A FEASIBILITY ANALYSIS OF APPLYING WATER QUALITY TRADING IN GEORGIA WATERSHEDS

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Abstract

Water quality trading is a policy tool that could improve the cost-effectiveness of achieving environmental goals, but it is not currently used in the state of Georgia. This paper evaluates the feasibility of applying water quality trading in Georgia watersheds. The criteria used for this evaluation include environmental suitability, regulatory incentive, economic incentive, availability of participants, and stakeholder response. The evaluation concludes that the Georgia watersheds where WQT appears to be most feasible include the *Chattahoochee, Coosa, Savannah, and Ocmulgee* basins. Feasibility is also likely to be high in the *Flint and Oconee* basins. However, it is important to note that WQT could develop in ***any*** watershed where a pollution source has an economic interest in trading. The evaluation concludes that the opportunity for WQT in Georgia is somewhat limited by present regulatory conditions, but offers alterative WQT models that should be considered.

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A FEASIBILITY ANALYSIS OF APPLYING WATER QUALITY TRADING IN GEORGIA WATERSHEDS

I. Introduction

Over the past several years, policy makers have developed a high level of interest in the use of water quality trading (WQT) to manage water pollutants in watersheds across the U.S. In 2003, the EPA issued a national water quality trading policy to support the development and implementation of trading in water quality management (USEPA, 2003). The EPA advocates WQT as a cost-effective means to preserve and improve water quality. To date there are over forty WQT programs established in the U.S. and an additional thirty programs or more currently in development, but at this time, WQT has not yet been established in Georgia.

For the past three years, WQT has been the subject of an on-going research project at Georgia State University and the Georgia Water Planning and Policy Center. This research is intended to assist Georgia policy makers in evaluating the applicability of WQT in Georgia watersheds. As a part of this research, this paper offers a detailed look at conditions that could support or hinder WQT on a watershed-by-watershed basis across Georgia.

II. Background

Water quality trading is a policy that allows pollutant sources to trade pollution control obligations in order to lower the joint costs of compliance. Trading takes advantage of differences in pollution reduction costs among pollution sources. The costs of pollution reduction are not uniform. Different pollution sources have different pollution reduction costs as a result of factors such as treatment plant size, level of reduction required, and available treatment technology. When trading is an option, a discharger can choose between reducing its pollutant load and purchasing pollutant reduction credits from another source that has exceeded its own pollution reduction obligation. Trading allows pollution sources to achieve environmental goals more cost-effectively. Furthermore, trading can be designed to achieve environmental improvement by requiring a trade premium (i.e., the trading ratio is greater than 1:1).

The success of water quality trading hinges on a broad range of economic, environmental, social, and political factors. Implementation is complex, and the potential benefits can only be realized when trading is implemented under appropriate conditions. Despite its complexity, trading can offer a tool for enhancing the cost-effectiveness of water quality expenditures. With over 50% of the state's rivers and streams only partially supporting or not supporting water quality standards, the costs of restoring water quality in Georgia's waters will be high. A policy tool that can improve the cost-effectiveness of water quality expenditures deserves serious consideration.

The key issues surrounding the potential application of water quality trading in Georgia are the adequacy of financial and regulatory incentives, the availability of potential traders, and the acceptance of trading policies by affected stakeholders. Another key issue for water quality trading, in general, is the lack of trading activity to date in existing water quality trading programs. Identifying barriers to trading activity and evaluating whether the paucity of trades elsewhere indicates failure of the policy are important questions that this research aims to address.

Nationally, water quality trading is a subject of great interest to policymakers, and research efforts on the topic are underway in watersheds around the U.S. In Georgia, over the past few years, the Andrew Young School of Policy Studies (AYSPS) at Georgia State University and the Georgia Water Planning & Policy Center (GWPPC) have issued several policy papers that have examined the potential use of water quality trading in Georgia (Morrison, 2002; Cummings et al., 2003; Rowles, 2004; Jiang et al., 2004; Rowles, 2005(a); Rowles, 2005(b); Jiang et al., 2005; Rowles and Thompson, 2005). Research on water quality trading at AYSPS and the GWPPC is continuing in collaboration with the Warnell School of Forestry at the University of Georgia. This research project aims to lay the policy research foundation on this issue of WQT in Georgia. Elsewhere in the state, another project at the University of Georgia is studying the potential use of water quality trading in the Lake Allatoona watershed in northern Georgia.

