October 2008

EPA Water Quality Trading Evaluation

Final Report

Promoting Environmental Results

Through Evaluation

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This report was developed under the Program Evaluation Competition, sponsored by OPEI. To access copies of this or other EPA program evaluations, please go to the EPA Evaluation Support Division Website at http:/www.epa.gov/evaluate.

EXECUTIVE SUMMARY

Water quality trading (WQT) offers a promising approach to controlling pollutants from multiple sources that collectively impact water quality conditions. In its most simple form, water quality trading allows one point source to over control for a pollutant at a low cost, selling the over control as "credits" to another source that is not able to reduce pollutants as cost-effectively.

Traditionally under the Clean Water Act, controls were focused on reducing pollutant impacts on local water quality from point sources such as wastewater treatment plants. The impacts of nitrogen, phosphorus and sediment have continued to be pervasive in the nation's waters. These particular pollutants impact water quality on much larger scales than toxic pollutants, whose acute impacts are near the point of discharge. Consequently, nitrogen, phosphorous and sediment can be more effectively addressed by controlling multiple point and non-point sources of these pollutants within a watershed.

The primary potential benefit of WQT that attracts consideration by policy makers is the potential ability to control pollutants at an overall lower cost to society. In addition, trading that involves non-point sources can have ancillary benefits such as controlling multiple pollutants and improving the health of aquatic habitats, and trading has the potential to spur innovation that can further reduce the cost of pollutant controls. Finally, pollution sources not traditionally regulated, most notably non-point pollutants from agriculture, are the primary source of water quality impairment in many watersheds. WQT provides a framework wherein pollutants can be voluntarily reduced by non-point sources more cost-effectively than imposing additional treatment controls on point sources.

EPA's Office of Water (OW) fosters WQT through policy development, guidance, and financial and technical support to watershed-based trading efforts. EPA has been undertaking these activities at the headquarters and regional level for over a decade. Despite the theoretical promise of water quality trading and EPA's efforts, however, WQT to date has met with limited practical success. Only 100 facilities have participated in trading, and 80 percent of trades have occurred within a single trading program.

The purpose of this evaluation is to assess the effectiveness of EPA activities to support WQT, and to better understand why more water quality trading activity has not occurred. In consultation with OW, IEc developed 14 detailed evaluation questions to guide the evaluation, which include questions about local/state water quality trading

programs, the broader context for water quality trading, and the direction of future EPA activities:

Local/state water quality trading program evaluation questions:

1. What are stakeholder attitudes towards water quality trading, and why?
2. What are the location-specific conditions conducive to water quality trading?
3. Have trading programs realized cost savings in meeting permit limits, and if so, how much?
4. What outcomes have water quality trading programs achieved?
5. What are the educational, institutional, legal, technical, and economic barriers to water quality trading?

Broader contextual questions:

6. What effects do other federal and state programs, particularly those administered by the U.S. Department of Agriculture (USDA), have on water quality trading programs?
7. Do any environmental justice issues arise in the context of water quality trading? If so, how can they be addressed?
8. Do any equity issues arise in the context of water quality trading? If so, how can they be addressed?
9. How should EPA measure its own progress on water quality trading?

Questions on future EPA activities:

10. Would more specific guidance or specific tools from EPA help state and local governments foster trading? If so, what kinds of guidance or tools are needed?
11. Are there legal, regulatory, or policy questions that impede trading, and if so, what can EPA do to address them?
12. What can EPA do to create flexibility and incentives for states to support legal and enforceable water quality trading programs?
13. What can EPA do to support water quality trading among point and non-point sources?
14. Have federal or state resources made a difference in establishing trading programs, or could they help make a difference?

As discussed in Chapter 2 of this report, IEc employed an interview-based approach to collecting information for this evaluation, using a literature review as a foundation. IEc completed a total of 55 interviews. Most of the interviews were conducted with individuals associated with 11 different WQT programs or initiatives. For each water

quality trading initiative studied, IEc interviewed between three and five individuals representing a variety of perspectives. IEc and EPA selected programs and initiatives to study based on a set of criteria including the program's transferability, legality/enforceability, level of success, illustration of barriers, and program maturity. In addition to interviewing individuals affiliated with specific water quality trading initiatives, IEc also interviewed 14 individuals from agencies and organizations that have a national perspective on water quality trading, including staff from EPA regional offices, USDA, environmental advocacy groups, and other experts.

IEc synthesized evaluation findings based on a detailed analysis of the interviewee feedback as well as on our literature review. We organize findings by evaluation question in Chapter 3:

- We first discuss general stakeholder perspectives on WQT as specified in Evaluation Question 1. Also included are stakeholder views on the conditions conducive to WQT (Evaluation Question 2) and opinions expressed on the equity and environmental justice implications of WQT (Evaluation Question 7 and 8).
- The next section describes the achievements of the WQT programs examined in this evaluation, focusing on environmental achievements; cost savings and other economic benefits; participation and trading activity; and other outcomes (Evaluation Questions 3 and 4).
- The third section describes interviewee perspectives on the barriers to WQT (Evaluation Question 5).
- The final section reviews interviewee suggestions for how EPA could support WQT in the future. The discussion covers regulatory, legal, and administrative issues that EPA can help address (Evaluation Questions 11 and 12); suggestions for future tools and financial support (Evaluations Questions 10 and 14); approaches to promoting the participation of non-point sources (Evaluation Question 6 and 13); and options for EPA to better measure progress of WQT programs (Evaluation Question 9).

As presented in Chapter 4, IEc has developed five main recommendations for EPA to consider when planning future Agency efforts to support WQT. We base these recommendations on our synthesis of interviewee feedback and our understanding of the history and implementation experience of WQT to date. These recommendations do not focus on the numerous barriers to WQT that EPA cannot address, such as statutory ambiguity, narrow circumstances conducive to trading, and the lack of a generic trading model applicable to most locations. Instead, the recommendations focus on the smaller set of barriers that are within EPA's purview to address. The main recommendations are as follows:

1. Recast water quality trading as one option within a suite of innovative permitting options supported by EPA.
2. Promote institutional changes at EPA that would support trading, including clarifying legal issues, changing EPA guidance, and developing and implementing strategies to move EPA and state environmental agency culture towards greater knowledge and acceptance of WQT.
3. Support trading only where conducive regulatory, economic, hydrologic, and geographic conditions are evident, and by requiring screening assessments as a condition of EPA funding for WQT programs.
4. Improve coordination with USDA to support involvement of non-point sources, including coordination on technical tools and approaches.
5. Adjust EPA's allocation of trading resources, including establishing a technical support team to provide on-site, hands-on assistance to nascent or struggling trading initiatives; restoring small and nimble grant funding for WQT programs; and investing in replicating the success of the Long Island Sound program.

CHAPTER 1 | INTRODUCTION

Water quality trading (WQT) offers a promising approach to controlling pollutants from multiple sources that collectively impact water quality conditions. Traditionally under the Clean Water Act, controls were mostly focused on pollutants with local impact from particular point sources, such as wastewater plants. As the focus of efforts to protect water quality has shifted to include pollutants whose collective impact is felt downstream, it is not always necessary or cost-effective to control pollutants at specific locations. Alternatively, some pollutants can be controlled across multiple sources within a watershed; nitrogen, phosphorus, and sediment are the three pollutants EPA most commonly recognizes as having such potential.

The primary potential benefit of WQT that attracts consideration by policy makers is the potential ability to control pollutants at an overall lower cost to society. In its most simple form of point-to-point trading, water quality trading allows one point source to over control for a pollutant at a low cost, selling the over control as "credits" to another point source that is not able to reduce pollutants as cost-effectively. Through the trade, the second point source can achieve its share of responsibility at a lower cost, the first point source can recoup part of its costs, local water quality is not negatively impacted, and downstream water quality is improved. Other potential benefits of greater flexibility include the ability to better plan capital intensive upgrades, and better time such upgrades within existing financial options (such as retirement of previous debt obligations prior to incurring new debt obligations).

A less tangible but no less real benefit of water quality trading is the increased incentive for innovation. Even if a point source purchases “credits,” the water quality trading program creates incentives for the point source to find low-cost ways to reduce pollutants, to reduce the need to purchase credits. At the same time, a point source selling such credits has added incentive to maintain the performance of their pollutant controls since doing so translates into more credits for sale. Both incentives work in balance to achieve the needed reduction of a pollutant at the overall lowest cost to society, and for all parties involved.

Finally, pollutant sources not traditionally regulated, most notably non-point pollutants from agriculture, are the primary source of water quality impairment in many watersheds. WQT provides a framework wherein pollutants can be voluntarily reduced by farmers for the purpose of selling credits. As such, WQT is one of few current tools that EPA has to address unregulated discharges.

BACKGROUND ON EPA'S INVOLVEMENT IN WATER QUALITY TRADING

EPA's Office of Water (OW) fosters water quality trading through policy development, tools and guidance, and financial and technical support to watershed-based trading efforts. Key activities include:

- *Policy development:* EPA developed a water quality trading policy to communicate the Agency's official position supporting trading a number of years ago, and most recently updated the policy in 2003. EPA also reviews and provides advice on state and local trading frameworks.
- *Tools and Guidance:* EPA has developed several tools and guidance documents to assist states and local governments in developing robust trading programs. Most recently, EPA developed the *Water Quality Trading Toolkit for Permit Writers*, a comprehensive "how to" manual on designing and implementing WQT programs. The Toolkit also contains fact sheets that provide detailed information on current trading programs. Other tools supported by EPA including the W*ater Quality Trading Assessment Handbook* and *Getting Paid for Stewardshi*p guide, as well as several communication materials (e.g., fact sheets, newsletters, website content).
- *Training:* EPA developed a training course on WQT and holds the course for individuals involved in trading efforts on a regular basis. The course provides an introduction to trading as well as specific modules on the Clean Water Act and trading, types of trading, assessing the financial feasibility of trading, and designing a credible trading program. EPA also provides separate training sessions for permit writers.
- *Financial Support:* EPA provides grant assistance to trading programs at the state and local level. One of the key EPA funding sources for WQT is the Targeted Watershed Grants Program, a portion of which has supported trading efforts.

EPA has been undertaking activities to support WQT at the Headquarters and regional level for over a decade. As a result of EPA, state, and local efforts, over 25 WQT programs have been launched.

Despite the theoretical promise of water quality trading and EPA's efforts, however, water quality trading to date has met with limited practical success. Only 100 facilities have participated in trading, and 80 percent of trades have occurred within a single trading program (Long Island Sound). Moreover, relatively few trading programs have been scaled up from pilot projects to permanent programs, and even fewer can claim to have had a significant impact in improving water quality or reducing pollutant control costs.

The purpose of this evaluation is to assess the effectiveness of the WQT Program and to better understand why more water quality trading activity has not occurred. The findings and recommendations of this evaluation will help identify opportunities for improving

EPA efforts to foster water quality trading and related permitting innovations. The evaluation will also inform the development of effective state trading policies and will help build OW's capacity to assist state partners in evaluating local water quality trading programs.

The remainder of this introductory chapter presents EPA's involvement in water quality trading with a logic model, and also discusses USDA programs related to WQT. Subsequent chapters of the report are organized as follows:

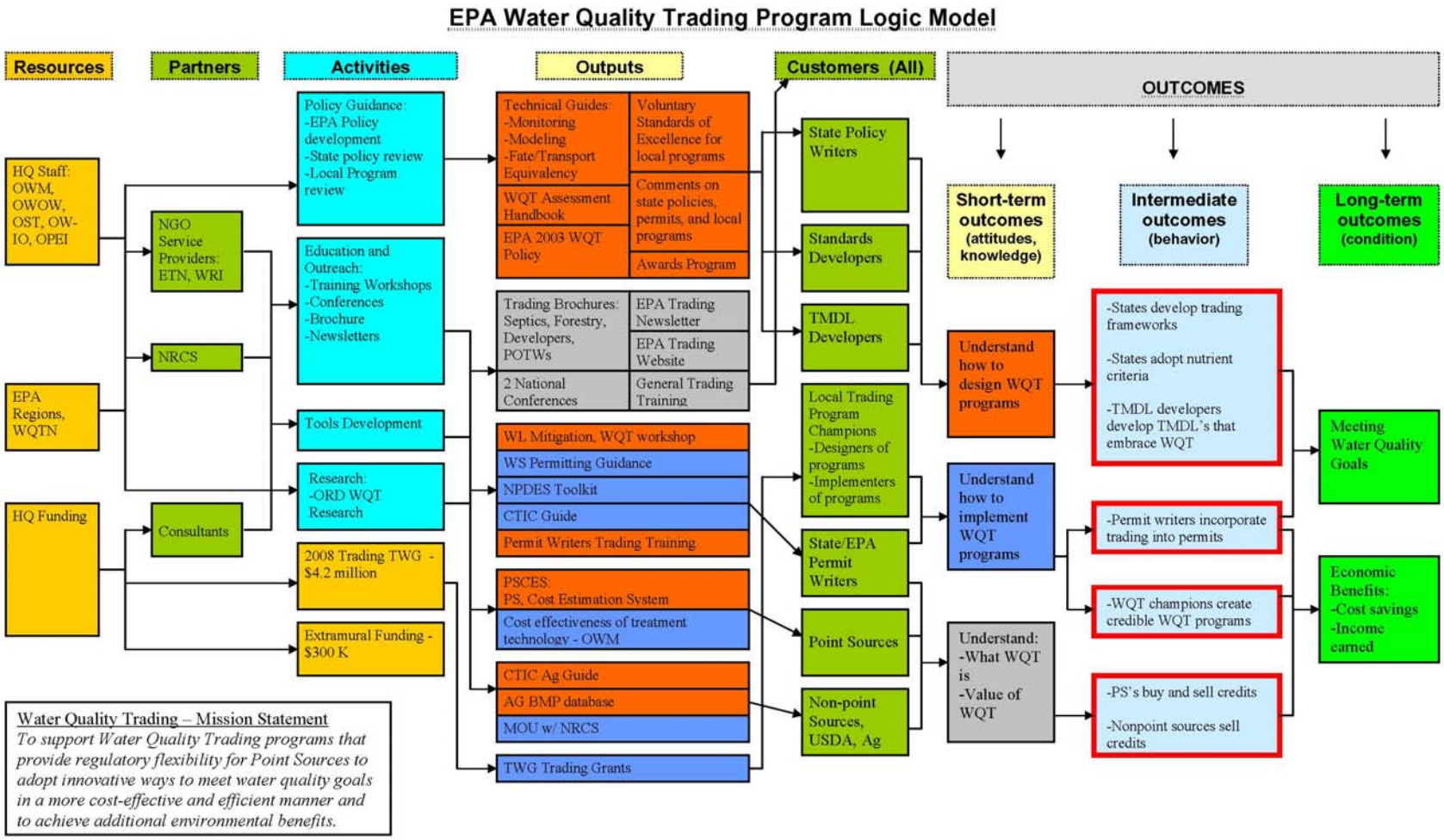
- Chapter 2 presents the methodology used in this evaluation. Specifically, IEc presents the Evaluation Questions, study design, and program selection process.
- Chapter 3 presents the evaluation findings based on information collected through interviews and literature review.
- Chapter 4 presents IEc's recommendations for moving forward based on our synthesis of findings.

Appendices A, B, C, and D include, respectively, a list of the individuals interviewed for this evaluation (position and affiliation only), a summary of a comprehensive review of both published and unpublished water quality trading literature, the interview guides used for various stakeholder groups with a crosswalk of evaluation and interview questions, and a bibliography of resources consulted for this evaluation.

Water Quality Trading Program Logic Model

To illustrate the various components of EPA WQT activities and to inform development of specific evaluation questions, EPA has developed a logic model (i.e., a graphical representation of the relationships between program inputs, outputs, and intended outcomes). As shown in Exhibit 1, the key components of the model include:

EXHIBIT 1: EPA WATER QUALITY TRADING LOGIC MODEL



- **Resources** are the basic inputs of funds, staffing, and knowledge dedicated to the program.
- **Partners** are the other agencies and organizations that contribute toward shared program goals. WQT Program partners include USDA/Natural Resources Conservation Service (NRCS) and non-governmental organizations (NGOs) that support water quality trading.
- **Activities** are the specific procedures or processes used to achieve program goals. For example, WQT Program activities include policy development, education and outreach.
- **Outputs** are the immediate products that result from activities and are often used to measure short-term progress. For example, EPA outputs include the 2003 Water Quality Trading Policy, trading brochures, newsletters and national conferences.
- **Customers** are the groups and individuals targeted by WQT Program activities and outputs. For example, EPA provides outreach to local trading program champions, Total Maximum Daily Load (TMDL) developers, and permit writers to educate them about the design and implementation of water quality trading programs.
- **Short-Term Outcomes** are the changes in awareness, attitudes, understanding, knowledge, and skills resulting from program outputs that are causally linked to the WQT Program. For example, technical guides, EPA's published water quality trading policy, and the Water Quality Trading Handbook provided to state policy writers and TMDL developers increase understanding of the design of water quality trading programs.
- **Intermediate Outcomes** are the changes in behavior that are broader in scope than short-term outcomes. Intermediate outcomes often build upon the progress achieved in the short-term. For example, increased understanding of the design of water quality trading programs results in States developing trading frameworks, and TMDL developers adopting TMDLs that embrace water quality trading.
- **Long-Term Outcomes** are the overarching goals of the program, which in this case include attainment of water quality standards in a more cost-effective and efficient manner.

USDA PROGRAMS RELATED TO WQT

USDA's NRCS administers several programs that fund best management practice (BMP) installation and conservation practices at farms, and provide associated technical assistance to farmers. Many of the conservation practices supported by USDA can also generate non-point source credits under water quality trading programs.

