the case studies revealed, effective implementation of the programs did not occur immediately because of insufficient funding, undeveloped property rights, lack of political will, or stakeholder inexperience with the understanding of the water quality trading concept.

The common assumption based on economic theory that suggests that market-based approaches can be directly substituted for outdated or inefficient traditional regulatory procedures has not been supported by evidence in the case studies presented. Market based environmental trading programs are often touted as alternatives to market regulation, but the markets are only successful to the degree that there are binding caps and allowances that are well defined. Water quality trading programs require supportive legislation, strong institutions, and effective monitoring and enforcement procedures to be viable.

In order to create a successful water quality trading program within the Reedy River and Saluda River Basins in relation to Lake Greenwood certain economic and institutional components are necessary. First, there must be an in-depth understanding of the nutrient pollution problem. This type of understanding is essential in order to define the baseline conditions and the nutrient reduction cap for a trading program. In fact, this type of broad based monitoring throughout the watershed is necessary in order to verify the effectiveness of any type of nutrient reduction program, with or without markets. Recent reports (McKellar, Bulak, and Taylor, 2008) have provided phosphorus models for the Saluda-Reedy Watershed that can determine load reduction goals for policy makers.

Secondly, within the watershed there is a need to accurately measure in-stream capacity. Monitoring and assessment studies of the Reedy River Watershed have determined that there is a significant phosphorus concentration problem that will continue to increase with pressures from point and non-point dischargers. Recent studies (McKellar, Bulak, and Taylor, 2008) have modeled phosphorus loads, algae dynamics, and oxygen depletion factors throughout the watershed linked to Lake Greenwood. This understanding of the specific nutrient problem within a basin coupled with knowledge of where the loads are coming from provides baseline information necessary in order to evaluate water quality trading as a policy option. An optimal cap must be set for critical constituents in relation to baseline and in-stream capacity information, and then ongoing monitoring of the watershed must take place in order to verify changes to water quality.

The next condition necessary for the assessing the option to incorporate a water quality trading program focuses on the number and type of potential buyers and sellers of water quality credits. There must be a certain number of interested point and non-point sources within a basin for a trading program to develop. Point sources are regulated, and may be required to participate in a program to meet certain reductions, but non-point

sources must participate in a program in order to decrease significant nutrient load amounts within specific watersheds. A condition that would greatly increase the option to implement a water quality trading program would be the incorporation of some type of binding constraint that linked point sources to non-point sources. At the present time there are two large (more than one million gallons per day) permitted domestic dischargers along the Reedy River. There are seven similar facilities along the Saluda River.

Another condition that is absolutely necessary for an effective water quality trading program to become a viable option is the retrieval and incorporation of better information concerning non-point source nutrient reductions. At the present time, as revealed by the case studies, monitoring and verification is not necessarily a condition of incorporating a trading program. The knowledge of what levels of nutrients are being reduced at non-point source credit sites is essential if the effectiveness of a water quality trading program is to be measured.

Lastly, both positive and negative externalities must be considered when assessing the conditions under which water quality trading is a viable option within the Reedy River Watershed. When a cap is set and enforced, and monitoring takes place, there is still the need to assess the benefits and costs that are being generated by the program. For instance, if the nutrient levels for a particular basin are being monitored and the assessments show that the water quality trading is reducing nutrient loads then measurements will suggest that water quality has improved. But, there must also be consideration for the land use, ecological, and hydrological changes that have taken place within the basin to improve the water quality. Planning decisions must be arranged before a water quality trading program is adopted in order to estimate the positive and negative externalities that would evolve from this type of policy option.

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