At this time, Georgia is beginning the process of setting a statewide plan for managing water and water quality through the Georgia Water Council, established by the Comprehensive Statewide Water Management Planning Act in 2004. This process presents the opportunity to discuss how water quality will be managed in the state for the foreseeable future. In these discussions, the potential use of WQT in Georgia should be considered as a potential tool to enhance the cost-effectiveness and flexibility of water quality regulation. This report and other reports issued through this project are intended as a resource to assist in evaluating whether WQT is an appropriate tool for Georgia.

Enthusiasm for WQT has driven many states to develop WQT policies and programs. Because of the complexity of implementing WQT, initiation of WQT requires a substantial investment in research, policy development, and partnership building. Many other states have already made this investment, but the returns to their investments are not yet clear. This research effort is designed to learn from the experiences of other states that have preceded Georgia in the use of WQT.

III. Research Design

To evaluate the applicability of WQT in Georgia, this research project has several components:

(1)*Evaluate 14 major Georgia watersheds for their suitability for WQT*: This evaluation uses criteria identified in our study conducted last year of the opportunity for water quality trading in the Upper Chattahoochee watershed (Rowles, 2004). These criteria include: environmental suitability, regulatory incentive, participant availability, economic incentive, and stakeholder response. This paper reports on results from this analysis.

(2) *Analyze the legal framework for water quality trading in Georgia*: The success of a water quality trading project requires that the administering agency has clear legal authority to create, implement, and enforce the program. We are analyzing the legal issues surrounding the implementation of WQT in Georgia by reviewing existing Georgia policy and by analyzing water quality trading policies adopted in other states that could provide policy models for Georgia. (See Rowles and Thompson, 2005)

(3) *Develop estimates for point source treatment costs*: The driving force of WQT is the variability of treatment costs among various pollution sources. In this project, we have developed cost estimates for point source treatment of phosphorus. These estimates

can be used to evaluate demand for WQT by point sources, which are usually the primary buyers in WQT markets due to their regulatory obligations. Two reports have been issued on the methods and results of estimating these costs. (See Jiang et al., 2004; Jiang et al., 2005)

(4) *Develop a simulation model for water quality trading in a Georgia watershed*: The STAND model (Sediment-Transport-Associated Nutrient Dynamics) developed at the University of Georgia will be used to bring together the results of our recent work to develop cost curves for phosphorus reduction by municipal wastewater treatment plants in a sophisticated water quality model that will be able to demonstrate the effects of water quality trading under various scenarios.

(5) *Conduct a monitoring study to support the development of trading ratios applicable for point to nonpoint source trades*: Continuous sampling methods will be used to estimate pollutant loads from potential sellers of nonpoint source pollutant credits. Monitoring results will support modeling efforts described above and provide a basis for the development of trading procedures, including trading ratios.

(6) *Engage stakeholders in discussion about the development of water quality trading in Georgia*: A new water quality trading program would affect stakeholders across the state. Successful adoption of water quality trading in Georgia will require that stakeholders are involved in the discussion of how trading should be implemented in the state. The primary focus of this part of our research effort is a stakeholder workshop planned for the fall of 2005. The workshop will be designed to provide an educational simulation of the use of market mechanisms in water quality policy. We are also continuing and expanding our efforts to meet with stakeholders from community

organizations, private interests, and all levels of government to provide information and facilitate discussion about WQT.

IV. Evaluation Criteria

As discussed above, this watershed-by-watershed evaluation uses criteria identified in our study conducted last year of the opportunity for water quality trading in the Upper Chattahoochee watershed (Rowles, 2004). These criteria include: environmental suitability, regulatory incentive, participant availability, economic incentive, and stakeholder response. These criteria were developed based on an analysis of existing trading efforts, a literature study, and guidance documents from EPA on WQT. These criteria are appropriate when considering a watershed-scale trading initiative that allows for point-nonpoint trading. This is the most common trading model considered in WQT initiatives elsewhere and the model most often discussed in the literature and EPA guidance documents. Later in this report, other models for trading, which may be more appropriate for use in some Georgia watersheds, will be discussed. A brief discussion of each of the criteria follows.