USDA conservation programs have a long history. The initial focus of the programs was to reduce soil erosion and improve soil health. The 1985 Farm Bill established the first of these programs, the Conservation Reserve Program, which pays farmers for conserving sensitive cropland. The 1990 Farm Bill created the Wetlands Reserve Program, and the Water Quality Incentives Program, which was the first time that the Farm Bill linked conservation programs to water quality. The 1996 bill created the Environmental Quality Incentives Program (EQIP), which provides cost sharing for BMPs. The 2002 Farm Bill greatly expanded funding for all of the above programs and created some additional sub-programs. Most relevant to water quality, the 2002 bill established the Conservation Security Program (CSP) and the Conservation Innovation Grants (CIG) program under EQIP. CSP provides incremental financial incentives to farmers for long-term land stewardship. CIG provides grant funding to state and local governments and NGOs for demonstrating and testing innovative approaches to conservation and stewardship. To date, CIG has funded approximately 10 projects, one of them being a project included in the Great Miami WQT program studied in this evaluation.

Most USDA conservation programs are now designed to yield multiple environmental benefits (e.g., water quality, soil management, and habitat preservation), but a USDA analysis of individual project funding indicates that some programs are geared more to addressing water quality issues than others. In particular, the EQIP, Conservation Security Program, and Conservation Reserve Program have significantly more funding dedicated to water quality concerns than other programs, (between 32-50% of funding and technical assistance is focused on water quality, compared with less than 15% for other programs).[1]

Funding for USDA conservation programs has increased significantly, from approximately $3 billion in 1990 to $5.6 billion in 2005. Funding for the EQIP program alone ranges from $200 million in 1996, its initial year, to an estimated $1.3 billion in 2007.[2] In 2004, fifteen percent of all U.S. farms received a conservation payment from USDA.[3]

A new farm bill is currently under consideration in Congress. The Administration's proposal includes a $500 million increase to the Conservation Security Program over 10 years, and a $4.25 billion increase to the EQIP program. The Administration's proposal would also add a new EQIP subprogram called the regional Water Enhancement Program to fund water quality and conservation projects.[4] The current version of the farm bill moving through Congress contains this new subprogram.

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[1] USDA, 2007 Farm Bill Theme Papers, *Conservation and the Environment*, June 2006, p. 18: http://www.usda.gov/documents/FarmBill07consenv.pdf

[2] CRS Report for Congress, *Previewing a 2006 Farm Bill,* January 30, 2006, p. 18.

[3] USDA, 2007 Farm Bill Theme Papers, *Conservation and Environment*, June 2006, p. ES-2: http://www.usda.gov/documents/FarmBill07consenv.pdf

[4] Letter from Mike Johans, former USDA Secretary, to Tom Harkin, Senate Chair of the Senate Agriculture, Nutrition, and Forestry Committee, April 25, 2007: http://usda.gov/documents/HonorableTHarkinLtr.pdf

The current version of the farm bill also contains a provision to establish a standards board relevant to water quality trading and other markets for ecosystem services. The purpose of this board is to "develop uniform standards for quantifying environmental benefits, establish reporting and credit registries, and promote actions that facilitate the development and functioning of environmental services markets involving agriculture and forestry."[5] USDA, EPA, and five other agencies would be represented on the board; the President is charged with designating a chair to oversee it.

In addition to the above programs, NRCS works directly to support water quality trading among non-point sources through tool development and outreach efforts. NRCS worked with EPA to develop a nitrogen modeling tool to estimate reductions from BMPs; the Nitrogen Trading Tool (NTT) prototype is currently being tested in Ohio, Maryland, and Colorado. USDA made significant contributions to *Getting Paid for Stewardship*, a guide to water quality trading for non-point sources. Currently, USDA is developing a handbook for NRCS field staff and partners to explain and support various types of trading, including water quality trading, wetlands trading, and carbon offsets. USDA also cosponsors water quality trading conferences and workshops in conjunction with EPA.

[5] 2007 Farm Bill Proposals, Title II: Conservation, Subtitle J: Market-Based Approaches to Conservation: http://www.usda.gov/documents/fbconservation_071.pdf

CHAPTER 2 | METHODS

This chapter discusses the methodology employed to evaluate EPA's water quality trading efforts. First, we present the questions that the evaluation sought to answer, followed by a discussion of the study's design. We then describe the processes of selecting specific trading programs to evaluate. Finally, we describe our quality assurance procedures and provide information on the availability of the final report.

EVALUATION QUESTIONS

IEc developed 14 detailed Evaluation Questions to guide the evaluation, which include questions about local/state water quality trading programs, the broader context for water quality trading, and the direction of future EPA activities.

Local/state trading program questions:

1. What are stakeholder attitudes towards water quality trading, and why?
2. What are the location-specific conditions conducive to water quality trading?
3. Have trading programs realized cost savings in meeting permit limits, and if so, how much?
4. What outcomes have water quality trading programs achieved?
5. What are the educational, institutional, legal, technical, and economic barriers to water quality trading?

Broader contextual questions:

6. What effects do other federal and state programs, particularly those administered by USDA, have on water quality trading programs?
7. Do any environmental justice issues arise in the context of water quality trading? If so, how can they be addressed?
8. Do any equity issues arise in the context of water quality trading? If so, how can they be addressed?
9. How should EPA measure its own progress on water quality trading?

Questions on future EPA activities:

10. Would more specific guidance or specific tools from EPA help state and local governments foster trading? If so, what kinds of guidance or tools are needed?
11. Are there legal, regulatory, or policy questions that impede trading, and if so, what can EPA do to address them?
12. What can EPA do to create flexibility and incentives for states to support legal and enforceable water quality trading programs?
13. What can EPA do to support water quality trading among point and non-point sources?
14. Have federal or state resources made a difference in establishing trading programs, or could they help make a difference?

STUDY DESIGN

IEc employed an interview-based approach to collecting information for this evaluation, using a literature review as a foundation.

Literature Review

IEc conducted a comprehensive review of both published and unpublished information related to water quality trading in the U.S. The literature review consisted of three distinct steps.

IEc first, conducted a preliminary review of key resources on water quality trading to develop a baseline understanding of trading activity to date, key issues and barriers in trading, and trading program models. Appendix B presents the sources identified in this review and the key findings associated with each source.

Second, IEc reviewed key EPA WQT documents including the *National Water Quality Trading Handbook*, the *Water Quality Trading Toolkit for Permit Writers*, and *Getting Paid for Stewardship: An Agricultural Community Water Quality Trading Guide*.

Finally, IEc reviewed literature and available information associated with specific trading initiatives. This review identified approximately 25 active and inactive water quality trading programs in the U.S., most of which involve trading between point and non-point sources and focus on control of nutrients and sediments. IEc collected information on each program's target pollutants, activity level, and structure.

Collect And Analyze Data From Interviews

Existing data and literature were insufficient to address the Evaluation Questions. Consequently, it was necessary to conduct primary data collection. IEc and EPA agreed on an interview-based approach to data collection for this evaluation. Specific considerations favoring an interview-based approach to data collection include the following:

- The issues of interest cannot easily be addressed by multiple-choice or short answer questions typically used in surveys.
- The evaluation involves a relatively large set of questions that will take most participants a half hour or more to answer.
- The topics to be addressed are highly intertwined, and responses are likely to bridge multiple questions.
- Some Evaluation Questions address sensitive topics (e.g., unsuccessful trading initiatives and competition for resources).
- Customizing questions for different groups would be beneficial.

IEc and EPA decided to conduct individual interviews instead of group interviews or focus groups. Focus groups work well when respondents can be categorized into a very small number of homogeneous groups. In contrast, for the water quality trading evaluation, we were interested in talking to several different groups of stakeholders. Moreover, stakeholders that share experiences (e.g., NGOs that promote water quality trading) are unlikely to be located close enough to one another that participation in an in-person focuses group would prove practical. Focus groups work where the subject matter is more "mile wide/inch deep" than focused and complex. In contrast, the individual interview focuses on questions in relatively narrow areas dealing with complex topics, requiring detailed feedback. Finally, focus groups are not ideal for addressing sensitive topics; participants are far more likely to be candid about sensitive topics when interviewed individually.

IEc completed a total of 55 interviews. For each water quality trading initiative studied, IEc interviewed between three and five individuals representing a variety of perspectives. IEc sought participation from several different types of stakeholders, including:

- A program coordinator who played a significant role in developing or implementing the program;
- A permit writer with the relevant state regulatory agency or EPA region;
- A representative from a major point source that participates in the program;
- A representative of a non-point source participating in the program (if applicable).

In addition to interviewing individuals affiliated with specific water quality trading initiatives, IEc also interviewed 14 individuals from agencies and organizations that have

a national perspective on water quality trading, including staff from EPA regional offices, USDA, environmental advocacy groups, and other experts.

Conducting Interviews

IEc structured the interviews using a series of interview guides.[6] In general, the interview questions expanded upon the Evaluation Questions presented earlier. IEc tailored each interview guide to a particular stakeholder group. For example, we asked permit writers about the permitting aspects of trading, and we asked professional economists for their views on the broader economic viability of water quality trading.

Mapping Interview Responses to Evaluation Questions

For each interview conducted, IEc prepared a written summary document that organized participant responses according to specific Evaluation Questions. For example, Evaluation Question 3 (have trading programs realized cost savings in meeting permit limits, and if so, how much?) is addressed by responses to the following interview questions:

- Program Coordinators: Have you (or other program partners) evaluated the cost savings realized through the trading program (relative to conventional effluent permitting approaches, (e.g., technology, pollution prevention, recycle/reuse)? If so, what have you found?
- Point and Non-point Sources: Has the program been economically beneficial for you? (If the interviewee is a "buyer" of credits, have they estimated cost savings? If the interviewee is a "supplier" or credits, have they estimated net income?)
- USDA: Does participation in a water quality trading program affect benefits that farmers receive under USDA programs? If so, which programs?

Appendix C includes a complete crosswalk of evaluation and interview questions.

Analysis of Findings

The interviews yielded a large volume of narrative information about water quality trading. Analysis of the interview results required IEc to conduct a critical review of the interview summaries and qualitatively synthesize conclusions. For each interview question, IEc reviewed all interview summaries and identified information relevant to that question. By comparing comments and observations, both within and across stakeholder groups, IEc identified key themes that form the basis of our findings and recommendations, as presented in Chapters 3 and 4 of this evaluation report.

Strengths and Weaknesses of Study Design

The interview-based approach to this evaluation has inherent strengths and weaknesses. The primary advantage of conducting a number of interviews across a wide spectrum of

[6] Appendix C presents the interview guides used for the evaluation.

trading initiatives is that it allows for exploration of "how" and “why” questions that are difficult to address using other methods. In addition, our program sample captures a diversity of program structures, implementation stages, and local conditions, allowing for a fairly representative picture of water quality trading in the U.S.

The primary limitation of the interview-based study design is that it does not yield quantitative data that are readily convertible into various performance metrics and indicators. However, quantitative data on the results of water quality trading initiatives are scarce; where programs have collected and provided such data to researchers it has been captured by our literature review.

PROGRAM SELECTION

IEc, in collaboration with OW staff, initially selected 11 WQT initiatives to study in this evaluation. IEc applied the following criteria to ensure selection of programs most relevant to the goals of the evaluation:

- **Transferability**: The evaluation should focus on WQT programs that have transferable designs and objectives. In general, the programs should address conventional pollutants (e.g., nutrients and sediment), and some should involve trades between point and non-point sources.
- **Legality/Enforceability**: The selected programs should have designs and objectives that meet minimum standards established under the Clean Water Act (and associated regulations). Furthermore, the programs should structure trades based on analytically sound, legally defensible methodologies.
- **Level of Success**: The selected programs should represent a cross section of implementation experience and initial success, including the extent of trading activity.
- **Illustration of Barriers**: The program should either illustrate how barriers to implementation were overcome or how key barriers proved insurmountable.
- **Information Base/Program Maturity**: Adequate information should exist for assessing the program’s performance. Most notably, the program should have at least a few years of operation, allowing for participants and potential trading activity to have been established.

Based on these criteria, IEc and EPA initially identified 11 water quality trading programs for inclusion in the evaluation. A brief description of the programs is provided over the next pages, and summary information is presented in Exhibit 3. Exhibit 3 also indicates the program type and market structure applicable to each program:

Program Types:

- Cap-and-trade: Also known as closed trading programs, cap and trade programs impose a ceiling on the combined quantity of a pollutant that participating facilities may release. The cap may remain fixed or decline over time. Participants are assigned initial pollutant allocations that they may trade among themselves.
- Case-by-case: This term refers to trading programs that require negotiation, review, and pre-approval for individual trades. This approach is commonly used for one-time, site-specific trades but can also apply to programs that may include multiple trades.
- Open Market: This program type is defined by systems of rules to allow trades between facilities without pre-approval by regulators. There is no mandatory system-wide cap in which all participants have a defined and limited initial allocation; participation is usually voluntary. Facilities can trade, and often bank, credits, or use them internally to achieve compliance.

Market Structures:

- Bilateral Negotiations: Under this structure, each transaction requires substantial interaction between the buyer and the seller to exchange information and negotiate the terms of trade. Buyers and sellers make agreements on their own, with a public authority participating to approve the trade and set an appropriate trading ratio.
- Clearinghouse: In this market structure, the link between the buyer and the seller is replaced by an intermediary. The clearinghouse is authorized by the oversight agency to pay for pollutant reductions and sell credits to sources that need them.
- Exchange: This market structure is characterized by its open information structure and fluid transactions between buyers and sellers. In an exchange, the price for credits is fully visible. Exchanges can develop only when a unit of pollutant control from one seller is viewed as equivalent to a unit from any other source.
- Sole Source Offsets: A sole source offset takes place when an individual facility is allowed to meet a water quality standard at one point if pollutants are reduced elsewhere, either on-site or by carrying out pollution reduction activities off-site.
- Third Party: In this market structure, buyers and sellers use a broker to conduct trading; the broker may be a regulatory agency, a NGO, or an independent body established for the purpose of trading. The broker facilitates bilateral trades; unlike a clearinghouse, using a third party does not eliminate contractual or regulatory links between sellers and buyers.

- **Chatfield Reservoir Trading Program:** A phosphorous trading program was implemented for the Chatfield Reservoir as part of the State of Colorado's Chatfield Reservoir Control Regulation. Trading is designed to occur within the framework of a Total Maximum Annual Load (TMAL), allocated between point and non-point sources. Point sources can increase their wasteload allocation if non-point sources reduce their phosphorus release by a ratio of 2:1 (this ratio is evaluated on a case-by-case basis). The Chatfield Watershed Authority accepts credits from non-point sources and pools them as credits to be purchased by point sources. In addition, point sources can bilaterally transfer pollutant allocations to one another if approved by the Chatfield Watershed Authority, but a 2:1 trading ratio is applied.
- **Long Island Sound Trading Program:** In 1990, Connecticut, the State of New York, and EPA adopted a Comprehensive Conservation and Management Plan (CCMP) for the Long Island Sound. The CCMP calls for the reduction of nitrogen to increase dissolved oxygen in Long Island Sound and mitigate hypoxia damaging the Sound's ecosystem. A TMDL, approved in April 2001, includes wasteload allocations for point sources and load allocations for non-point sources in the watershed. Connecticut chose to develop a trading program for contributing point sources within its borders to lower the cost of implementing the CCMP and the TMDL. The trading program is stipulated in state law. Connecticut's program uses both its general state authority and its NPDES permitting authority to issue a single general permit for the total nitrogen loads of all 79 wastewater treatment plants (WWTPs)that discharge to the Sound. Sources discharging less than their annual limit receive credits for over-control; the State is obligated by law to purchase all nitrogen credits from these sources. Facilities that exceed their limit must purchase credits from the State at a price set by the Nitrogen Credit Exchange.
- **Middle-Snake River Demonstration Project:** After a five-year development process, the Upper Snake Rock TMDL was finalized in 2005 and called for significant reductions in phosphorous discharges to meet water quality goals. The Middle-Snake River stakeholders, including aquaculture and fish-processing facilities, municipalities, the State of Idaho, and EPA, have developed a trading program for buying and selling total phosphorus credits among dischargers. Under the trading arrangement, the City of Twin Falls' WWTP, fish-processing facilities, and aquaculture may generate phosphorus reduction credits that can be purchased by other aquaculture facilities in that same section of the Middle Snake River. The permit allowing for trading under the TMDL was recently finalized, and stakeholders predict that trading may commence shortly depending on final wasteload allocations.

- **Neuse River Basin Total Nitrogen Trading:** North Carolina established a Nutrient Management Strategy for the Neuse River Basin to reduce the total nitrogen load to the Neuse estuary from all sources. The Strategy sets annual nitrogen allocations for existing point source dischargers under a TMDL and allows dischargers a group compliance option to collectively meet their permit limit for mass loading of nitrogen. Currently, 22 point sources are members of the Neuse River Compliance Association, which is issued a single, collective NPDES permit for nitrogen based on the sum of the members' individual nitrogen allocations. If new or expanding dischargers cannot secure nitrogen allocations from other point sources, they can purchase non-point source nitrogen offsets by paying into the North Carolina Wetlands Restoration Fund. The Compliance Association must pay into the fund at a fixed, per-pound price if it exceeds its annual nitrogen allocation, making the Association more like an exceedance tax than a traditional trading program.
- **Rahr Malting Phosphorous Offset:** The Rahr Malting company negotiated an agreement with the Minnesota Pollution Control Agency (MPCA) to offset five-day carbonaceous biochemical oxygen demand (CBOD5) discharge from its new WWTP by funding upstream non-point source phosphorus reductions. A TMDL on the Minnesota River was barring Rahr from obtaining a load allocation for CBOD5 and, therefore, from building its own WWTP, but Rahr worked cooperatively with the MPCA and EPA to craft a NPDES permit incorporating pollutants trading. In five years, Rahr achieved the necessary non-point source reduction credits through four trades, thereby achieving its goal of building its own WWTP to lower production costs and increase operational flexibility.
- **Red Cedar River Nutrient Trading Pilot Program:** The Red Cedar River was chosen in 1997 as one of three water quality trading pilots for the State of Wisconsin. The trading program began when the City of Cumberland, faced with a state-wide 1 mg/L phosphorus discharge limit for WWTPs, looked to water quality trading as a means of reducing compliance costs. Cumberland believed that a non-point phosphorus reduction effort would be more beneficial for protecting water quality than chemical phosphorus removal at the plant, since non-point sources accounted for 93% of the phosphorus loading to the watershed. The City of Cumberland pays landowners to employ conservation tillage techniques on lands with high concentrations of phosphorus in the soil.
- **Southern Minnesota Beet Sugar Cooperative Permit:** The Minnesota Pollution Control Agency (MPCA) incorporated water quality trading provisions into the wastewater treatment permit for the Southern Minnesota Beet Sugar Cooperative. A phosphorous TMDL on the lower Minnesota River prohibited the addition of a new discharger, but the MPCA allowed the Cooperative to build a WWTP and obtain a NPDES permit, provided it offset all discharges with non-point source

phosphorus reductions. The Cooperative has achieved most of its offsets by contracting with its beet growers to grow spring cover crops to reduce runoff.

- **Truckee Meadows:** The Cities of Reno and Sparks, Washoe County, and the Nevada Division of Environmental Protection (DEP) are developing creative solutions to solve water quality and flow issues in the Truckee River, which flows from Lake Tahoe to Pyramid Lake through the Cities of Reno and Sparks. The Truckee Meadows Water Reclamation Facility (TMWRF) needs to expand capacity, but the Cities are seeking creative solutions because TMWRF already faces the most stringent nitrogen discharge limits in the nation as a result of the TMDL. Three avenues of water quality trading are being explored to authorize increased discharge at the TMWRF: water rights purchases and flow augmentation as part of the 1996 Truckee River Water Quality Settlement Agreement (point/non-point trading for agricultural best management practices and septic conversions, and point/point trading with two other WWTPs.
- **Wayland Center:** When the Wayland Business Center, LLC (WBC) redeveloped an abandoned commercial property in Wayland, MA, it sought to reactivate the previous owner's NPDES permit for the small, on-site wastewater treatment plant. EPA and the Massachusetts Department of Environmental Protection denied WBC the permit renewal, interpreting the discharge as a new source to the Sudbury River. In developing a new NPDES permit for WBC, the USEPA initially set a 0.2 mg/L phosphorus limit, but the final permit allowed a 0.5 mg/L phosphorus limit in exchange for non-point source offsets. The non-point source phosphorus reductions came from sewering over two dozen properties in downtown Wayland that have failing septic systems.

IEc originally selected two additional initiatives for inclusion in the evaluation– Charlotte Mecklenberg and Las Vegas Wash—but the interviews for these initiatives did not generate sufficient data. IEc selected two replacement initiatives that also meet program selection criteria:

- **Great Miami River Watershed Trading Pilot:** The Great Miami River Watershed Water Quality Credit Trading Pilot Program is a ten-year project to reduce phosphorus and nitrogen loadings into the Great Miami River. Despite pollutant reductions by point sources, over 40 percent of the rivers and streams in the Great Miami River watershed do not meet Ohio's water quality standards. Non-point sources, especially agriculture, are the major remaining causes of impairment. The pilot was established to increase funding for agricultural BMPs in the Great Miami River watershed, provide regulated dischargers with a cost-effective regulatory compliance option, and improve water quality in the Great Miami River watershed. Under the trading program, farmers will implement BMPs to generate credits that WWTPs can use to meet regulatory requirements. Funding for the projects will come from the WWTPs, combined with a grant from the USDA that provides more than $1 million for agricultural projects during the

program's first three years. The pilot commenced in 2006; evaluation of project success is premature.

- **Lower Boise River Effluent Trading Demonstration Project:** EPA and the Idaho Department of Environmental Quality designed a phosphorus trading demonstration project for the Lower Boise River. The trading framework developed for Lower Boise is considered to be among the best, and it informed development of Idaho's state trading policy. Trading will occur within a watershed-wide, market-based trading system that will include both point and non-point sources. Ultimately, trading will be implemented to help achieve the nutrient reduction goals set by a forthcoming TMDL. However, trading activity has been stalled by a delayed TMDL process for the Lower Boise, where stakeholders are currently at an impasse about how to proceed.

QUALITY ASSURANCE PROCEDURES

In conducting the evaluation, IEc, EPA's Office of Policy, Economics, and Innovation (OPEI) and the EPA Office of Water (OW) agreed on three key quality assurances:

- IEc and EPA agreed on the key data sources, which include data from (1) interviews with stakeholders, including program coordinators, permitters, point source managers, non-point source managers, economists, and environmental advocates; (2) literature on the economic basis for trading and the performance of existing water quality trading programs; (3) OW's inventory of current water quality trading programs; and (4) OW's water quality trading training program.
- IEc designed its analyses in the context of the project's program logic model and overarching Evaluation Questions. IEc developed interview guides based on these Evaluation Questions. IEc also developed a crosswalk table that matches each interview question to one or more Evaluation Questions, clearly illustrating how they are linked.
- IEc ensured consistent data collection by using a core interview guide across stakeholder groups; IEc tailored the guide to include only those topics appropriate for each stakeholder group. IEc recorded data from all interviews in written summaries using a standardized format to allow easy comparison across interviews.

FINAL REPORT AVAILABILITY

EPA intends to make the final version of this report available on the Evaluation Support Division's (ESD's) website at http://www.epa.gov/evaluate.

EXHIBIT 3: PROGRAMS SELECTED FOR WATER QUALITY TRADING EVALUATION

WATER BODY	PROGRAM NAME	STATE	POLLUTANT(S)	YEAR LAUNCHED	PROGRAM TYPE	MARKET STRUCTURE
Chatfield Reservoir	Chatfield	CO	Phosphorous	1999	Case-by-Case	Clearinghouse or Bilateral Negotiations
Great Miami River, Mad River, Stillwater River	Ohio River Basin Trading/Great Miami River Watershed Trading Pilot	OH	Phosphorous & Nitrogen	2006	Open Market	Third Party Broker
Long Island Sound	Long Island Sound Trading Program	CT	Nitrogen	2002	Cap and Trade	Exchange
Lower Boise River	Lower Boise	ID	Phosphorous	1997	Open Market	Bilateral Negotiations
Middle-Snake River	Middle-Snake River Demonstration Project	ID	Phosphorous	2001	Cap and Trade	Bilateral Negotiations
Minnesota River	Southern Minnesota Beet Sugar Cooperative Permit	MN	Phosphorous	1999	Case-by-Case	Sole Source Offsets
Minnesota River	Rahr Malting Phosphorous Offset	MN	Phosphorous, Nitrogen, Sediment, CBOD	1997	Case-by-Case	Sole Source Offsets
Neuse River	Total Nitrogen Trading in the Neuse River Basin	NC	Nitrogen	1998	Cap and trade	Clearinghouse for non-point source offsets; bilateral negotiations for point/point trades
Red Cedar River	Red Cedar River Nutrient Trading Pilot Program	WI	Phosphorous	1997	Case by Case	Bilateral Negotiations
Sudbury River	Wayland Center	MA	Phosphorous	1998	Case-by Case	Does not fit any market models
Truckee River	Truckee Meadows	NV	Nitrogen, Phosphorus, Dissolved solids	(Unclear)	Point/point: bilateral negotiations; point/non-point: not yet determined	Does not fit any market models

CHAPTER 3 | FINDINGS

This chapter examines the detailed findings of IEc's literature review and interviews with stakeholders involved in water quality trading. Each section addresses one or more of the Evaluation Questions reviewed earlier:

- We first discuss general stakeholder perspectives on WQT as specified in Evaluation Question 1. Also included are stakeholder views on the conditions conducive to WQT (Evaluation Question 2) and opinions expressed on the equity and environmental justice implications of WQT (Evaluation Question 7 and 8).
- The next section describes the achievements of the WQT programs examined in this evaluation, focusing on environmental achievements; cost savings and other economic benefits; participation and trading activity; and other outcomes (Evaluation Questions 3 and 4).
- The third section describes interviewee perspectives on the barriers to WQT (Evaluation Question 5).
- The final section reviews interviewee suggestions for how EPA could support WQT in the future. The discussion covers regulatory, legal, and administrative issues that EPA can help address (Evaluation Questions 11 and 12); suggestions for future tools and financial support (Evaluations Questions 10 and 14); approaches to promoting the participation of non-point sources (Evaluation Question 6 and 13); and options for EPA to better measure progress of WQT programs (Evaluation Question 9).

The findings are based primarily on a detailed analysis of the interview summaries completed following each interview as well as on our literature review. Throughout the discussion, we attempt to identify the prevalence of key views and perspectives, either through explicit counts or through qualitative synthesis of the interview summaries. The text clearly indicates instances where IEc supplements the interview findings with its own views or opinions.

STAKEHOLDER PERSPECTIVES ON TRADING

The subsections below examine general perspectives on water quality trading, including: (1) how interviewees classify water quality trading; (2) the conditions under which trading is most effective; and (3) the equity and environmental justice implications of trading.

General Perspectives on WQT (Evaluation Question 1)

Interviewees were invited to speak broadly on their perceptions of trading as a technique for managing water quality. The first interview question posed to many interviewees asked if they consider WQT as a tool within the regulatory toolbox, a means of promoting voluntary stewardship, or something else entirely. Exhibit 4 summaries a very rough tally of the responses.[7] As shown, the most prevalent view was to classify WQT as a regulatory tool. Only one interviewee classified WQT as primarily a means of promoting voluntary stewardship. Several others felt that trading is both a regulatory tool and a form of voluntary stewardship, with some seeing the distinction as being artificial or unnecessary. The remaining respondents characterized WQT in terms other than those initially presented. The "Other – Positive" category includes interviewees who see trading primarily as a tool of economic development (i.e., a way to get cost-effective pollutant control and enhance the economic prospects of a region) as well as individuals who spoke positively of trading but were unable or unwilling to classify it more specifically.

EXHIBIT 4. INTERVIEWEE PERSPECTIVES ON HOW WQT IS BEST CLASSIFIED

CLASSIFICATION	NUMBER OF INTERVIEWEES CLASSIFYING TRADING THIS WAY
Tool in the Regulatory Toolbox	24
Form of Voluntary Stewardship	1
Both a Tool and Voluntary Stewardship	4
Other - Positive	3
Other - Negative	5

Most of the interviewees who viewed WQT as a tool in the regulatory toolbox were very quick to caveat this designation. The most common qualification was that trading is a tool that requires specialized conditions in order to be effective. These conditions include an adequate mix of point and non-point dischargers; regulatory hammers such as discharge targets such as those that accompany a TMDL; and/or clear water quality objectives such as ambient nutrient standards. Several respondents felt that the need to satisfy these conditions significantly limits the applicability of trading. These concepts are discussed more thoroughly below when we consider interviewee perspectives on the conditions conducive and not conducive to trading.

Other reservations expressed by those who view WQT as a viable tool include the following:

[7] Note that: (1) we did not ask this question of all respondents; and (2) of those respondents addressing the question, not all treated it as a discrete choice between a few alternatives (i.e., a tool in the regulatory toolbox, a way to promote stewardship, etc.). For this reason, the response tallies should be viewed as an approximate, relative indicator of how interviewees view trading.

- One project coordinator expressed concern over the administrative demands of trading programs and questioned whether state and federal regulators are up to the task of managing the programs.
- Another permitter feels that trading is too often used as a tool of political or economic accommodation. Specifically, where poor water quality and development pressure coincide, regulators and other decisionmakers try to find ways to accommodate development. Consequently, water quality may take a back seat to economic and political goals.

Five individuals felt that trading is good only in concept; i.e., it has significant flaws that make its application impractical (the "Other – Negative" category). For instance, one point source representative highlighted that surface waters are complex biological systems with too many factors that point sources cannot influence, undermining the reliability of trading. Another respondent highlighted how nitrogen comes in various forms, some more bioavailable than others; this individual asserted that the discharge allocations inherent in TMDL and trading programs ignore these complexities. Similarly, one permitter noted that trading effectiveness is limited by the unpredictable nature of watersheds and runoff; for instance, weather will greatly influence discharges, making it hard to meet discharge/trading allocations with confidence. In addition, one permitter saw trading as still too "experimental" to qualify as an established regulatory tool. Many of these concerns and limitations are discussed further in our review of barriers to trading (see below).

Finally, it is worth noting that some interviewees expressed a lack of comfort with the term "trading." Some program interviewees noted that their program lacks the defining features of trading (e.g., buyers and sellers, credits) and felt that EPA and others may apply the term too freely. One program coordinator felt that EPA may act as too much of a "cheerleader" for trading, ignoring regulatory innovations that are effective but which lack key trading features. Acknowledging these innovations as being distinct from trading may help eliminate misperceptions and encourage more creativity in permitting and other aspects of water quality regulation.

Perspectives On Conditions Conducive To WQT (Evaluation Question 2)

Evaluation Question 2 concerns interviewee perspectives on the location-specific conditions conducive to WQT. Specifically, most interviewees were asked to identify the factors that influenced the success of particular initiatives. Interviewees highlighted three major categories of trading preconditions:

- The regulatory environment in which trading takes place;
- The nature and involvement of key participants; and
- Regional factors, ranging from the hydrological and geographic features of the watershed to demographic and economic patterns in the region.

We discuss these considerations below. It is important to note that many publications have provided a more comprehensive discussion of conditions recommended for a successful trading program.[8] This discussion focuses exclusively on those factors that interviewees highlighted for this evaluation.

Regulatory Setting

One theme that emerged in the interviews is that trading is an outgrowth of more fundamental water quality-based permitting activities. First, stakeholders of all types – permitters, point sources, program coordinators – emphasized the importance of TMDLs in establishing a framework for trading. A TMDL is often the driving force that motivates the participation of key players. In particular, the finite loading limits produced under TMDL allocations serve as a red flag for point sources that may have previously been governed only by effluent concentration limits. Waste load allocations dictated by a TMDL underscore the effluent controls that must be instituted in order to accommodate growth, motivating point sources to find options for reducing loadings. One permit writer noted that without the Truckee River TMDL, "trading wouldn't have happened." Likewise, the existence of a TMDL and the associated waste load allocations create the data foundation necessary to develop trading ratios and other parameters used to structure WQT programs. Programs for which interviewees emphasized the important role of TMDLs included Truckee Meadows, Long Island Sound, Great Miami, Middle Snake River, Lower Boise River, Las Vegas Wash, and Chatfield Reservoir.[9]

In some locales, however, TMDLs have not surfaced as broad a key driver for trading as EPA expected. According to one trading expert, during TMDL development in Idaho and Colorado, point sources negotiated individual waste load allocations that were not very stringent. As a result, end-of-pipe treatment is still financially viable for most point sources in these areas, negating the need in many cases to buy credits to achieve greater reductions.

Explicit ambient water quality criteria for nutrients can also serve as a driver for encouraging trading. First, ambient water quality criteria can guide NPDES permit development, providing a foundation for more stringent effluent standards; in turn, these standards can motivate point sources to seek new compliance avenues. Second, criteria can facilitate development of TMDLs, indirectly enhancing incentives for trading (see above). Finally, criteria can provide measurable, objective water quality baselines for gauging environmental progress. The Agency's National Nutrient Policy recognizes these influences and explicitly notes how nutrient criteria can help support trading.[10]

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[8] See, for example, EPA's Water Quality Trading Assessment Handbook, November 2004.

[9] The view that TMDLs are a pre-requisite to WQT was not shared universally among interviewees. For example, the coordinator of the Neuse River program noted that the group compliance permit preceded development of the TMDL. However, the Neuse program is not a traditional trading arrangement.

[10] See "Water Quality Criteria for Nitrogen and Phosphorus Pollution – Basic Information," accessed online at http://www.epa.gov/waterscience/criteria/nutrient/policy.html, February 11, 2008.

Very few states have completed the process of developing nutrient criteria for surface waters, although most states are in the process of developing them.[11] As a result, few interviewees cited the influence of water quality criteria on trading programs. However, according to interviewees involved with the Great Miami project, Ohio has been developing criteria for several years and is close to issuing these standards. According to both the coordinator and permitter for the program, these forthcoming standards have signaled likely tightening of NPDES effluent limits and have encouraged point sources to participate in the pilot program. Another interviewee in an EPA regional office and an important trading expert highlighted the importance of water quality criteria as well. The regional contact's view is that without explicit water quality goals, trading is simply an exercise in saving dischargers money, with no assurance that water quality will benefit in the long run.

A final aspect of the regulatory system that may influence trading is enforcement. As with any environmental permitting system, compliance will likely improve when permittees face penalties or other legal action. Several interviewees acknowledged the importance of solid enforcement for trading. For instance, a permitter involved with the Long Island Sound program felt that Connecticut DEP's reputation for strict enforcement dispelled the perception that a facility could opt out of the general permit governing the trading program and avoid compliance by seeking a conventional individual permit.

Participants

Almost all interviewees offered perspectives on the appropriate set of stakeholders integral to a successful WQT program. Focusing on different categories of participants, observations offered in interviews included the following:

- **Senior-Level "Champions"**: Several interviewees stressed the need for a senior-level individual whose influence can initiate development of a WQT program. One trading expert with experience in multiple programs saw Agency-level support as most critical. This type of individual can influence the behavior of state agencies and permit writers, whose cooperation will be essential. Other interviewees also stressed the importance of champions at the regional EPA level and at the senior policy level in state agencies; we discuss this finding in more detail later in this chapter when we review future activities for promoting trading.
- **Permitters**: Permitters represent a critical link between regulatory agencies and point source facilities. As we will review in the barriers section below, the resistance of permitters to innovative approaches can be problematic for trading. Conversely, interviewees stressed that an openness to novel approaches is a vital feature for permitters involved in a WQT program. One interviewee with extensive experience across multiple programs suggested that newer permitters may be less wedded to standard operating procedures and, therefore, more open and creative when incorporating trading into permits.

[11] See http://www.epa.gov/waterscience/criteria/nutrient/strategy/status.html for status as of May 2007.