A. Environmental Suitability

WQT is best suited to conservative pollutants that degrade slowly and create impacts through total accumulation. The EPA WQT policy specifically supports trading in nutrients and sediment. It also supports cross-pollutant trading that involves oxygen-related products, including nutrients, dissolved oxygen, and biological oxygen demand. To date, the majority of WQT programs have focused on nutrient trading, with phosphorus trading being the most common. WQT is also well-suited to water systems with long pollutant residence times. In this type of water system, pollutant loads are less subject to fluctuations as a result of weather. Thus, trading is most appropriate for water systems involving lakes and estuaries (Ribaudo et al., 1998).

In this report, we considered waterbody type and pollutants of concern to evaluate watersheds on their environmental suitability for trading. Watersheds with major lakes and estuaries were considered the best suited to trading. For pollutants, we considered whether pollutants appropriate for trading are pollutants of concern in the watershed. The EPA has identified several pollutants as appropriate for trading, including nutrients, sediment, oxygen demand (and related pollutants), and temperature. If these pollutants were identified as a stressor in the EPD watershed plan or if the watershed had a TMDL for the pollutant, then the watershed was evaluated more highly for trading feasibility.

B. Regulatory Incentive

Trading activity will not occur unless there is sufficient regulatory pressure to induce demand for pollutant credits. Regulatory incentive is closely tied to economic incentive because regulation results in compliance costs which form the basis of the economic drive for trading activity. In many existing trading programs, regulatory pressure is not adequate at this time to induce trading activity. In Georgia, regulatory incentive for WQT is most likely to be created by the implementation of Total Maximum Daily Loads (TMDLs) and nutrient loading limits for lake watersheds (e.g., Lake Lanier, Lake Allatoona). In the future, if and when Georgia implements nutrient standards for all waterbodies, as encouraged by EPA's nutrient criteria initiative, new regulatory pressures for trading may develop.

In this report, we considered whether the following conditions exist to evaluate the regulatory incentive for trading in a watershed: limits on phosphorus loading based in major lake watersheds, limited unallocated assimilative capacity, and TMDLs for pollutants appropriate for trading (see above).

C. Economic Incentive

The difference in marginal treatment costs drives trading activity. Trading will occur only when one pollution source can provide abatement at a lower cost than another source. The economic incentive to trade will be reduced by transaction costs and trading ratios greater than 1:1. The economic incentive is closely tied to regulatory incentives to trade because strict regulation of some pollution sources can create treatment cost differentials. Differences in trading costs also arise when economies of scale help larger pollution sources to comply with regulatory requirements as a lower per unit cost than smaller sources.

Many trading initiatives are based on the assumption that treating nonpoint pollution is less costly than treating point source pollution. In fact, the cost differential between point and nonpoint source treatment often does not turn out as expected. The Tar-Pamlico River Basin in North Carolina, the Fox-Wolf River Basin and the Rock River Basin in Wisconsin, and Lake Dillon in Colorado are four water quality trading initiatives that began in the 1980's and 1990's in the U.S. Trading was developed in these watersheds based on estimates of significant cost savings that could be achieved through point-nonpoint source trading. Despite the projection of heavy regulatory compliance costs for point sources without trading, no point-nonpoint trading activity followed the establishment of these programs. The primary reason for the lack of trading in these programs was that point sources were able to comply with regulatory requirements at costs lower than expected (Breetz et al., 2004; Environomics 1999; Kramer, 2003, WDNR, 2002).

A lack of trading activity in most existing trading initiatives is an indication that the cost difference between pollution sources often does not turn out to be as great as expected. A recent report generated in this research project estimates the costs for point source abatement of phosphorus. The estimates provide a basis for evaluation of the demand side of a potential phosphorus trading market. The results suggest that point source costs at advanced treatment levels may not be high enough to stimulate water quality trading. In part, these results could explain the lack of demand for trading credits in existing nutrient trading initiatives.

Despite policy-maker's enthusiasm for water quality trading, the gains of trading have not been realized. As King notes in a recent critique of water quality trading programs, "enthusiasm about WQ trading is based mostly on conceptual arguments about its potential to generate cost savings and ideological arguments about the superiority of market-based solutions over conventional regulatory programs" (King, 2005). Trading may still offer great potential for cost savings as regulatory requirements tighten with the implementation of EPA's nutrient criteria program. However, better methods for assessing supply and demand in potential trading markets are needed.