- **Program Administrators**: The administrative structures of the WQT initiatives studied vary greatly. Some are operated primarily by state permitting agencies while others take advantage of a "middle-man" organization to perform administrative functions. In general, interviewees praised the role of third-party administrators, primarily for their willingness to do the "heavy lifting" necessary to keep programs running. For instance, on Great Miami, all the interviewees stressed the role of the Miami Conservancy District in initiating the program and handling the daily administrative demands. Other examples include the Neuse River Compliance Association and the Idaho Clean Water Cooperative on behalf of the Lower Boise. The Idaho Clean Water Cooperative in this case does not administer the program, but instead plays a valued role on behalf of participants such as ensuring trades are accurately recorded and trade reports are prepared that permitted sources submit to officials at the end of every month of the compliance period (along with their Discharge Monitoring Reports).
- **Non-Point Source "Link" Organizations**: For programs involving non-point sources, interviewees emphasized the critical role of field-level organizations with established connections to the agricultural community. These organizations not only garner the trust of farmers, but can supply vital technical expertise in planning and implementing best management practices (BMPs). Most notably, conservation districts can fill an essential niche. Permit staff involved with the Red Cedar River project lauded the performance of local conservation districts in administering trades, and noted how communities without LCD involvement were unable to establish trading activity. Likewise, on Great Miami, conservation districts prepare BMP proposals for farmers, calculate the associated pollutant reductions, and monitor the implementation and maintenance of the BMPs. Similarly, the trading expert at the World Resources Institute (WRI) noted how conservation districts can play an important planning role, helping locate and aggregate credits among the agricultural community. The Ohio Farm Bureau Federation contact further emphasized the role of conservation districts, stressing that farmers will be more comfortable with inspections and monitoring performed by a known, trusted organization.
- **Point Sources**: The recommended features of the point source participants are a direct function of the type of program in question; therefore, interviewees did not identify any single recommendation or profile for point source participants. For larger, point-point trading programs, interviewees stressed the importance of a large and varied set of participants. For instance, the coordinator for the Long Island Sound program emphasized how a diversity of buyers and sellers – in terms of size and pollutant control economics – has propelled the program. Not surprisingly, many interviewees also highlighted the importance of regulatory and economic pressures in garnering point source participation. For example, the point source representative interviewed for the Truckee Meadows project emphasized the cost of the treatment option faced by the facility and cited it as a key driver behind their participation in trading. Finally, several interviewees noted that the point source sector most conducive to trading is typically publicly

owned treatment works. The coordinator for the Neuse River program noted that some private corporations may have internal rules barring the kind of collaboration necessary to participate in a trading or group permitting arrangement. Industrial facilities may also feature a much more diverse set of pollutants in their permits, relative to municipal treatment plants. As a result, program managers emphasized the value of collaboration with municipal treatment authorities. A point source representative for the Long Island Sound project stressed how towns were involved in the planning of the program from the outset, making them full and committed participants in the effort and helping avoid "surprises" when the program was implemented.

- **Non-Point Sources**: A large and diverse community of non-point sources appears to present economic conditions conducive to trading. The permitter on the Red Cedar project noted that watersheds with large non-point source loads relative to point sources generally present good opportunities for trading. One expert noted that a robust trading market will include many buyers and sellers; bilateral trading solely between two entities is ultimately not sustainable. While a USDA official noted that more "progressive" farmers may actively opt into a trading program, extensive outreach may be necessary. For instance, the coordinator of the Great Miami program emphasized the extensive (but worthwhile) investment associated with involving farmers; the Miami Conservancy District completed between 60 and 80 meetings with farmers and conservation districts during development of the pilot.

Regional Factors

A variety of other regional factors contribute to creating a positive environment for water quality trading. First, some interviewees emphasized the physical and hydrological features of the watershed and their influence on trading. In particular, some noted that a watershed with a nutrient "sink" that collects regional streamflow represents the best setting for trading. The permitter on the Great Miami project indicates that this type of setting simplifies the process of gauging water quality improvements associated with the program. In contrast, the Great Miami program must contend with free-flowing rivers with myriad influences that include seasonal changes in streamflow.

Not surprisingly, water quality itself can influence the motivation for trading and other innovative initiatives. The coordinator on the Neuse River project noted that fish kills and other problems created a public outcry for action, leading to legislation that mandated a unique strategy for the river. The overall lesson is that acute problems can spur creative approaches.

Economic conditions in a region also can affect prospects for trading. Several interviewees noted how growth pressures in a particular region played a major role in the search for innovative water quality management initiatives. The WRI trading expert pointed out how population growth in the Chesapeake basin has increased flows to treatment plants, necessitating trading with non-point sources simply as a stop-gap means of offsetting discharges and satisfying ambient nutrient criteria. Likewise, according to

several interviewees, development pressure in the town of Wayland was the primary impetus for the Wayland Center project. Some of the interviewees even felt that water quality took a secondary role to politically accommodating the commercial landowner interested in developing the site.

As noted above, the individual economic incentives of participants (i.e., point and non-point sources) can create conditions conducive to trading. In the broadest sense, a collection of credit buyers with high control costs and sellers with low control costs forms the foundation of a trading system. State or regional funding can greatly influence these incentives, however. Most notably, the availability of grants under state revolving loan funds is potentially a way of "priming the pump" when a subset of treatment plants are considering upgrades. A permitter on the Long Island Sound project highlighted how supplements that Connecticut made to its revolving loan fund were influential in producing sellers of credits.

Equity And Environmental Justice Issues (Evaluation Questions 7 And 8)

We asked interviewees to identify any environmental justice (EJ) or equity-related issues that arise in the context of trading programs.[12] Few interviewees identified explicit EJ or equity issues associated with trading and based on their remarks, none of these issues posed a major barrier or stumbling block for the programs in question. However, several themes did emerge from the discussion:

- Two interviewees indicated that issues concerning equitable regulation of point and non-point sources have arisen in the context of their programs. A state regulator associated with the Chatfield Reservoir program said that point source participants have complained that they shoulder compliance burdens while non-point sources are allowed to participate voluntarily. Similarly, a point source manager associated with the Middle-Snake River project emphasized how non-point sources do not have to face "regulatory hammers" the way that point sources do. The Water Environment Federation (WEF) contact clarified that point sources do not consider *trading* to be inequitable, but rather the baseline permitting system that doesn't regulate non-point sources.
- A common argument facing trading programs concerns whether they constitute the "right to pollute." Only one interviewee indicated that they encountered this argument during the development of a WQT program. Others acknowledged that the concept may influence how a program is structured. For example, the coordinator for the Long Island Sound project noted that inclusion of private industrial dischargers in a program can increase public sensitivities about placing profit before water quality considerations, sentiments that may be less prevalent when dealing exclusively with publicly owned treatment facilities. A representative of the American Farmland Trust indicated that farmers have

[12] EPA defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." See http://www.epa.gov/oecaerth/environmentaljustice/index.html.

expressed concern that, by participating in trading arrangements, they "enable" point sources to buy the right to pollute.

- Another concern with trading programs is the potential for creating "hot spots," i.e., areas where discharges from a credit buyer inadvertently cause a localized pollution problem. On the Neuse River program, one of the group permit members initially received a large allocation because it is far upstream and had a low transport factor relative to the estuary. However, discharges from this facility had the potential to affect a local lake, and this point was highlighted by environmental advocates and ultimately addressed by state regulators. On the Southern Minnesota Beet Sugar Cooperative project, planners also addressed hot spot potential by reducing allowed discharges from the facility during low-flow summer months.
- Another variation on equity considerations arises with respect to equivalency factors applied in trading programs. Estimated through water quality modeling or other means, equivalency factors establish the relative "value" of pollutant reductions in one region versus another. The permitter for the Long Island Sound project noted that some minor disagreement emerged among towns over the equivalency factors developed in initial modeling efforts. Similarly, the coordinator for the Middle-Snake River project acknowledged that equivalency considerations entered into their planning. Ultimately, it was agreed that one pound of phosphorus upstream would be equivalent to one pound of phosphorus downstream, avoiding controversy along the lines of "my phosphorus upstream is worth more than your phosphorus downstream." Analogously, a USDA representative noted that inequities can develop in trading because farmers in different locations can receive different compensation for producing the same pollutant reductions.
- Because economic benefits are at stake, disagreements can sometimes develop over who is allowed to participate in a trading program and who is not. Generally, these issues are geographic in nature. An interviewee on the Southern Minnesota Beet Sugar Cooperative project said that many farmers want to take part in the program because it is seen as a competitive advantage; initially, however, only farmers in the Minnesota River watershed were allowed to participate, raising equity concerns. A related concern arose in the planning of the Red Cedar River project when town residents expressed a reluctance to pay for BMPs implemented on farms outside of the political jurisdiction of the WWTP. An analogous issue emerged on the Wayland Center project under which owners of failing septic systems were allowed to tie into the privately owned treatment plant. The project coordinator indicated that some interested septic system owners had to be turned away once the treatment plant excess capacity was filled.
- The Long Island Sound project faced minor equity issues surrounding the varying fiscal positions of participating towns. A point source interviewee suggested that smaller and/or less wealthy towns initially felt that it was unfair for them to shoulder the burden associated with the project (i.e., purchasing credits).

However, these towns eventually saw that trading gave them more diverse compliance options than under a strict command/control arrangement.

ACHIEVEMENTS TO DATE (EVALUATION QUESTIONS 3 AND 4)

Two of the Evaluation Questions (3 and 4) directed IEc to examine the environmental and economic achievements of trading programs. In characterizing these accomplishments, we focus primarily on the eleven WQT programs selected for detailed examination, drawing on both interviews and existing literature. The discussion addresses four major categories of achievements:

- Water quality improvements and associated reductions in pollutant loadings;
- Cost savings and other economic benefits;
- The degree of participation and level of trading activity; and
- Other indicators of success.

The sections below provide detail on each of these topics.

Water Quality Improvements

The Long Island Sound program represents a region-wide trading system that has been in operation for several years. Of the programs examined in this evaluation, it is the only one that has recorded improvements in ambient water quality. Specifically, the areal extent of hypoxia in Long Island Sound has shown a marked decrease. The text box on the Long Island Sound program in this chapter provides more detail on this outcome and other program achievements.

Other programs addressed in this evaluation have realized loading reductions, but a number of factors limit the ability to link those achievements to explicit water quality improvements:

- Many programs are small in scale relative to their affected surface waters. Therefore, program managers do not expect to realize distinct water quality improvements that can be definitively traced to the WQT initiative. For instance, the Minnesota River Basin is extensive, and the nutrient reductions achieved under the Southern Minnesota Beet Sugar Cooperative project are a small component of overall loadings in the basin. The same is true of the septic systems remediated under the Wayland Center project relative to the Sudbury River receiving waters.
- Similarly, many program managers point to the myriad influences on water quality in their watersheds, influences that introduce “noise” into the process of gauging program impacts. For instance, the permitter interviewed for the Red Cedar project acknowledged that water quality has probably degraded since the trading effort began. However, this is due to exogenous influences such as

development and changes in agricultural practices (e.g., more land being farmed for corn and soybeans). Likewise, the coordinator for the Chatfield Reservoir program pointed to recent droughts and severe storms that have made it difficult to assess water quality trends.

- Some programs are large in scale, but are in the early stages of implementation. As a result, water quality improvements may emerge, but are not yet discernible. For instance, the Great Miami project began operating in 2006, so impacts are still limited. However, the extensive monitoring network installed as part of the pilot is yielding baseline data, and program coordinators believe that ambient water quality improvements will be realized.

As a proxy indicator of water quality benefits, WQT programs often compile estimates of loadings reductions attributable to the program efforts. Exhibit 5 summarizes loadings reductions associated with several of the programs examined, drawing on both interviews and available literature. Note that in most cases, the loadings reductions are estimated by modeling the effectiveness of best management practices, as opposed to monitoring end-of-pipe discharges.

EXHIBIT 5. POLLUTANT LOADING REDUCTIONS ASSOCIATED WITH SELECT WQT PROGRAMS

PROGRAM	LOADINGS REDUCTION	INFORMATION SOURCE
Great Miami	434,000 lbs. combined annual nitrogen and phosphorus reductions across all BMP projects in first three auction rounds.	Interview
Long Island Sound	15,500 lbs. per day nitrogen reduction (halfway to stated goal under the LIS TMDL) from participating treatment plants.	Johnson, et al. (2007), p. 1
Neuse River	69 percent reduction in N loadings to the estuary since 1995. Association is well below collective nitrogen discharge cap.	EPA (2007), p. A-78
Rahr Malting	BMPs offset 212 lbs. of CBOD per day.	EPA (2007), p. A-42
S. Minn. Beet Sugar Coop.	BMPs achieve 15,768 lbs. of phosphorus control annually.	EPA (2007), p. A-47
Red Cedar	31,500 lbs. of phosphorus removal through BMPs funded by the Cumberland facility as of 2004.	EPA (2007), p. A-117
Wayland Center	Estimated 0.375 lbs. per day of phosphorus discharge from failing septic systems.	Interview

Cost Savings and Other Economic Benefits

The basic economic theory underlying trading suggests that when entities with high pollutant control costs are able to secure reductions through entities with lower pollutant control costs, net economic savings are realized. Therefore, cost savings and other economic benefits represent another key category of achievements for WQT programs.

While simple in theory, the cost savings associated with trading programs can be challenging to estimate. For instance, estimating the economic benefits of a point/non-

point trading arrangement requires data on the unit cost (capital and operating) of controlling the pollutant of interest at the point source; data on the unit costs of loading reductions achieved through specific non-point BMPs; data on the pollutant control effectiveness and spatial application of those BMPs; and other information.

Because of these analytic challenges, few of the programs examined have produced detailed studies of cost savings. During the pilot planning stage, the Miami Conservancy District funded a prospective study of the Great Miami pilot.[13] This study estimated that anticipated treatment plant upgrades at all facilities in the watershed would cost about $423 million, with unit costs of about $23 per pound of phosphorus. The average unit cost of phosphorus reduction through no-till practices on farms was estimated to be about $1.08 per pound. The study estimated aggregate potential cost savings for the watershed of about $385 million. Somewhat lower cost savings of $314 million are estimated if the mix of BMPs includes nutrient management.

It is important to note that these figures reflect potential savings if trading opportunities throughout the Great Miami watershed are pursued. While the current pilot-level trading program demonstrates the viability of the system, these large-scale savings are not currently being realized. Furthermore, the program coordinator for Great Miami suggested that average BMP unit costs are running at about $1.29 per pound of phosphorus removal, slightly higher than the unit costs assumed in the study. Therefore, the aggregate potential savings estimates may need to be revised downward. Nonetheless, interviewees state that the BMP unit costs recorded for the program compare favorably with average unit costs recorded in other settings.

The only other program for which cost savings have been analyzed is the Long Island Sound Nitrogen Credit Exchange. Although no recent studies exist, the Water Environment Research Foundation published a prospective analysis of the Long Island Sound program in 2000, which estimated capital cost savings of $200 million.[14]

Although aggregate benefit studies for our selected programs do not exist, other trading programs have generated concrete estimates of cost savings. For instance, Oregon DEQ managed a model trade involving temperature and BOD impacts from a regional sewage and water management agency (Clean Water Services) on the Tualatin River. The temperature trade involves paying landowners (primarily farmers) to plant shade trees along river banks to cool the water. This non-point approach has proven to be significantly less costly than the technological control option of installing refrigeration units at the treatment plant. These units would have cost between $60 and $150 million in capital investment and between $2.5 and $6 million in annual operating costs.[15]

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[13] See Kieser & Associates, Preliminary Economic Analysis of Water Quality Trading Opportunities in the Great Miami River Watershed, Ohio, July 23, 2004.

[14] See Water Environment Research Foundation, Nitrogen Credit Trading in the Long Island Sound Watershed (Executive Summary), WERF Project #97-IRM-5B, obtained online at http://www.werf.org/AM/CustomSource/Downloads/uGetExecutiveSummary.cfm?File=ES-97-IRM-5B.pdf&ContentFileID=3418.

[15] See Oregon DEQ, "Water Quality Credit Trading in Oregon: A Case Study Report," July 2007, p. 13.

ACHIEVEMENTS UNDER THE LONG ISLAND SOUND NITROGEN CREDIT EXHANGE PROGRAM

Of the WQT programs examined in this evaluation, the Long Island Sound Nitrogen Credit Exchange is the largest and longest-running. As a result, the program has produced a more extensive body of information on its impacts and achievements.

As of 2006, 79 municipal treatment facilities were governed by the general permit allowing trading. The table below presents the number of municipalities buying and selling nitrogen discharge credits, and the price at which credits sold.

YEAR	MUNICIPALITIES SELLING CREDITS	NUMBER CREDITS SOLD	MUNICIPALITIES BUYING CREDITS	CREDITS PURCHASED	CREDIT PRICE
2002	38	1,671,105	38	798,317	$1.65
2003	37	1,134,976	40	989,194	$2.14
2004	35	1,399,896	44	940,387	$1.90
2005	28	623,408	50	1,169,553	$2.11
2006	33	704,000	46	1,126,000	N.A.

Sources: EPA, Water Quality Trading Toolkit for Permit Writers, Appendix A; 2006 figures from interview with Paul Stacey, CT DEP, September 17, 2007.

Since the introduction of the 2001 TMDL and the initiation of trading, treatment facilities have implemented a total of 31 nitrogen removal projects. These efforts have reduced the total nitrogen load from the 79 facilities by 15,500 pounds per day. This equates to approximately 50 percent of the reduction needed to achieve the daily nitrogen discharge target established in the TMDL (Johnson, et al., 2007).

While many factors influence the quality of Long Island Sound, the reductions achieved under the nitrogen credit exchange program appear to be having an impact on water quality. Hypoxia surveys completed in 2002 and 2006 show a marked reduction in the areal extent of severe hypoxia (Johnson, et al., 2007).

Although no recent cost savings studies exist, the Water Environment Research Foundation published a prospective analysis of the Long Island Sound program in 2000 (WERF, 2000). This study estimated capital cost savings of $200 million associated with the trading program.

The Boulder Creek offset agreement represents another example where explicit cost savings have been recorded. The City of Boulder used a combination of treatment plant upgrades and stream restoration projects to meet water quality standards for nutrients. Although the stream restoration projects cost an estimated $1.3 to $1.4 million, the city still realized savings of $3 to $7 million relative to approaches relying purely on point source control of nitrogen.[16]

While other programs highlighted in this evaluation have not developed comprehensive cost savings estimates, we identified economic benefits associated with several of the initiatives, either through interviews or literature searches. Exhibit 6 summarizes this information. Some of the findings demonstrate a strong potential for cost savings. For instance, a study of the Rahr Malting project estimated BMP unit costs that are significantly lower than point source control costs. Other cost savings indicators represent secondary, spinoff benefits. For instance, Neuse River interviewees highlighted how the group permit approach has facilitated economic growth in a region that would otherwise have been constrained by TMDL loading limits.

EXHIBIT 6. ECONOMIC BENEFITS ASSOCIATED WITH SELECT WQT PROGRAMS

PROGRAM	BENEFITS DESCRIBED	INFORMATION SOURCE
Chatfield Reservoir	Trade allowed point sources to avoid fines that would have resulted from exceeding allocations.	Interview
Great Miami River	Potential cost savings of $314 to $385 million across entire watershed (see text).	Kieser & Associates (2004), p. 4-3
	Estimated cost savings for Dayton Water Department of $44 million if program is implemented over the long term.	Interview
Long Island Sound	Prospective analysis estimated capital savings of $200 million.	WERF (2000), p. 2
	Credit sellers view value of credits sold as a direct economic benefit to them. Stamford annual revenue from credit sales is about $400,000.	Interview
	Credit buyers see economic benefit in being able to delay large investments.	Interview
Neuse River	Point sources realize savings when group permit association handles water quality monitoring; relieved of inefficient cost of performing own monitoring.	Interview
	Trading can accommodate economic/residential growth in a region that would otherwise be constrained under a TMDL allocation.	Interview
Rahr Malting	Non-point phosphorus control costs average $3.07 per pound, compared with point source facility costs of $4.44 to $6.14 per pound.	Fang and Easter (2003), p. 14
	WQT program kept the point source economically viable; would otherwise have had to relocate.	Interview

[16] See Morgan, Cynthia, and Ann Wolverton, "Water Quality Trading in the United States," NCEE Working Paper #05-07, June 2005, p. 32.

Participation and Trading Activity

Interviewees frequently cited trading activity and participation of key stakeholders as evidence of their programs' achievements. Exhibit 7 summarizes the various ways in which activity can be framed, drawing on both the interviews and available literature. It is noteworthy that some observers see these types of measures as poor indicators of program performance given that programs define "trades" differently.

EXHIBIT 7. TRADING ACTIVITY AND PARTICIPATION MEASURES FOR SELECT WQT PROGRAMS

PROGRAM	BENEFITS DESCRIBED	INFORMATION SOURCE
Chatfield Reservoir	Nine trades and more are likely.	Interview
Great Miami River	Across three reverse auction rounds, 149 proposals received and 36 BMP projects implemented. Good geographical coverage with several counties involved.	Interview
Long Island Sound	In 2006, 33 municipalities sold credits and 46 municipalities purchased credits. Roughly 1.8 million credits exchanged.	Interview
Neuse River	Of 32 large dischargers in the watershed, 23 participate in group compliance permit.	Interview
Rahr Malting	Four large, longer-term non-point offset projects implemented.	Interview
Red Cedar River	More than 60 BMP projects implemented; 891 acres enrolled in 2004.	EPA (2007), p. A-117
S. Minn. Beet Sugar Coop.	Approximately 200 trades/year are completed under the Beet Sugar permit.	Interview
	Contracts on 579 non-point sites totaling over 58,000 acres	EPA (2007), p. A-47

Other Achievements

A number of program achievements do not fall into the categories discussed above (water quality improvements, cost savings, trading activity). Some interviewees point to smooth program administration and the satisfaction of participants as signs of success:

- On the Long Island Sound project, all 79 participating towns recently signed onto the renewed permit, an indicator of confidence in the program. Furthermore, interviewees suggested that no enforcement actions have been necessary under the permit.
- The point source interviewee on Great Miami stressed how the Miami Conservancy District has created a streamlined process for the reverse auctions, summarizing bids, and presenting them to the point source participants in a clear, user-friendly format.
- The program coordinator pointed out that the Neuse River Compliance Association is self-sustaining, requiring minimal management from North Carolina DENR.

Similarly, some interviewees emphasized how a smaller-scale pilot effort has established "proof of concept," (i.e., the program has set the stage for broader-scale activity in the future). For example, the point source interviewee on Great Miami expressed concern over the fact that the trading agreements being established are not yet formally approved in his NPDES permit; however, he is encouraged that once the trading system goes beyond the pilot stage, the process of purchasing BMP offsets will be up and running and procedural details will be settled. Likewise, interviewees associated with the Middle Snake project noted that the initiative is in an early stage and expressed satisfaction that Idaho has a scientifically credible, transparent, and verifiable process for conducting trading (through the state's Pollutant Trading Guidance). They emphasized that their established trading process and associated guidance will likely produce future results.

Finally, many of the trading programs have produced ancillary benefits, (i.e., outcomes that are secondary to water quality improvement, but still valuable). Some of these ancillary benefits are environmental. For instance, the non-point source projects implemented for the Rahr Malting project have reduced sedimentation and improved soil conservation. In general, trading experts recommended that EPA and other regulators do more to highlight the value of ancillary environmental benefits such as soil conservation, wetlands creation, and carbon sequestration.

Some programs have spawned procedures that will refine water quality management and other types of environmental management in the future. For instance, Neuse River interviewees noted that group compliance programs can produce a technology transfer effect, (i.e., Association members collaborate on the group permit and learn cost-effective pollutant control approaches from each other). The Southern Minnesota Beet Sugar project features audits by a third-party to verify that BMPs are in place and functioning properly. These third-party auditors collect photos and select field audit sites to verify BMPs.

BARRIERS TO WQT (EVALUATION QUESTION 5)

Interview participants were asked to identify barriers to water quality trading, including institutional, legal, technical, and economic barriers. Responses to this interview question were extensive, and highlight a number of obstacles to the practical implementation of the WQT concept. The following discussion of barriers is organized by primary barriers (i.e., the most significant and most commonly identified) and secondary barriers (i.e., important but less universal) considerations.

Primary Barriers

The most common barriers identified by interviewees were institutional and economic/regulatory factors, discussed below.

Institutional Barriers

The barriers to WQT most frequently cited by interviewees are institutional in nature. Institutional barriers refer to obstacles that arise in the operation of state and federal environmental agencies involved in WQT, and in the interaction of other trading participants with these institutional actors. Interviewees cited institutional barriers to trading approximately 50 times; some interviewees cited multiple institutional barriers while a minority of interviewees omitted mention of this category of barriers.

Institutional Barriers at EPA:

Many interviewees discussed that EPA support for WQT varies by office, and that EPA is not coherent or consistent in its support of trading. While interviewees recognized that the WQT contacts at HQ are consistent in their support for trading, they indicated that resources to support trading vary at the regional level, and that support for the concept is particularly spotty among EPA legal counsel and permit writers who are uncomfortable with the legal grey area that trading occupies. Legal counsel and permit writers also tend to be more rigid in their interpretation of law and regulation, and are often uncomfortable with the idea of collaborating with polluters to reduce the cost of compliance, even if reduced costs may lead to accelerated and better environmental improvements. An EPA regional WQT contact noted that in some instances, hiring new permit writers with fresh perspectives might help to promote trading in the regions.

The specific institutional barrier at EPA identified by interviewees most often is a lack of flexibility. For example, one point-source participant in the Long Island Sound program commented that EPA has a predetermined idea of how trading programs should be structured that is not sensitive to variability in local conditions. This participant commented that EPA adheres to certain program design elements that do not stray from their "handbook" conception of trading. In the case of the Long Island Sound program, however, EPA's preferred design concepts were not conducive to a program with all municipal facilities. An attorney affiliated with the Neuse River program echoed this sentiment by noting that more than other organizations, EPA finds it hard to be flexible when an approach diverges from the standard permit that they are accustomed to administering. Other interviewees affiliated with the Great Miami River program also cited EPA's lack of flexibility in meeting compliance schedules as a primary barrier to trading.

Several interviewees noted that EPA officials' concerns about enforceability slow the diffusion of trading. For example, the permitter for the Neuse River program specified that EPA legal counsel was initially very skeptical of the group compliance arrangement underpinning the program. EPA originally rejected the North Carolina DENR's initial memorandum of understanding with dischargers as a blueprint for the group compliance arrangement. The Neuse permitter indicated that because EPA was unfamiliar with the practice, they were more inclined to point out its potential legal vulnerabilities, rather than think creatively with the DENR about how to facilitate a workable permitting approach.

EPA's variable support for trading was said to be especially problematic for states such as Idaho and Massachusetts, two of four states where the NPDES program is not delegated. Two affiliates of the Middle Snake River program noted EPA Region 10 was reluctant to issue permits incorporating trading until Idaho's state trading policy was finalized, a contingency that EPA ultimately dropped. However, the permits written by EPA Region 10 for the program were not what IDEQ and participants anticipated. EPA was of the understanding that there was no initial interest and/or economic potential for point/non-point trading, yet for this report IDEQ expressed a desire for the permit to allow it. In response to similar comments received during the public comment period on the proposed permit, EPA authorized it in the final permit with the requirement that it be done according to the Idaho's Water Pollutant Trading Guidance. In addition, apparent miscommunication and misunderstanding between EPA Region 10 and IDEQ led to a permit that covered trading in only four aquaculture facilities for the Middle-Snake program; IDEQ and other aquaculture facilities anticipated that the permits would cover additional facilities.

Institutional Barriers at State Environmental Agencies:
Other institutional barriers commonly cited pertain to state environmental agency resources, as well as State agency culture. Several interviewees noted the lack of state funding for trading initiatives as a significant impediment. One independent trading expert tied these two issues together by saying that overcoming cultural inertia in state permitting agencies to explore new options like trading is an uphill battle exacerbated by resources shortages. Several interviewees also noted that it can be difficult to get capable, motivated staff working on WQT at state agencies. Similarly, an attorney involved with several trading programs as well as a point source in the Neuse River program concurred that state permitting authorities can be inflexible in the types of trades that they allow under WQT programs.

A number of the institutional barriers identified by interviewees pertain to the difficulties of permitting as it relates to trading. As discussed at length later in this section under Legal, Regulatory, and Policy Changes, several interviewees bemoaned the time needed to incorporate new sources into existing permits that include trading. In addition, many respondents cited the time-intensive nature of the permitting process for new permits as well. Developing permits, putting them out for public comment, and finalizing them are all very time consuming activities that slow the progress of trading.

A former permitter for the Connecticut DEP discussed an institutional barrier specific to the Long Island Sound program that could crop up in future programs. Through the Clean Water Fund, the state exercises significant control over which nitrogen removal projects are implemented at treatment plants; projects that receive supplementary funding typically are pursued promptly. DEP recently funded a number of removal projects with high costs per pound of nitrogen removed, basing the decisions on a relatively old formula for Clean Water Fund eligibility. This encourages less cost-effective removal projects and reduces the cost savings that could be realized under the trading program.

Economic/Regulatory Barriers

Interviewees cited economic and regulatory barriers a total of 26 times. These barriers pertain to inadequate supply of, or demand for, credits as a result of economic and regulatory conditions.

The most common economic barrier identified in this category was lack of regulatory drivers for trading such as nutrient criteria, but especially lack of a TMDL in the targeted waterbody. Interviewees from the majority of programs indicated that TMDLs are a prerequisite for trading, as discussed earlier in this chapter. As the permitter for the Long Island Sound program explained, a TMDL motivates participation in a trading program because point sources see that they face tough standards and are more likely to participate in an initiative where some cost savings may be possible. A few interviewees noted, however, that a TMDL can also have a negative effect on demand for trading, and sometimes act as a barrier. In some waterbodies, TMDL load allocations may be so high for some facilities that it negates the need to participate in trading. Regarding non-point sources, several interviewees also pointed to the lack of regulatory lever as a barrier to involving farmers in trading.

Sometimes the lack of economic drivers for trading exists independently from regulatory conditions. For example, the permitter for the Wayland Center program discussed that trading is motivated by high costs of on-site control. Some dischargers are not yet in the high part of the marginal cost curve for on-site control, so pollutant reductions still come fairly easily and cheaply, reducing the economic rationale for trading. In addition, the program coordinator for Great Miami noted that improved wastewater treatment practices may reduce nutrients to such a degree that it obviates the economic need for trading for some facilities.

Several interviewees pointed to limited trading opportunities among both point and non-point sources as a barrier to trading in some areas. Trading opportunities among point sources may also be exhausted in some areas where limited point sources are participating. In watersheds that bridge multiple states, the economic potential of trading may be stymied by the legal constraints to expanding trading to participants across state lines.

Similarly, there may be insufficient opportunities for non-point source credits to offset the volume of point source releases; this barrier was mentioned by Great Miami contacts, Rahr Malting contacts, and independent experts. Several issues confound trading with non-point sources, but chief among them is making the economic equation work for farmers. As discussed by USDA interviewees and non-point sources interviewed, many farmers are already receiving payments or cost-sharing from NRCS programs for BMPs, and the ability to receive trading credits on top of these payments is still an open question (See Evaluation Question 13). Farmers have not demonstrated a willingness to forego participation in the familiar, administratively simple, and reliable NRCS funds to participate in trading. Consequently, the potential universe of farmers willing to participate in trading may be small if there is no way to participate in both trading and NRCS conservation programs. Moreover, as described by the permitter for the Wayland

Center program, there is a lack of obvious non-point sources to participate in trading in urban/residential areas.

Finally, several interviewees, including USDA staff, also linked the difficulty in establishing trading ratios for non-point source reductions (discussed at length later in this section) as an economic as well as a technical barrier to trading.

Secondary Barriers

In addition to primary institutional and regulatory/economic barriers, interviewees identified a number of secondary barriers to trading. Secondary barriers include technical, information/ uncertainty and administrative/start-up issues. Each of these categories of barriers is discussed in greater detail below.

Technical Barriers

Interviewees cited technical barriers to water quality trading a total of 15 times. Most of the technical barriers cited involve difficulty measuring pollutant releases and reductions and converting this information into appropriate equivalency factors or trading ratios. This barrier was mentioned by contacts from Great Miami, S. Minnesota Beet, Red Cedar River, Long Island Sound, Neuse River, as well as the interviewee from WRI and other independent experts. Several factors contribute to difficulty in development of equivalency factors, including lack of scientific or technical information (e.g., for waterways that lack water quality modeling), and complex local geography and hydrology.

The permitter for the Red Cedar River program, as well as other contacts, focused on the complex process of developing equivalency factors for point/non-point source trades in particular. On the Red Cedar River, for example, point and non-point sources release different forms of phosphorous, which have different eutrophication potentials. The translation of different forms of a pollutant significantly complicates the calculation of equivalency factors. Feedback on the issue of establishing more user-friendly methods for calculating pollutant reductions from non-point sources is explored in depth under Evaluation Question 10, Improved Tools and Guidance.

Informational and Uncertainty Issues

Interviewees cited informational and uncertainty issues a total of 12 times. Several interviewees cited lack of understanding about the rules of trading, the authority to conduct trades, and the mechanics of permitting as barriers to finalizing trading guidance and encouraging participation by both point and non-point sources.

Related to informational and educational barriers are issues of uncertainty. For example, an attorney involved in setting up several trading programs points to lack of confidence in trading among potential participants as a major barrier. Several interviewees noted reluctance on the part of point sources to rely on an outside party to accomplish necessary pollutant reductions, because the point source is ultimately liable for the reduction. As

contacts from EPA Region 5 and Ross & Associates commented, even if in-house controls are more expensive, they are at least guaranteed.

A number of point and non-point sources cited concerns that participating in trading might lead to increased regulatory burden. This concern is particularly salient among non-point sources; many interviewees, including USDA representatives, the Ohio Farm Bureau representatives, and NGOs cited the agricultural sectors' distrust of EPA and state environmental agencies as a key barrier to trading.

Exogenous factors are another source of uncertainty about the ability of trading to achieve net improvements in water quality. For example, a point source in the Great Miami River program cited the corn boom that prompted some farmers to plant new fields at the same time that other farmers were implementing BMPs.

Administrative/Start Up Barriers

Interviewees cited administrative and program start-up barriers a total of 10 times, with high start-up cost being the most frequently cited barrier. Launching trading programs can be expensive and time consuming, especially, as the permitter for the Wayland Center program noted, when there is already a backlog of permits to be processed. EPA Region 4 staff, and contacts from Truckee Meadows and Wayland Center, commented that given the lack of demonstrated success with water quality trading, large investments of time and money in new program development may not be justified. In addition, EPA Region 5 staff note that the high start-up costs may not be justifiable given that the trading markets that ultimately develop are generally quite small.

In addition to the time and expense associated with getting a trading program off the ground, several interviewees cited ongoing administrative burdens (e.g., such as tracking trades, monitoring and verifying discharge reductions, and reporting) for the entity overseeing/implementing the program as a barrier. Ongoing program costs were cited by Long Island Sound, Middle-Snake, and independent experts as a barrier to scaling up trading activity.

Sometimes, decisions about jurisdiction can plague trading programs, which often do not fit neatly into preexisting regulatory silos. For example, the Long Island Sound program was involved in a protracted disagreement over which entity would oversee the Nitrogen Credit Advisory Board, which was time consuming for program staff.

PROMOTING TRADING IN THE FUTURE

Program staff and other trading experts were asked to identify changes that would help support water quality trading in the future. The questions focused on five major topics:

- Legal, regulatory, or policy changes that EPA could institute to support trading (Evaluation Questions 11 and 12);
- Improved funding mechanisms for promoting trading (Evaluation Question 14);
- Improved tools and guidance for promoting trading (Evaluation Question 10);

- Tactics for promoting non-point source involvement (Evaluation Question 6 and 13); and
- Improved indicators that EPA can use to measure its progress on promoting water quality trading (Evaluation Question 9).

Legal, Regulatory, And Policy Changes (Evaluation Questions 11 And 12)

Interviewees were asked to identify legal, regulatory, and policy changes that EPA could pursue to increase flexibility and create incentives for WQT. In general, the suggestions reflect back on a subset of the barriers highlighted under Evaluation Question 5 (see above), particularly institutional barriers. The recommendations were broad and, in some cases, far-reaching; hence, there is a general recognition that EPA may have only limited, indirect means to pursue some of these suggestions. The proposals can be organized into the following categories:

- Changes under the NPDES program;
- Changes under the TMDL program; and
- Trading policies and related regulations.