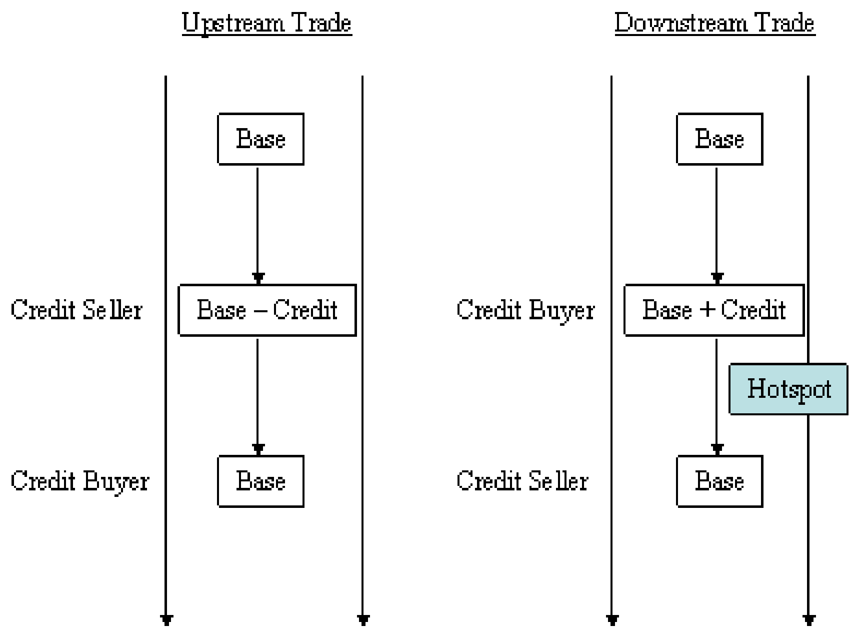
In our evaluation of Georgia watersheds, the close association between regulatory requirements and the costs of treatment is the driving factor for the economic incentive for trading. In the evaluation results, we discuss whether regulatory restrictions are currently adequate to support trading in Georgia and how future regulatory changes may affect the economic incentive.

D. Availability of Participants

The availability of a suitable number of potential trading partners is important to the success of a WQT market. Trading markets can fail if the participants are too small or too few (Letson et al., 1993, Crutchfield et al., 1994). The number and size of credit selling participants must be sufficient to supply the pollutant credits adequate to meet the load reductions sought by credit buyers. If the market consists of numerous small participants, transaction costs may be too high. In this report, we examined the number of NPDES permit holders in a watershed and the proportion of land devoted to agriculture to evaluate the availability of potential participants and a balance among the types of potential market participants.

An important factor related to both the availability of participants and environmental suitability is the location of the trading partners. Some trades have the potential to create adverse, local impacts ("hot spots") while still resulting in decreased pollutant loadings at the aggregate level. A "hot spot" might be created when a pollution source pays a source downstream for pollutant reductions through trading (Figure 1). Pollutant loads in the stream segment between the two sources could become too high. Thus, upstream trades are generally preferable. When a buyer of pollutant credits pays an upstream source for pollutant reductions, water quality in the segment between the two sources is improved and the risk of creating a "hot spot" is greatly reduced. The risk of "hot spots" can also be high when the credit buyer discharges to slow moving water or a

Figure 1 : Changes in Pollutant Loads in Water Quality Trading:
Creation of Hotspot in Downstream Trade



Note: A 1:1 trading ratio is assumed in this diagram.

lake. Factors that can contribute to the creation of “hot spots” include characteristics of the pollutant, availability of assimilative capacity in the receiving water, low flow or long retention periods, and interaction with other pollutants. The risk of “hot spots” is not assessed for each watershed in this evaluation, because it is a general WQT concern that applies in any watershed. It must be taken into account in the design of trading programs and rules. Implementing WQT in water systems where potential credit generators are clustered upstream of potential credit buyers will help to minimize the risk of hot spots. Also, when trading involves credit buyers that discharge to a lake, trading rules and monitoring efforts will need to be designed to ensure the protection of local, as well as aggregate, water quality.