The discussion below explores each of these topics.

Changes Under the NPDES Program

Point source discharge permits represent a critical link in the institutional machinery of trading. As such, several interviewees suggested how procedural and legal changes under the NPDES program could support trading. First, some interviewees highlighted how strict NPDES permit schedules can squelch interest in trading. A permitter associated with the Great Miami program said that flexibility in NPDES schedules could give point sources the "breathing room" they need to think more creatively about trading options. Specifically, it takes time to secure trading partners, navigate legal questions, and otherwise develop a trading program. Without adequate time to explore these tasks, point sources tend to fall back on well-known abatement technologies and permitters tend to fall back on standard operating procedures.

Other interviewees stressed the need for flexibility in how trading is introduced into existing permits. One legal expert wondered if there might be options for allowing trading to be added to a permit without reopening the entire permit for discussion. In particular, several interviewees highlighted the system of public notification and comment under the NPDES program as being onerous; hence, allowing insertion of trading into a permit without reopening the permit for public comment could be especially beneficial.

Several interviewees with legal expertise called attention to the ways in which trading interacts with anti-degradation and antibacksliding policies. In general, interviewees did not present specific suggestions for how these policies could be changed or clarified. Instead, they called attention to the confusion surrounding the issues, particularly in the context of NPDES permitting:

- Antibacksliding regulations prohibit EPA from reissuing NPDES permits with effluent limitations that are less stringent than the final limits established in the previous permit. Exceptions are recognized, however, including situations where the circumstances on which the previous permit was based have materially and substantially changed.[17] Therefore, the primary question raised by interviewees is whether participation in a trading program or offset arrangement is a valid basis for allowing relaxation of a water quality-based effluent limitation for a particular pollutant.
- States are required to develop rules protecting existing surface water uses and preventing clean waters from being degraded. In states with anti-degradation policies, a discharger who wishes to increase loadings typically must justify the change (on social or economic grounds) or demonstrate that the discharge is exempt. Interviewees noted that confusion remains over whether trading is a valid justification for an increased load where an anti-degradation policy is in place.

In both these cases, interviewees believe that clarification from EPA would help support trading or at least define whether trading is a valid option for certain NPDES permittees.

Additional legal questions are posed by the recent court decision by the U.S. Ninth Circuit Court. The court ruled that EPA could not issue a permit to a mine on an impaired Arizona creek, despite the fact that the company intended to offset its discharges through remediation at an inactive mine upstream, because nothing in the regulations or the CWA allows for offsets in impaired waters. Citing this decision, some interviewees, including an independent expert and the permitter on Rahr Malting, stressed that EPA needs to address the uncertainty regarding whether trading can occur on an impaired waterbody.

Changes Under the TMDL Program

Some interviews underscored the importance of expediting TMDL development to enable trading. TMDLs often provide the biological and hydrological basis for a trading arrangement. For this reason, several interviewees stressed the need for the TMDL program to move forward as quickly as possible. Specifically, one of these individuals suggested that TMDL program managers need to revise the current emphasis on extensive modeling and data refinement, which often delays TMDL implementation. Instead, the program needs to show the "political will" to proceed with imperfect information. Somewhat in contrast with this sentiment, an interviewee on the Long Island Sound project suggested that EPA work to refine the models and data on which TMDLs are based. To the extent that TMDLs are more scientifically sound, EPA will gain the confidence of participants in trading programs.

[17] Thorme, Melissa A., "Antibacksliding: Understanding One of the Most Misunderstood Provisions of the Clean Water Act," Environmental Law Reporter, 3-2001, p. 10323.

Trading Policies and Related Regulations

Interviewees called attention to several other policies and regulations that EPA may wish to consider in promoting trading:

- EPA helps states develop affordability criteria for sewage and drinking water systems. These guidelines help determine whether treatment and water supply costs are excessive, placing these costs in the context of median household income in a given town. One state regulator noted that, based on current guidelines, many Massachusetts towns do not appear to incur a heavy cost burden. However, the guidelines have not been updated since the mid-1990s. If EPA helped revise these guidelines, water quality managers may see increased interest in trading because sewage service costs would be deemed "excessive/burdensome" (in the more official sense), and there would be greater pressure for reducing treatment plant costs.
- Another interviewee pointed to the important role that revolving loan funds play in trading programs (see below) and suggested that the guidance for distributing money from these loan funds is outdated. If EPA helped update this guidance, it might promote a funding distribution that is more in line with the cost-effectiveness objectives of trading programs.
- A representative of a national agricultural organization suggested that EPA devise a system of regulatory dispensation for farmers who voluntarily participate in trading programs. Farmers may see trading as the leading edge of mandated pollutant controls. By providing legal assurance to farmers that participating now will absolve them of future regulation, EPA could promote interest in trading.
- Some interviewees perceive a lack of consistency between trading policy expressed by EPA Headquarters versus EPA Regions. This can create uncertainty for state regulators and trading participants. One interviewee said that "it would be extremely beneficial…if EPA would resolve its internal cultural communication…so that one mouth speaks for all. As it currently stands, many mouths speak for all, and this gets too confusing to [state regulators] and to the industries involved in this program (and other similar programs)."
- Finally, one interviewee pointed out that the Clean Water Act contains no explicit trading provisions. Adding trading language could provide the needed authority to pursue trading more vigorously, although this would entail opening the statute for revision.

Improved Funding Mechanisms (Evaluation Question 14)

In discussing improved ways to fund WQT efforts, some interviewees first highlighted existing funding sources that were instrumental to their programs. The funding sources were diverse and facilitate different aspects of the initiatives. For instance, interviewees for Long Island Sound, a regional project with numerous point source participants, stressed the importance of the Connecticut Clean Water Fund (i.e., the state's revolving loan fund devoted to municipal treatment plant upgrades). They emphasized how this

type of cost sharing can "prime the pump" by ensuring prompt implementation of key nitrogen control projects at treatment plants. One of the interviewees also pointed out that recent cuts in the Clean Water Fund have contributed to a slow-down in treatment plant projects. Furthermore, this individual is concerned that the formula for distributing these funds may be outdated, with the result being that less efficient nitrogen control projects are being funded at the expense of more efficient options. This outcome could undermine the fundamental economic logic of the trading system.

On the Middle-Snake River project, Idaho DEQ received federal (EPA) funding that they used to secure a contractor overseeing program development and coordination between DEQ and industry. Likewise, the Minnesota Pollution Control Agency received EPA funding to explore trading opportunities in the state and to develop a state-wide rule for water quality trading. USDA funding is a central element of the Great Miami project. The program received a Conservation Innovation Grant totaling roughly $900,000. The funding has been used for several critical program functions, including prospective research on economic benefits and extensive outreach to farmers and conservation districts.

Much of the funding discussion focused on how EPA can target resources to support WQT in the future. The suggestions were divided between direct funding options (i.e., funding for implementing trading programs) and indirect funding options (i.e., funding on programs that drive an interest in trading). We discuss these two categories below.

Suggestions for Direct Funding

The broad theme running throughout interviewees' direct funding suggestions is to fund more pilot level studies. While few explicitly used the term "pilot study," interviewees tended to highlight those aspects of program administration that proved most challenging or costly on their respective initiatives, recommending that future programs receive funding targeted to these areas. One interviewee may have put it most succinctly when she highlighted the need for smaller, more "nimble" grants for trading. In contrast to large grant programs that have significant application hurdles (e.g., Targeted Watershed Grants), smaller grants could fund the practical aspects of program administration that many interviewees emphasized, including the following:

- Several interviewees stressed the resource demands associated with outreach to program participants. For instance, the coordinator of the Chatfield Reservoir project noted how collaboration with program participants is a major demand; as a private consultant, he must charge participants for his time beyond a certain limit. Likewise, the Great Miami coordinator highlighted the cost of the many program development meetings he conducts with farmers, county officials, and soil and water conservation districts.
- Many interviewees pointed to the importance of directing funding to the right level of program bureaucracy. However, their suggestions varied greatly as to what level is most appropriate. Long Island Sound interviewees recommended that state permitting agencies receive more funding for program administration. The coordinator on the Middle-Snake River project advised that funding be

targeted to the regional offices of Idaho DEQ, not to the state office, since the regional offices are best positioned to tailor trading programs to the unique aspects of regional industries. An interviewee on the Las Vegas Wash project believes that funding is best targeted on local governments and other local organizations.

- For programs involving agricultural non-point sources, we have noted that local soil and water conservation districts can provide a link to the farming community and perform key technical functions. One interviewee suggested that funding be channeled directly to the districts to fortify this administrative link.

These disparate suggestions for targeting funding highlight how EPA regional staff may best function as a "gatekeeper" for directing resources. This role would be consistent with several interviewees' view that EPA needs to establish a regional point of contact devoted exclusively to promoting WQT. For example, one EPA regional staffer who already plays this role advocated having a regional leader who would perform more outreach with state regulators and with the regulated community. The coordinator for Rahr Malting echoed this suggestion, saying that more leadership from EPA regional offices is necessary to make trading work.

Suggestions for Indirect Funding

When asked how future funding could be directed, a somewhat surprising number of interviewees focused their suggestions on supporting activities that influence trading, rather than funding trading programs proper. First, interviewees advocated funding existing programs that drive regional interest in trading. For instance, consistent with suggestions to step up the pace of TMDL development, several interviewees said that putting more resources into TMDLs would propel interest in trading. Likewise, one interviewee recommended increased funding for enforcement to create stronger incentives for NPDES permittees to explore trading.

To support point/non-point trading, several interviewees suggested that funding should flow directly to non-point partners. A state official involved with the Red Cedar project said that a cost-sharing program for non-point sources would defray the cost of BMP implementation and enhance farmers' interest in trading. Likewise, a representative of the Ohio Farm Bureau Federation suggested that funding more conservation planning would help identify BMPs and nutrient reduction potential in different areas, thereby allowing project planners to identify good watersheds for trading initiatives.

Some interviewees stressed the importance of funding improved water quality modeling to inform program development and build the case for trading. For instance, a USDA official suggested that EPA could fund field-level monitoring of in-place BMPs to better characterize their pollutant control effectiveness. Similarly, the coordinator of the Great Miami program described the extensive water quality monitoring network that has been implemented as part of the program. While this network is generating potentially valuable information, funding is needed to ensure technically sound and thorough analysis of the data.

Some respondents went so far as to suggest that new funding not focus on trading programs at all. Instead, the most efficient tactic may be to simply direct funds to non-point source control, either through grants to farmers (as currently exist) or through development of a regulatory program that explicitly controls agricultural runoff.

Improved Tools And Guidance (Evaluation Question 10)

In the interviews, we asked respondents to comment on the usefulness and quality of existing tools and guidance for assisting WQT efforts. In most cases, interviewees seemed familiar with at least a subset of the products that EPA had produced, including the *Water Quality Assessment Handbook* and the *Water Quality Trading Toolkit for Permitters*. Six interviewees explicitly complimented these tools, indicating that they were "very useful" and "well-written and organized."

In several instances, interviewees were critical of a specific product with which they were especially familiar. Two interviewees expressed the view that EPA guidance squelches flexibility and promotes rigidity, and that by being over-prescriptive, EPA can deter states and other organizations from exploring WQT.

One interviewee stated that the *Water Quality Trading Assessment Handbook* is a "disaster" because it places too much emphasis on conducting complex fate and transport modeling. This individual felt strongly that the technical and resource demands of fate and transport modeling are too great and that trading will not scale up if this kind of analysis is a prerequisite. The criticism that the *WQT Handbook* demands too much fate and transport modeling appears to have some validity. The *Handbook* proceeds from the assumption that the program designer has a good watershed profile (i.e., discharger inventory, loadings, etc.), which is a relatively demanding assumption. However, it does not explicitly recommend fate and transport modeling so much as it assumes that such fate and transport modeling will already be done in support of a TMDL. [18]

One interviewee with agricultural expertise was unhappy with the *Getting Paid for Stewardship* document that EPA helped fund. This individual felt that the document places the onus on farmers to identify trading partners and otherwise initiate trading programs. IEc reviewed the language in *Getting Paid for Stewardship* and agrees that it does seem to place some onus on farmers, telling them to take the initiative to organize a trading program (e.g., "find a partner"). However, given that farmers are the primary audience for the document, it is difficult to envision a different approach for framing the document.

Most of the discussion in this area was devoted to identifying future tools and guidance to support WQT. Several interviewees said that additional *general* technical guidance (e.g., trading theory, pointers for structuring programs, etc.) has been covered well by existing EPA products, and that additional general guidance is not needed. Others provided

[18] For several of the criticisms and suggestions raised in relation to tools, IEc reviewed the existing EPA tools and guidance to assess the validity of the remark. Specifically, we reviewed the content of the *Water Quality Trading Toolkit* (EPA, 2007); the *Water Quality Trading Assessment Handbook* (EPA, 2004); EPA's Water Quality Trading: One-Day Training Course; and *Getting Paid for Stewardship* (CTIC, 2006).

constructive suggestions for new tools and guidance. These suggestions were wide-ranging and reflect a desire to overcome specific barriers that programs have encountered. Exhibit 8 summarizes the ideas expressed and provides a rough indicator of how frequently interviewees made a particular suggestion. The remainder of this section considers these suggestions in greater detail.

EXHIBIT 8. OVERVIEW OF SUGGESTED TOOLS AND GUIDANCE

SUGGESTION	APPROXIMATE NUMBER OF INTERVIEWEES OFFERING THE SUGGESTION
Methodologies for estimating pollutant reduction benefits of agricultural BMPs	7
Case studies of successful trading programs	5
Conceptual models for expanding trading to non-point sources *other* than agriculture	4
Specialized or targeted WQT training/guidance	4
Analysis of secondary benefits of trading	3
Improved information on BMP potential in different geographic regions	2
Methods for trading different pollutants across participants in a given program	1
Systems to assist farmers in BMP selection	1
Recognition program for innovative actors	1
Mentoring program to provide technical assistance	1
Guidance on interface between trading and the backsliding issue	1

Seven interviewees offered some variation on the suggestion that EPA support development of a tool for characterizing pollutant reductions associated with agricultural BMPs. As noted in the barriers discussion earlier, estimating the pollutant reduction effectiveness of BMPs is essential to developing trading ratios in point/non-point programs. Interviewees stressed two key characteristics. First, the method or model should be simple. A USDA representative highlighted the need for a "rule of thumb" approach and others used terms such as "formula" or "general framework." Clearly, the desire is to avoid complex modeling that would require extensive data, technical knowledge, or program resources to implement.

Second, interviewees pointed to the need for a method or model that is fully "blessed" by EPA as well as state regulators. Program managers want the confidence of knowing that the modeling estimates and associated trading ratios would stand up to legal scrutiny and not be called into question in the permitting stage or in enforcement actions. Our review of the existing tools indicates that this is a valid suggestion. None of the current guidance documents provides a detailed discussion of accepted models for assessing BMP effectiveness or simplified methods (e.g., USLE) for rough estimation of nutrient reductions. Even *Getting Paid for Stewardship* circumvents the issue with simplistic

advice like “you might have this information through existing conservation programs or tools…”

Five interviewees suggested that case studies of successful trading initiatives would be helpful. The Permitter's Toolkit contains comprehensive case studies that may address this need; it is possible that these interviewees had not read or recalled the case studies in this resource. In some instances, interviewees specified the case study content, acknowledging how it would complement existing case study material. For example, the coordinator for the Long Island Sound project recommended detailed economic studies highlighting the program’s societal economic benefits as well as the savings for individual participants (e.g., municipalities). There may be a legitimate need for case studies targeted on economic benefits; the WQT Toolkit fact sheets provide little information of this type.

Four interviewees highlighted the need for guidance on how to structure a trading program that incorporates dischargers other than traditional point sources and farms. For instance, an interviewee on the Chatfield Reservoir program is interested in a simple method for estimating phosphorus reductions associated with the retirement of aging septic systems. Similarly, an EPA regional contact suggested considering how programs could incorporate urban stormwater control. These seem like valid suggestions to IEc, as existing materials focus almost exclusively on farm runoff when considering non-point sources. Incorporating different sources presents unique planning and analytic demands. For example, the best management practices for urban stormwater control are distinct from those for agricultural runoff. Likewise, incorporating septic systems and urban stormwater sources requires knowledge of different regulatory settings (e.g., urban stormwater permitting).

Four interviewees expressed an interest in re-orienting or targeting existing WQT training and/or guidance materials to serve a specific stakeholder group. One Neuse River interviewee felt that EPA should develop WQT training for environmental groups that oppose the concept. The WRI contact suggested developing guidance specifically geared to watershed managers and other non-technical program coordinators. She believes that these groups need a more complete primer on program design and outreach to stakeholders (in addition to standard technical guidance).

Several additional tools were mentioned by three or fewer interviewees. Briefly noted, these ideas include the following:

- Three interviewees highlighted how programs involving non-point sources can produce ancillary environmental benefits such as carbon sequestration and wetlands creation. In addition, a representative of American Farmland Trust emphasized how the revenue from participating in trading can benefit the farming sector, improving the economic viability of small farms and enhancing food security. The interviewees suggested that more systematic information on these benefits may help support trading.
- Two interviewees suggested promoting trading by providing information on agricultural BMP potential in different geographic areas. A point source

representative associated with the Lower Boise project noted that EPA or USDA could centralize and publicize information on where BMP funding goes; such information could be helpful to point sources seeking trading partners. A representative of the Farm Bureau Federation suggested more emphasis on GIS analysis and watershed assessments to identify areas with the greatest point/non-point trading potential.

- One interviewee requested more information on what he referred to as "offset trades," (i.e., trading between different pollutants).
- One interviewee recommended that EPA and USDA collaborate on an Internet-based system for helping farmers select BMPs. The system would be interactive and allow farmers to see tradeoffs between BMP costs and pollutant control effectiveness.
- One interviewee suggested a recognition program for rewarding especially innovative actors (e.g., companies, municipalities, farmers) who take part in trading.
- One interviewee suggested that EPA institute a mentoring program whereby the Agency identifies effective program coordinators or consultants, puts them on retainer, and has them assist individuals who are establishing new trading initiatives.
- One interviewee recommended that EPA publish guidance on the anti-backsliding provisions of the Clean Water Act and their implications for water quality trading.

Promoting Non-Point Source Involvement (Evaluation Questions 6 And 13)[19]

Several interviewees discussed challenges and opportunities regarding non-point source involvement in WQT. A general comment shared among many interviewees is that USDA and EPA need to take steps to better coordinate their policies and activities to send clear messages to the non-point source community regarding WQT. The Great Miami River program coordinator pointed to the MOU signed between USDA and EPA in 2006 as a positive step in demonstrating to staff carrying out programs and activities related to trading that the agencies are committed to work together. This section presents feedback from interviewees on concrete steps that USDA and EPA can take to better coordinate trading activities.

[19] Evaluation Question 6 inquired about the effects of other federal and state programs on WQT, in particular the role of USDA programs. USDA programming related to trading was described in the Introduction of this report, and is further explored in this section. The role of state policy and programs is a very broad topic discussed throughout this Findings chapter.

Coordination on BMP Pollutant Reduction Tool

As discussed in the Improved Tools and Guidance section, seven interviewees suggested that EPA support development of a tool for characterizing pollutant reductions associated with agricultural BMPs; these include interviewees from Chatfield, Great Miami, and Red Cedar programs among others. Based on IEc's review of available tools, we think this feedback is valid. NRCS worked with EPA to develop a nitrogen modeling tool to estimate reductions from BMPs; the Nitrogen Trading Tool (NTT) prototype is currently being tested in Ohio, Maryland, and Colorado. However, officially endorsed tools for phosphorous and sediment are still needed.

In addition, as discussed by the interviewee from the Ohio Soil and Water Commission, as well as an independent expert consulting to that program, the Great Miami program developed a spreadsheet model for nitrogen and phosphorous control by BMPs. Great Miami interviewees credited this model with program success; the model has been endorsed by Ohio EPA. A couple of interviewees stressed that (the federal) EPA should "bless" this kind of streamlined model as a way of promoting trading.

Coordination on Trading Ratio Approach

As discussed earlier, some interviewees expressed that EPA should rethink its approach to developing trading ratios, because reliance on fate and transport modeling is a significant barrier to participation of non-point sources as well as point sources. USDA officials are among interviewees that promote a streamlined approach; one USDA interviewee noted that EPA should research the track record of "rule of thumb" approaches to identify circumstances where they may be applied with confidence. One USDA official went further, saying that EPA should consider revising their guidance to address equity issues caused by trading ratios within the non-point source community, which the official cited as another barrier to non-point source participation. For example, the interviewee stated, if two non-point sources are participating in a trading program, and one is receiving $X per credit and the other $2X, then perhaps they should both receive $1.5X to reduce equity concerns.

Clearly, EPA and USDA differ in their preferred approaches to developing ratios; as a result, it is likely some non-point sources are receiving a mixed message about trading ratios and how best to establish them. USDA contacts, an independent expert, and interviewees from Great Miami and Rahr Malting alluded to the need for EPA and USDA to work to harmonize their policy and message on this issue to support non-point source trading.

Resolution of NRCS Program Participants and Trading

USDA interviewees, independent experts, and the program coordinator for the Great Miami program expressed that EPA and USDA need to clarify the policy for non-point sources participating in trading while receiving NRCS financial incentives or cost-sharing funds. This need for clarification is underscored by the fact that IEc received conflicting information from interviewees on the current rules for participating in both. USDA

indicated that farmers participating in WQT have not been required to subtract the value of cost-share from trading revenue to-date, but we were told by Great Miami interviewees that the local conservancy district did not allow farmers to participate in both programs.

While EPA is officially silent on the issue, persons from both EPA and USDA indicated to IEc a personal preference that farmers subtract the value of NRCS incentives or cost-sharing funds from trading credits. The arguments provided to IEc for instituting this requirement are as follows:

- Farmers can use NRCS incentives and cost-sharing funds to bring them up to baseline and allow them to trade.
- If farmers are already receiving funds for BMPs, adding the potential of generating WQT trading will not incentivize additional conservation, but rather just provide additional subsidy for the same level of benefit.
- NRCS credits are price distorting, at least in theory, and have the potential to reduce the value of trading credits if used in conjunction with WQT credits.

In contrast, USDA's official position, as expressed to IEc by USDA officials, is that farmers participating in cost share should be able to participate in trading without subtracting the value of NRCS incentives. USDA rationale is as follows:

- NRCS cost share programs pay for only a portion of BMP installation, and they do not pay for BMP operations and management costs.
- The rationale for NRCS programs are broader than the rationale for generating a WQT credit to achieve a water quality goal. NRCS incentives encompass other benefits of conservation, such as combating soil erosion. However, it would be difficult, if not impossible, to calculate how much of the NRCS program incentive or cost sharing to subtract from WQT credits.
- The potential for realizing additional value from generating credits will only make farmers want to increase participation in trading more, and they need additional incentives to participate.
- NRCS financial incentive and cost-share program participants are not going to give up participation in NRCS programs for the opportunity to participate in trading. NRCS conservation programs have been in affect for many years, 15 percent of all farmers take advantage of them. Farmers view NRCS program as a simple and certain revenue stream, in contrast to the new and uncertain world of WQT.
- It puts USDA in an "awkward position" vis-à-vis their agency’s promotion of trading if farmers participating in their programs are precluded from participating in trading.

In addition, two independent trading experts stated that NRCS programs are not adequate to address the entirety of the non-point pollution problem.

Additional Feedback on EPA and USDA Coordination

Interviewees provided some additional feedback on how EPA and USDA could better coordinate to support non-point source involvement in trading. First, as discussed previously in this chapter under Suggestions for Indirect Funding, several interviewees suggested that EPA reconsider its WQT funding approach in light of non-point source challenges, and fund non-point source projects directly.

Secondly, several interviewees stressed that USDA, state conservation agencies, and soil conservation districts should be the conduit of information on trading to farmers. Two independent experts, the program coordinator for Great Miami (a program which has received NRCS funding and has non-point participants), and USDA contacts underscored that these agencies have credibility among the agricultural community that EPA and state environmental agencies lack because of their respective historical roles, and that farmers are more likely to be receptive to trading if USDA is the conduit of information on available opportunities. With that said, information provided by these agencies needs to be consistent with EPA policy and messages, otherwise confusion and ultimately disinterest in trading among non-point sources would be the likely result.

Improved Indicators For Measuring EPA's Progress (Evaluation Question 9)

Few interviewees expressed substantive opinions on how EPA should measure its progress on WQT. Of those who did, nearly all began by stressing that the number of trades is a poor measure. First, programs have very different definitions of what constitutes a "trade." A point/point program might consider each credit exchanged to be a trade, while a point/non-point program might count the number of BMP contracts established. Further undermining the standardization of the definition, the number of trades is not meaningful when trading ratios vary from program to program. Two EPA regional representatives suggested that the Agency explore developing a method for estimating net loading reductions by combining raw estimates of reductions with information on the program-specific trading ratios.

Other suggestions for meaningful indicators of progress included the following:

- The EPA Region 10 contact suggested tracking the number of permits that authorize trading and the number of facilities covered by the permits.
- One independent expert recommended tracking the river miles or lake acreage associated with a trading program.
- Because TMDLs can provide a strong incentive to pursue trading, a state regulator suggested that EPA track and publish information on TMDL waste load allocations and the progress that dischargers are making against those allocations.

CHAPTER 4 | RECOMMENDATIONS

In this chapter, IEc draws on both its review of the literature and the comments of those we interviewed to provide recommendations to EPA on the direction of future efforts to support water quality trading. As context for these recommendations, it is important to acknowledge that EPA has limited ability to address some substantial barriers to trading. In particular:

- The Clean Water Act does not mention water quality trading, and has several requirements that pose potential impediments to trading (e.g., anti-backsliding and anti-degradation requirements; permitting and public comment requirements). A significant amount of creativity and staff time is necessary to work around the complexities caused by statutory ambiguity. Over-burdened permit writers and cautious legal counsel may be unwilling or unable to make such an investment.
- Water quality trading appears to be viable and sustainable only in locations where a narrow set of regulatory, economic, hydrologic, and geographic circumstances exist. Likewise, it may be limited to areas where program coordinators have both a high level of interest in trading and the talent needed to shepherd stakeholders through a challenging program development and implementation process.
- No generic approach works in developing a water quality trading program. The myriad local conditions noted above (regulatory, economic, hydrologic, and geographic) necessitate a customized program design.
- The regulatory conditions necessary for trading -- e.g., TMDLs and/or nutrient criteria -- are still not in place in many areas. States have been slow to develop TMDLs and nutrient criteria, and EPA has limited leverage in accelerating the process.

These are some of the most significant barriers to implementing water quality trading. Given the Agency's limited leverage in addressing these barriers, it may be unrealistic to expect widespread diffusion of trading programs. In particular, EPA should avoid comparisons to air quality trading, which does not face the same barriers.

IEc has developed five main recommendations for EPA to consider when planning future Agency efforts to support water quality trading. These recommendations do not focus on addressing the above barriers, but rather on addressing other barriers that are within EPA's purview:

1. Recast water quality trading as one option within a suite of innovative permitting options supported by EPA.

2. Promote institutional changes at EPA that would support trading.
3. Support trading only where conducive conditions are evident.
4. Improve coordination with USDA to promote involvement of non-point sources.
5. Adjust EPA's allocation of trading resources.

RECOMMENDATION 1: RECAST WATER QUALITY TRADING AS ONE OPTION WITHIN A SUITE OF INNOVATIVE PERMITTING OPTIONS SUPPORTED BY EPA.

As EPA pushes forward with numerical nutrient criteria, nutrient standards, and water quality-based permit nutrient limits, the nature of nutrient pollution inherently affords greater flexibility than has traditionally been the case with toxics, heavy metals, and primary and secondary treatment. The very fact that nutrients often exhibit downstream collective impacts without upstream impairments opens the door to far more flexible permitting approaches

Trading, however, is one of several flexible permitting options. Some of the programs studied for this evaluation, including Neuse River, Wayland, and Long Island Sound, do not fit a "classical" definition of trading; Neuse revolves around a group compliance approach, Wayland is essentially an offset program in which a single regulated entity purchases offset credits from non-point sources in the absence of additional regulated entities from which to “trade,” and the Long Island Sound program is based on a centralized approach to establishing the most efficient waste load allocation. In addition, a few of the individuals we spoke with do not characterize their initiatives as trading initiatives. In fact, the program coordinator for Las Vegas Wash, a program that we sought to study originally, would not participate in the evaluation because he did not consider the program to be a trading program. In addition, at least one interviewee pointed to others' initiatives as being something other than "real" trading; for example, an EPA regional contact commented that the Long Island Sound program is simply "trading construction schedules."

All of the programs studied, however, are examples of innovative permitting of one type or another, and the lines between different types of innovative permitting are fuzzy. For example, EPA's watershed-based permitting program features some trading programs – Clean Water Services, Chesapeake Bay, Neuse River, Rahr Malting – as case studies of watershed-based permitting.[20] Given the limited examples of "classic" forms of trading, and the current ambiguity of the term's meaning, IEc's recommendation would be to recast classical trading as one option within a suite of innovative water quality permitting options supported by EPA.

IEc does not see an inherent value in promoting trading as a concept separate from other innovative permitting options. All of these approaches represent potentially flexible and cost-effective ways of meeting water quality goals, and should be selected based on local conditions. In addition, focusing on trading in particular invites continued comparison to

[20] See EPA's home page for watershed-based permitting at: http://cfpub.epa.gov/npdes/wqbasedpermitting/wspermitting.cfm.

the highly successful use of trading in the air program, which is neither fair nor relevant. By casting a wider net and addressing innovative water quality permitting more comprehensively, EPA will be under less pressure to scale up the specific concept of trading, and be better positioned to support a larger universe of promising water permitting initiatives at the state and local levels.

To recast trading as one option within the broader suite of innovative permitting, IEc would suggest reorganizing OW webpages and communications to link water quality trading and watershed-based permitting, as well as WQT and broader opportunities for offsets.

Finally, some interviewees provided interesting ideas about expanding the scope of WQT and linking it to other initiatives. IEc agrees with the recommendation that EPA explore these linkages and the potential opportunities that lie therein:

- Some interviewees mentioned that EPA should explore the potential to involve non-point sources other than farms in trading, because agricultural sources of credits are limited in many areas, especially urban areas. Potential sources of urban non-point source credit generation may include stormwater BMPs, which are increasingly utilized to mitigate impacts of development projects. EPA is emphasizing these BMPs through its new Green Infrastructure Partnership, which potentially dovetails with water quality trading efforts. [21]
- Two independent experts interviewed stressed that EPA should link WQT to related opportunities such as carbon offsets. WRI recently published a guide to ecosystem services including carbon offsets, and USDA is currently developing guidance on ecosystem services for its field staff.[22]

RECOMMENDATION 2: PROMOTE INSTITUTIONAL CHANGES AT EPA THAT WOULD SUPPORT TRADING.

In identifying obstacles to water quality trading, interviewees cited institutional barriers more often than any other issue. While EPA cannot directly address the institutional barriers to water quality trading imbedded in the Clean Water Act, interviewees suggested that the Agency could help to support trading by providing clarification on several legal points. In addition, interviewees noted changes to EPA guidance that would support trading. Finally, interviewees indicated that increased Agency consistency in attitudes towards trading would be very helpful in promotion of the concept. IEc largely agrees with interviewee feedback on institutional changes; we summarize our recommendations below.

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[21] For information on stormwater BMPs, see: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm. EPA's green infrastructure strategy and activities can be found at: http://cfpub.epa.gov/npdes/greeninfrastructure/information.cfm#greenpolicy.

[22] WRI, *Ecosystem Services: A Guide for Decision-Makers*, March 5, 2008: http://www.wri.org/publication/ecosystem-services-a-guide-for-decision-makers.

Legal Clarifications

- Interviewees discussed the stifling effects of tight NPDES permit review and development schedules and the difficulty of developing a trading program within these time constraints. It is unclear to IEc if EPA has latitude in adjusting the schedule for renewal of NPDES permits. If it does, we recommend that the Agency develop more flexible policies and schedules for permits that include trading. If it does not, EPA should clarify these limitations for its trading partners.
- EPA should communicate more broadly about the interplay of WQT and anti-degradation and anti-backsliding provisions, for example by taking content from the Toolkit and developing frequently asked questions for posting on EPA's website.
- EPA should clarify whether trading is allowable on an impaired water body given the recent U.S. Ninth Circuit Court decision related to this issue, as discussed in the Findings chapter.

EPA Guidance Changes

- Based on feedback that TMDL development needs to be accelerated to support trading, and persisting confusion regarding the use of imperfect data in setting TMDLs and the level of analytic rigor needed for TMDL wasteload allocations, we suggest that EPA increase communication to states regarding phased TMDLs. The 2006 phased TMDL memo states that TMDLs can be developed with imperfect data and imperfect analytic techniques, as long as the state expects that the loading capacity and allocation scheme will be revised in the future as additional information is collected.[23]
- EPA should update affordability guidelines for sewage and drinking water systems. New guidelines may increase pressure for reducing treatment costs, and thus help create economic conditions conducive to trading.
- Based on feedback received on the Long Island Sound program, EPA should conduct more outreach to encourage states to make WQT projects eligible for State Revolving Loan funds, by adding WQT projects to the eligible projects list.

Culture Change

Some interviewees stressed a lack of consistency between EPA Headquarters' promotion of trading and attitudes encountered among EPA regional staff (most notably permitting staff) and legal counsel. WQT shares this problem with many other innovative programs at EPA; innovations cheerleaders are often found at Headquarters with a small set of likeminded staff at the regions, but roadblocks to implementation are often encountered in permitting, enforcement, and legal offices. Often, roadblocks result from uncertainty

[23] Memo from Benita Best-Wong, Director, EPA OW Assessment and Watershed Protection Division, to EPA Regional Water Division Directors, "Clarification Regarding "Phased" Total Maximum Daily Loads," August 2, 2006: http://www.epa.gov/owow/tmdl/tmdl_clarification_letter.html

over interpretation of EPA policy, and a real or perceived lack of resources to implement innovations.

Managers of innovative programs at EPA have employed several strategies to address these types of intangible but important barriers to innovation within the Agency. IEc recommends that OW staff learn from the experience of other programs by meeting with managers of other innovative EPA programs to gather input and advice.[24] Examples of potential strategies include:

- Restate EPA top management support for trading and other innovative water permitting options for controlling nutrients on the scientific basis that impacts are typically realized downstream, and not locally. Ask the Administrator's office to send a communication on the subject to regional administrators, regional directors of the water program, as well as OECA and regional enforcement office directors.
- Hold small meetings and one-on-one conversations with regional and state permit writers, legal staff, and other appropriate individuals to discuss the realized and potential environmental benefits of trading and other innovative water permitting options.
- Change the "beans" counted in work-sharing agreements between EPA Headquarters and States (i.e., commitments recorded in the Annual Commitment System) as well as in work-sharing agreements between regions and states (i.e., PPAs/PPGs and block grants) to support trading. Currently, IEc understands that all permits issued are counted equally within these arrangements, providing a disincentive for permit writers to incorporate trading because permits that do so are more complex and take longer to develop. If EPA gave additional credit for writing a trading permit, commensurate with the level of effort needed to develop one, it would remove a key resources barrier.

RECOMMENDATION 3: SUPPORT TRADING ONLY WHERE CONDUCIVE CONDITIONS ARE EVIDENT.

In Chapter 3, we reported that interviewees communicated a consensus on local conditions necessary to support trading. When combined, these observations suggest a narrow set of regulatory, economic, hydrologic, and geographic circumstances. In the past, EPA issued WQT implementation grants where assessments of trading conditions were not conducted, and some of those programs failed. In addition, trading may be limited to areas where program coordinators have both a high level of interest in trading and the talent needed to shepherd stakeholders through a challenging program development and implementation process.

Assuming that EPA continues to fund nascent or struggling trading programs, IEc recommends focusing resources on programs that, at the very least, meet conducive regulatory, economic, hydrologic, and geographic conditions. Specifically, we suggest

[24] Should OW want to pursue this recommendation, IEc has several suggestions of contacts in OPEI and other offices who may be of assistance.