E. Stakeholder Response

Stakeholder willingness to accept and support the development of WQT is very important to its success. Stakeholders in Georgia will have a range of views on WQT, but some opposition can be expected. Farmers may be reluctant to participate because they are unfamiliar with trading. They might fear that WQT will create negative publicity, and they might also fear that their participation will draw attention to their pollutant contributions and provide justification for future regulation. Point sources are likely to favor WQT, but some point sources may perceive WQT as unfair because they would be paying to mitigate the increasing nonpoint source pollutant load.

Environmental organizations do not uniformly support or oppose WQT. Some organizations, such as Environmental Defense and World Resources Institute, have been active in supporting the development of WQT as a tool for water quality improvement. Others have opposed WQT because they disagree with the principle of a market-based policy that permits sources to buy and sell the right to pollute. During the 2003 session of the Georgia Legislature, a proposal to establish transferable water rights to manage water withdrawals in the state was strongly opposed by many state environmental organizations because they disagreed with the principle of using markets to manage water quantity. They may react similarly to WQT in Georgia.

Involvement of stakeholders is one of the primary objectives suggested by the EPA for success in the development of WQT. Some of the longest standing WQT projects in the U.S. are those that were initiated by stakeholder coalitions that included representatives of various affected interests (e.g., Dillon Lake, Tar-Pamlico). Gaining the support of all affected stakeholders is unlikely, especially in watersheds where water issues are particularly divisive. However, if WQT is pursued in Georgia, stakeholder response will be a critical factor in determining its success, and any effort to initiate WQT in the state should engage all affected stakeholders in a meaningful public involvement process.

In this report, the criterion of stakeholder response was not evaluated on a watershed-by-watershed basis, but the importance of this factor is discussed further in the section on evaluation results below.

V. Evaluation Results

In the following section, the results of the watershed-by-watershed evaluation for the feasibility of implementing a water quality trading initiative are presented. The fourteen major watersheds of Georgia are included (Figure 1). Only those sections of the watersheds that are within the state are evaluated in this paper. For some watersheds, more information was available than others; only limited information was available on the Tennessee River basin.

A. Environmental Suitability

For the criterion of environmental suitability, Table 1 summarizes the evaluation factors. Most watersheds include lake or estuary sections that provide an appropriate water body type for WQT. It is important to note, however, that impoundments also create barriers over which trading is difficult. A trade involving one source above an

FIGURE 2: Georgia's 14 Major River Basins

TABLE 1: Factors Affecting Environmental Suitability for Trading

	Lake/Estuary System	Pollutant of Concern (stressor or TMDL)			
		Nutrients	Sediment	Oxygen Demand	Temperature
Chattahoochee	X	X	X	X	X
Flint	X	X	X	X	
Coosa	X	X	X	X	
Tallapoosa	X	X	X		
Oconee	X	X	X	X	X
Savannah	X	X	X	X	
Ogeechee	X	X	X	X	
Ochlockonee	X	X	X		
Suwanne	X	X	X		
Satilla	X	X	X	X	
St. Marys	X	X	X		
Ocmulgee	X	X	X	X	
Altamaha	X		X	X	
Tennessee				X	

impoundment and one source below an impoundment presents a difficult challenge to the determination of environmental equivalence. Recently, a trade proposed in the Neuse River basin in North Carolina was not approved, and a major reason for the rejection of the trade was the presence of an impoundment between the trading partners.

The remaining columns of Table 1 indicate in which watersheds the pollutants most appropriate for trading are also pollutants of concern, as determined by their listing as a stressor in the watershed plan or by the existence (or development) of a TMDL for that pollutant in the watershed. WQT could focus on any one of these pollutants, and it is also possible that WQT could be developed separately for multiple pollutants in a single watershed. Additionally, the EPA is open to considering proposals for WQT that would allow trading across related pollutants, such as dissolved oxygen, oxygen consuming pollutants, and nutrients.

B. Regulatory and Economic Incentive

Table 2 summarizes the regulatory incentive for trading in each watershed based on the presence of various regulatory pressures. The presence of any one of these factors could provide a basis for WQT if the regulatory pressure is significantly great on some sources to create an economic interest in trading. However, it is important to note that although these regulatory pressures may be present in these watersheds, regulation might not be strict enough at this time to support substantial trading activity. A major, potential impediment to trading in Georgia is a lack of regulatory pressure and subsequently a lack of economic drivers for WQT.

TABLE 2: Regulatory Pressures that Could Enhance the Feasibility of Water Quality Trading

	Nutrient Limits in Lake Watersheds	Critical Limitation of Assimilative Capacity	TMDLs (for Sediment, Dissolved Oxygen, Nutrients, or Temperature)
Chattahoochee	X		X
Flint			X
Coosa	X	X	X
Tallapoosa			
Oconee			X
Savannah		X	X
Ogeechee			X
Ochlockonee			X
Suwanne			X
Satilla			X
St. Marys			X
Ocmulgee	X		X
Altamaha			X
Tennessee			X

A common focus of water quality trading projects is nutrients, including nitrogen and phosphorus. In most Georgia watersheds, nitrogen and phosphorus are not regulated or they are regulated at a level insufficient to support water quality trading at this time. Nutrient limits exist in the watersheds of six lakes in Georgia: West Point Lake, Lake Walter F. George, Lake Jackson, Lake Allatoona, Lake Sidney Lanier, and Carters Lake (Ga. Comp. R. & Regs. r. 391-3-6-.03). Additionally, TMDLs for nutrients have been developed in the following watersheds: Ochlockonee, Satilla, St. Mary's, Suwannee, and Coosa. However, the limits set by these regulations are generally not restrictive enough to drive nutrient trading activity. It is possible that only in the Lake Lanier and West Point Lake watersheds are regulations within a range to create an economic impetus for trading activity at this time.

A potential trade will be driven by a cost difference for pollution abatement between different sources. As the level of regulation on one type of pollution source (i.e., point sources) increases, abatement costs increase, and the cost difference relative to less regulated or unregulated sources (i.e., nonpoint sources) also increases. Furthermore, as the level of regulation for point sources increases, the costs among point sources may also become more variable if the returns to scale become more prominent, and the costs for small source diverge more widely from costs for large sources.

A recent analysis of the costs of phosphorus treatment by point sources indicates that the marginal costs of abatement may not be adequate to stimulate trading until regulation is at least as restrictive as a 0.5 mg/l concentration limit. For example, at a limit of 1 mg/l phosphorus, the costs of abatement for a 1 million gallon per day (mgd) discharger were estimated between $13 and $40 per pound. For a 20 mgd discharger, the costs at the same level were estimated between $7 and $15 per pound. These cost ranges overlap directly with cost estimates for nonpoint source abatement, which range from $5 to $100 per pound (Ross and Associates, 2000; Faeth, 2000; Camacho, 1991; Environomics, 1999). With the addition of a trading ratio greater than 1:1 and transaction costs, on-site abatement by the point source is likely cost less than compliance through trading at this level of regulation.

If regulation is set at 0.5 mg/l phosphorus, the cost estimate ranges are $89 to $122 per pound for a 1 mgd plant and $28 to $34 per pound for a 20 mgd plant. Even at this level, only the smallest plants (1 mgd) would be likely to have an economic interest in trading. With a 0.13 mg/l phosphorus limit, the cost estimate ranges are $114 to $126 per pound for a 1 mgd plant and $54 to $59 per pound for a 20 mgd plant. At this level of regulation, some larger plants might be interested in trading, but if trading ratios require trading at 2:1 or greater, trading may still only be likely for the smallest plants. At this time, regulation of phosphorus this restrictive is found only Chattahoochee River basin.

Future tightening of nutrient limits may increase the impetus for trading in some watersheds. Tightening may be driven by TMDLs, mass-based load allocations, or the EPA's effort to promote the adoption of nutrient criteria by the states. TMDL development on phosphorus is currently underway in the Lake Allatoona and Lake Seminole watersheds. In lake watersheds with existing phosphorus loading limits, as communities grow, concentration limits will continue to decrease to maintain loading rates. The state of Georgia's response to the EPA's nutrient criteria is uncertain at this time, but regulation of nutrients is likely to become more prevalent in Georgia as a result of this effort. However, until regulation of phosphorus becomes at least as restrictive as 0.5 mg/l, trading activity would be likely to be limited.

Although current regulatory conditions may not be sufficient to support substantial trading activity, growth of communities in watersheds regulated by mass-based TMDL limits (and lake nutrient loading limits) could create conditions conducive to trading in the future. Other models for trading (i.e., in addition to point to nonpoint nutrient trading) may also offer opportunities for Georgia and will be discussed later in this paper. Thus, although current regulatory conditions may not be favorable for WQT, future use of water quality trading is not precluded in Georgia and efforts to develop trading in some watersheds are may not be premature.

C. Availability of Participants

Table 3 summarizes the watershed data on the availability of participants for WQT. The presence of ten or more major NPDES permittees is not required to support WQT in a watershed, but a greater number of permittees offers greater opportunities to support WQT activity. Opportunities for trading may be greatest for minor NPDES permittees for whom the marginal costs of compliance are higher than larger permittees who gain the advantages of economies of scale. However, this opportunity is dependent upon the level of regulation to which minor permittees are subject, which may be less than major permittees. The presence of substantial areas of agricultural land was used a proxy for the availability of agricultural operations that could engage in point to nonpoint WQT.

TABLE 3: Availability of Participants for Water Quality Trading

	10 or More Major NPDES Permittees	Agricultural Land Use >15%
Chattahoochee	X	X
Flint	X	X
Coosa	X	X
Tallapoosa		X
Oconee	X	X
Savannah	X	X
Ogeechee		X
Ochlockonee		X
Suwanne		X
Satilla		X
St. Marys		
Ocmulgee	X	X
Altamaha		
Tennessee		

D. Summary of Results

Table 4 summarizes the results provided in Tables 1, 2, and 3. Based on these criteria, the watersheds where WQT may be most feasible in Georgia include: *Chattahoochee, Coosa, Savannah, and Ocmulgee*. Feasibility is also likely to be high in the *Flint and Oconee* basins. This qualitative evaluation is meant only as a preliminary analysis of where watershed-scale WQT might work best in the state of Georgia. However, it is important to note that these conditions could change quickly as regulations change in each watershed. Also, WQT could develop in ***any*** watershed where a pollution source has an economic interest in trading, finds a potential trading partner, and seeks approval from the Georgia Environmental Protection Division. While in many states, WQT is being developed through intensive policy development efforts, interest in a single bilateral trade is all that is needed to develop WQT in Georgia.

TABLE 4: Summary of Watershed Evaluation Results

Watershed	Environmental Suitability	Regulatory (&Economic) Incentive	Availability of Participants
Chattahoochee	**X**	**X**	**X**
Flint	**X**		**X**
Coosa	**X**	**X**	**X**
Tallapoosa			
Oconee	**X**		**X**
Savannah	**X**	**X**	**X**
Ogeechee	**X**		
Ochlockonee			
Suwanne			
Satilla	**X**		
St. Marys			
Ocmulgee	**X**	**X**	**X**
Altamaha			
Tennessee			

E. Stakeholder Response

As discussed above, stakeholder involvement has been an important factor for WQT in other states. In Georgia, stakeholder response to trading is likely to be mixed, with some in support and others in opposition. The involvement of stakeholders is considered a critical element to success in the development of WQT. In Georgia, water quality issues are closely tied to water quantity issues, especially in the Apalachicola-Chattahoochee-Flint (ACF) and the Alabama-Coosa-Tallapoosa (ACT) basins where interstate water allocation issues are the focus of heated disputes. The development of WQT, particularly in these watersheds, must proceed within the context of water quantity constraints. Water quality trading guidelines would need to consider quantity variations and limitations and the potential effects of WQT during periods of low flow. Furthermore, the heated nature of water quantity and allocation issues in Georgia makes the resolution of any water issue – quality or quantity – a difficult task for policy makers.

WQT should not be developed without considering it within the full context of other important water issues in the watershed where it is proposed and without engaging all affected stakeholders in discussion of how WQT should proceed.

VI. Water Quality Trading in Georgia: If, When, and How?

Given the results of this evaluation, the opportunity for WQT in Georgia is somewhat limited by present regulatory conditions. However, regulatory conditions are likely to change, and regulatory changes could enhance the feasibility of WQT in Georgia. Any increased regulation of pollutants could create an opportunity for WQT. New TMDLs are being developed and implemented each year in Georgia watersheds. The mass-based loading limits of TMDLs facilitate the use of WQT when the limits are strict enough to create an economic interest in trading by some pollution sources. Furthermore, mass-based nutrient limits currently exist in six lakes in Georgia, and as communities in these watersheds grow, their loading allocations will create regulatory constraints that will increase the opportunity for WQT in these watersheds. Finally, the implementation of nutrient limits by the state in response to the EPA initiative on nutrient criteria may also create regulatory conditions that could enhance opportunities for WQT.

Some future regulatory conditions, however, may limit opportunities for trading. Wastewater constituents that are unregulated at this time, such as endocrine disrupting chemicals and pharmaceuticals, may be regulated in the future, and the regulation of these chemicals could obviate drivers for WQT. For example, it is possible that some pharmaceuticals could be treated using the same technologies that currently provide advanced treatment for nutrients. WQT in nutrients becomes a less attractive option if the investment in nutrient treatment technology must be made to treat pharmaceutical chemicals in the wastewater as well. The gains to trading are greatly reduced, if not completely eliminated. Thus, future regulation could diminish as well as enhance opportunities for WQT.

This paper has focused on the development of WQT at the watershed-scale in a form similar to what has been used to date in other states, primarily point-nonpoint nutrient trading. However, other WQT arrangements offer alternatives that might be more immediately appropriate in Georgia:

- *Small treatment plants*: As noted in section V.B above, treatment costs are usually higher for small treatment plants than for large treatment plants. The cost differential created by economies of scale offers an opportunity for WQT by small treatment plants with other treatment plants and/or with nonpoint sources. Larger treatment plants are more likely to have the resources to pursue the process of developing WQT, but smaller treatment plants may receive greater relative benefits from trading. Realizing these gains, however, may require some facilitation of WQT development by state agencies or other third parties.
- *Stormwater programs*: Local governments across the country are developing stormwater management programs to comply with NPDES stormwater management requirements and to address problems with combined sewer overflows and sanitary sewer overflows. The development of stormwater management programs presents an opportunity to incorporate WQT. An EPA research project in Cincinnati is evaluating the use of tradable credits to create an economic incentive for the use of small BMPs that are dispersed across a

watershed, closer to stormwater sources and approximating water retention in an unaltered watershed, in place of large and costly centralized facilities. The City of Williamsburg, Virginia, offers new developers a choice of implementing stormwater nutrient controls on-site or purchasing credits for stormwater controls from centralized facilities. These WQT arrangements offer flexibility and cost-effectiveness in implementing stormwater management.

- *Septic tank conversion*: WQT initiatives in Colorado and Massachusetts have offered pollutant credits for septic tank "tie-ins" to sewer systems. These initiatives create an incentive to accelerate the conversion of aging septic systems to centralized wastewater treatment.
- *Cross-pollutant trading*: WQT among related pollutants offers increased flexibility and opportunities to trade. Cross-pollutant trading among pollutants that affect dissolved oxygen levels, including oxygen demanding wastes and nutrients, can be used to focus on cost-effective resolution of an environmental problem (i.e., low dissolved oxygen). However, research is needed to support the evaluation of environmental equivalence of related pollutants.
- *Development offsets:* In the Dillon Lake watershed in Colorado, nonpoint source regulations require that new nonpoint sources offset their water quality impacts by implementing best management practices at older nonpoint source sites, in addition to practices implemented at their own new development sites. These regulations seek to directly reduce nonpoint sources of nutrients to the watershed through nonpoint-nonpoint trading offsets.

- *Water flows:* The Charles River Watershed Association is seeking to address water quality problems in its watershed by creating incentives to increase the river's base flow and to recharge local aquifers. The association aims to recharge clean water to the ground as an alternative to the collection and treatment of contaminated stormwater. A water flows trading program will create a water bank that will be funded through payments for consumptive uses and water losses (i.e., to inflow/infiltration). The water bank will be used to fund rainwater collection and recharge systems. This new WQT approach focuses at the linkage between water quantity and quality issues and on the prevention, rather than the treatment, of contaminated stormwater.

Given the limitations on the feasibility of WQT in Georgia due to current regulatory conditions, these alternative WQT models could offer more immediate WQT opportunities for Georgia and warrant further consideration and attention from state policy makers because of their potential to provide cost-saving and flexibility while achieving environmental goals. Although this report concludes that WQT is more feasible in some watersheds than others, as noted above, WQT could develop in ***any*** watershed where a pollution source has an economic interest in trading.

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