EPA require grant applicants to demonstrate that conducive conditions exist to be eligible for implementation grants or other EPA funding. Moreover, we suggest that EPA consider the interest and capacities of local champions and stakeholders in making funding decisions.

Screening for the above conditions could be accomplished through a relatively simple assessment, which was recommended by two independent trading experts interviewed. We suggest that EPA develop criteria associated with each of the conditions, identify the information required to assess a location against the criteria, and perhaps include potential data sources. The local government or organization interested in developing a WQT program would conduct the screening assessment and submit it to EPA as part of an application for grant or other funding.

In cases where a screening assessment indicates that a particular location is not well-suited for trading, EPA should consider if it would be a good candidate for one of the other innovative permitting options discussed under the first recommendation. Consistent with the recommendation to broaden the Agency's focus, EPA may want to consider providing resources to local or state governments to help them pursue locally applicable innovative permitting options other than trading.

RECOMMENDATION 4: IMPROVE COORDINATION WITH USDA TO SUPPORT INVOLVEMENT OF NON-POINT SOURCES.

EPA and USDA approach the involvement of the agricultural community in water quality trading from very different perspectives, consistent with the different functions of the respective agencies. EPA sees trading as a cost-effective way of delivering clean water, while USDA views trading as a means of offsetting farmers' BMP costs. As discussed in the report, USDA's resources related to BMP promotion are extensive and have expanded considerably over time; currently, 15 percent of all American farms receive some form of conservation funding from USDA. USDA funding for projects specific to trading is also growing. Given both its resources and its credibility with the agricultural community, USDA's influence in encouraging farmers to participate in WQT cannot be underestimated. Thus, to the extent possible, EPA should rationalize views and messages regarding trading with USDA, and forge a solid collaboration with USDA to jointly address barriers to non-point source participation.

Collaboration On Technical Tools And Approaches

The Findings chapter discusses two potential areas of technical collaboration between EPA and USDA: developing new measurement tools to gauge BMP effectiveness and coordinating on a delivery ratio approach. In terms of new tools to gauge BMP effectiveness, the process used to jointly develop the current nitrogen tool may serve as a model for developing and testing a similar tool for phosphorous and sediment.

IEc understands that fate and transport modeling is required to support trading, to provide a scientific basis for the activity and to comply with the CWA. However, EPA could communicate existing flexibilities to state and local government, for example the fact that EPA allows 2-D as opposed to 3-D modeling. Moreover, in light of the realities of

imperfect science that go into trading ratio development, as well as anti-backsliding and anti-degradation considerations, EPA should consider the effectiveness of "rule of thumb" or simple spreadsheet approaches to developing delivery ratios where non-point sources are involved, and determine if there are circumstances under which streamlined approaches could be applied with confidence. This research is another potential area of collaboration between EPA and USDA.

When EPA and USDA jointly develop a tool or approach to assist non-point sources in participating in trading, IEc recommends co-branding any products. Co-branding sends a clear message that both agencies support the tools, and more generally demonstrates that the agencies are working together to address technical needs associated with WQT. However, because NRCS, analogous state agencies (e.g., state soil conservation agencies), and local soil conservation districts have high credibility with the agricultural community, these agencies and not EPA should be the public face of communication and outreach efforts for tools directed towards the non-point source community.

Joint NRCS/ WQT Participation

IEc recommends that EPA and NRCS coordinate more closely on the overlap between NRCS programs and WQT. As discussed previously, NRCS conservation program participants are unlikely to forgo participation in NRCS programs to take advantage of an opportunity to sell WQT credits. Although EPA is officially silent on the issue because NPDES permitting authority is delegated to most states, the Agency has legitimate concerns about the potential for double-counting environmental benefits for joint NRCS and WQT participants.

Although NRCS and EPA are unlikely to resolve their fundamental differences on this issue, there are some areas along the margins that the two agencies could collaborate on. First, EPA could better communicate to the agricultural community that NCRS cost-share and incentives can be used to bring farmers up to the baseline nutrient control required for trading. Secondly, EPA and NRCS could improve coordination and information sharing on the distribution of EQIP funding.

RECOMMENDATION 5: ADJUST EPA'S ALLOCATION OF TRADING RESOURCES.

Many of the recommendations provided above have implications for resources in the form of staff time, including instituting institutional changes, developing additional tools and resources, and improving coordination with USDA. While IEc acknowledges the increase in staff time needed in the short-term to implement these recommendations, we think that these investments would lead to more effective promotion of trading.

In addition to recommendations discussed above, IEc has developed further recommendations for strategic resource allocation:

- Establish a technical outreach group for trading at Headquarters that could provide on-site, hands-on assistance to nascent or struggling trading initiatives. Alternatively or in addition to a Headquarters-based group, establish centers of WQT knowledge at the EPA regional level, consisting of one or more FTEs

dedicated to providing technical outreach on trading (we realize that this currently exists in some regions).

- Restore the Agency's focus on providing small levels of seed funding for promising trading efforts. To facilitate this, we suggest that EPA develop a more nimble grant funding program. We agree with interviewee feedback that the current grant program used for WQT is oversized for this particular purpose, as it provides very large grants and requires an extensive proposal effort.
- Identify opportunities to build on the current success realized by the Long Island Sound program, for example, by exploring possible replication in the Connecticut River Valley and other locations with similar conditions: a single political entity, large number of point dischargers, a well-defined sink, and a state legislature friendly to a statute like the one underpinning the Long Island Sound program.

PRIORITIZING RECOMMENDATIONS

In this chapter, IEc has provided five main recommendations for moving forward with water quality trading, and several specific recommendations within each. We realize that integrating these recommendations as a package would require significant change and long-term planning. Thus, we suggest getting started with the following changes that would provide a foundation for implementing the other recommendations:

- Recast WQT as one option within a broader suite of innovative permitting options and change communications accordingly.
- Clarify legal issues associated with WQT.
- Make changes across EPA guidance noted to support WQT.
- Develop and implement strategies to move EPA and state environmental agency culture towards greater knowledge and acceptance of WQT.
- Use screening assessments to guide EPA investments in local WQT initiatives.
- Establish a technical outreach group for trading and EPA Headquarters and/or the regional level, to provide on-site, hands-on assistance to nascent and struggling programs.

APPENDIX A

LIST OF INTERVIEWEES

WATER QUALITY TRADING EVALUATION INTERVIEWEES

STAKEHOLDER GROUP	AFFILIATION	POSITION
CHATFIELD		
Permitting Authority	Colorado Department of Public Health and Environment, Water Quality Division	Clean Water Facilities Program Manager
General	Colorado Dept. of Public Health & Environment, Watershed Section	Chief of the Watershed Section
Program Coordinator	RNC Consulting (formerly with Denver Regional Council of Government)	President
GREAT MIAMI RIVER		
Program Coordinator	Miami Conservancy District	Manager, Watershed Initiatives
Non-point source (representative of)	Ohio Division of Soil and Water Conservation	Assistant Chief
Point Source	City of Dayton, Water Department	Wastewater Treatment Manager
Permitting Authority	Ohio EPA, Division of Surface Water	(not provided)
LONG ISLAND SOUND		
Point Source	Stamford Water Pollution Control Authority	Executive Director
Permitting Authority	Camp, Dresser, McKee (formerly with Connecticut DEP, Planning & Standards Division)	Senior Environmental Engineer
Point Source	Metropolitan District Commission	Chief Administrative Officer
Program Coordinator	CTDEP, Water Management Bureau	Long Island Sound Study Coordinator
LOWER BOISE		
Program Coordinator	Idaho DNR	TMDL Program Manager
Point Source	City of Boise Public Utilities	Water Quality Manager
General	EPA Region 10	Market Incentives Specialist
General	Ross & Associates	VP and Principal
MIDDLE-SNAKE RIVER		
Program Coordinator	Idaho DNR	TMDL Program Manager
Program Coordinator	Idaho Department of Environmental Quality, Twin Falls Region	Regional Manager, Water Quality Protection

STAKEHOLDER GROUP	AFFILIATION	POSITION
Point Source	Clear Springs Foods	VP, Research and Environmental Affairs
Non-point Source	Twin Falls Canal Co.	Manager
Point Source	City of Twin Falls	City Attorney
NEUSE RIVER		
Program Coordinator and Permitting Authority	North Carolina Department of Natural Resources	Permit Writer
Point Source	Neuse River Compliance Association	Executive Director
Point Source	Town of Clayton	Wastewater Operations Superintendent
Point Source	Neuse River Compliance Association	Legal Counsel
RAHR MALTING		
Permitting Authority	Minnesota Pollution Control Agency	Principal Engineer
Program Coordinator	Keiser & Associates (formerly with MN Pollution Control)	Senior Project Engineer
Non-point Source (representing)	Coalition for a Clean Minnesota River	Executive Director
Point Source	Rahr Malting Company	Vice President of Operations
RED CEDAR RIVER		
Permitting Authority	Wisconsin Department of Natural Resources	Basin Engineer
Program Coordinator	Wisconsin Department of Natural Resources	Chief of Watershed Section
General	Wisconsin Department of Natural Resources	Watershed Supervisor
SOUTHERN MINNESOTA BEET SUGAR		
Point Source	Southern Minnesota Sugar	Master Mechanic
Program Coordinator	Keiser & Associates (formerly with MN Pollution Control)	Senior Project Engineer
TRUCKEE MEADOWS		
Permitting Authority	Nevada Department of Environmental Protection, Bureau of Water Quality Planning	TMDL Program Engineer
Point Source	Truckee Meadows Water Reclamation Facility	Water Quality Coordinator
Point Source	City of Reno	Senior Civil Engineer

STAKEHOLDER GROUP	AFFILIATION	POSITION
WAYLAND CENTER		
Permitting Authority	Massachusetts Department of Environmental Protection, Southeast Regional Office	Surface Water Permitter
Permitting Authority	EPA Region 1	Water Quality Specialist
Program Coordinator	Wayland Wastewater Management District Commission	Chair
NON-PROGRAM		
General	EPA Region 5	Chief, NPDES Programs Branch
General	EPA Region 5	Water Quality Trading Coordinator/ NPDES Nutrients Coordinator
General	EPA Region 4	Water Quality Trading Coordinator
USDA	USDA, Natural Resources Conservation Service	National Leader for Clean Water
USDA	USDA, Natural Resources Conservation Service	Senior Economist, Animal Husbandry and Clean Water Division
USDA	USDA, Natural Resources Conservation Service	Director, Animal Husbandry and Clean Water Division
General	Ohio Farm Bureau Federation	Director of Environmental Policy
General	Kieser and Associates/ Environmental Trading Network	ETN Acting Chair and Senior Scientist
General	American Farmland Trust	VP for Research
General	Jackson and Kelly LLC	Attorney
NGO/Environmental Advocacy	World Resources Institute	Senior Associate, People and Ecosystems
NGO/Environmental Advocacy	Water Environment Federation	Staff Liaison

APPENDIX B

WATER QUALITY TRADING LITERATURE REVIEW

CITATION	DESCRIPTION	WATER QUALITY TRADING BARRIERS IDENTIFIED	KEY CONCLUSIONS/RECOMMENDATIONS
Conservation Technology Information Center, *Getting Paid for Stewardship: An Agricultural Community Water Quality Trading Guide*, 2006, accessed at: http://www.conservationinformation.org/?action=learningcenter_publications_waterqualitytrading.	This Guide presents an overview of water quality trading as it pertains to agriculture and was developed for individuals and organizations that serve as agricultural advisors to producers. The Guide outlines the eight key elements of a water quality trading program, explains how agricultural producers can benefit from trading, and discusses the potential challenges producers might face.	Potential challenges of involving agricultural producers in trading include: (1) concerns about increased liability, (2) potentially high transaction costs, (3) concern that complicated trading procedures might result in delays of payment from trading partners, (4) resistance to bringing government employees onto private farms, and (5) fear that the rules of trading are subject to change.	(1) Producers can address liability in trading by working with their trading partners to enter into a trade agreement that is transparent and has clearly delineated roles and responsibilities. (2) Use of a third party broker can reduce bilateral transaction costs. (3) Careful consideration of verification and reporting requirements is necessary during the trading program design process. (4) It is important to identify options for verifying conservation practices that do not involve government employees (e.g. third party verification). (5) Stakeholders should participate in the development of trading rules and state up-front what aspect of the rules cannot be compromised without affecting participation.
Blacklocke, Sean and Ben Dziegielewski, "The U.S. Environmental Protection Agency's Water Quality Trading Policy: New Opportunities for Environmental Advocacy Groups?" *Watershed Update*, 2005, 3(1).	This article describes the debate among environmental advocacy groups over use of water quality trading as a tool to address pollution in public waters.	Some environmental advocacy groups do not endorse EPA's water quality trading policy because of concerns about the development of "hot spots," the potential for environmental justice conflicts and a belief that trading is inconsistent with the polluter pays principle. The article indicates that political resistance can be a significant barrier to more widespread acceptance and implementation of EPA's water quality trading policy.	There is no clear consensus among environmental advocacy groups concerning EPA's water quality trading policy; some groups support it while others oppose it. It is reasonable to believe that environmental groups would eventually purchase and retire surplus water pollutant reduction credits if trading were scaled up.
King, Dennis, "Crunch Time for Water Quality Trading," *Choices*, 2005, 1st Quarter, pp 71-75.	This article examines current economic and regulatory disincentives that have frozen many water quality trading initiatives (especially those involving non-point sources) in a pre-trading stage of development.	The article argues that demand for credits among point sources is limited by a lack of strong enforcement of discharge limits, which makes the cost of not complying lower than the cost of complying by purchasing credits. Supply of non-point source credits is limited by farmers' concerns that demonstrating low-cost reductions of non-point source pollutants may bolster the case for stricter regulation of runoff from agricultural land.	Bolstering the supply and demand for water quality markets will require stronger enforcement of individual pollutant allowances and meaningful penalties for exceeding them, for both point and non-point sources.

CITATION	DESCRIPTION	WATER QUALITY TRADING BARRIERS IDENTIFIED	KEY CONCLUSIONS/RECOMMENDATIONS
Fisher-Vanden, Karen, et al. (Dartmouth College), *Water Quality Trading and Offset Initiatives in the U.S.: A Comprehensive Study*, 2004.	This report summarizes 46 individual water quality trading initiatives in the U.S., including state-wide policies and recent proposals at the time of the report's release. For each trading initiative or state-wide policy reviewed, the report describes program background, structure of trades, and program outcomes.	The report identifies barriers specific to each individual trading initiative or policy; it does not include a discussion of the barriers to water quality trading in general. The most commonly identified barriers include (1) insufficient credit supply and demand by point sources in the absence of strong regulatory drivers, (2) lack of credit supply by non-point, agricultural sources concerned they would be making a case for future regulation and (3) availability of low-cost control technologies for meeting discharge limits.	This report does not provide recommendations or draw conclusions from the individual program reports.
U.S. EPA, *Water Quality Trading Assessment Handbook*, November 2004, accessed at: http://www.epa.gov/owow/watershed/trading/handbook/ .	This handbook outlines an assessment process that watershed stakeholders can use to evaluate the viability of watershed-scale trading conducted in the context of a TMDL or equivalent framework. The factors considered in the assessment process include pollutant suitability, financial attractiveness, market infrastructure, and stakeholder readiness.	The Handbook identifies several factors that can determine the success of watershed-scale trading, such as: (1) the existence of a single pollutant in common form, (2) alignment of potential excess pollutant reductions with the reduction needs of credit purchasers, (3) watershed conditions (such as proximity of dischargers, presence of tributaries, or complexity of hydrology) that allow for reliable relationships between load reductions and water quality in receiving waters, (4) alignment of the timing of dischargers' compliance deadlines and seasonal variability in discharge quantities, (5) the incremental costs of trading relative to the incremental costs of other control options, (6) selection of an appropriate market structure for transacting trades, (7) non-point source concern that the monitoring requirements will be a precursor to additional regulation, and (8) stakeholder concern that trading reduces the degree of certainty in meeting water pollutant reduction targets and may create "hotspots."	In order to establish successful, large-scale water quality trading, it is important to carefully evaluate key conditions such as pollutant suitability, economic viability and financial attractiveness, feasible market structures, and stakeholder readiness. If evaluation of these factors indicates a particular watershed has limited or no potential for large-scale trading, smaller scale trading such as site-specific offsets and intra-plant trades may be viable options.
King, Dennis M. and Peter J. Kuch, "Will Nutrient Credit Trading Ever Work? An Assessment of Supply and Demand Problems and Institutional Obstacles," *Environmental Law Reporter,* May 2003, pp 10352-10368, accessed at: http://www.envtn.org/docs/ELR_trading_article.PDF.	This article assesses whether the obstacles preventing nutrient credit trading involving non-point sources are supply-related, demand-related, or the result of institutional problems that inhibit buyers and sellers from consummating trades.	The authors argue that the primary obstacle facing nutrient trading programs is inadequate supply of and demand for nutrient credits. In cases where farmers are already receiving payments to implement low-cost BMPs, credits for trading must be generated from incremental higher-cost measures. In addition, supplying credits for trading draws regulatory attention to farmers' nutrient discharges and the costs of controlling them. Credit demand is limited by reluctance on the part of point sources to participate in a program that is perceived as unfair.	Promote market-style nutrient credit trading only in areas where favorable supply and demand conditions can be demonstrated. In order to stimulate demand, an increase in regulatory pressure on point sources is needed. To stimulate supply, a shift away from federal and state subsidies for implementing BMPs is needed.

CITATION	DESCRIPTION	WATER QUALITY TRADING BARRIERS IDENTIFIED	KEY CONCLUSIONS/RECOMMENDATIONS
National Association of Conservation Districts, *Water Quality Trading Non-point Credit Bank Model*, 2003, accessed at: www.nacdnet.org/resources/CITF/TradingBankModelPaper.doc.	This article outlines several factors that could present acceptance problems to buyers, sellers and the general public when water quality trading involves non-point sources implementing cost-shared BMPS. The article proposes a non-point source credit bank model as a component of a state cost-share program for addressing these concerns.	Barriers to the acceptance of non-point trading programs discussed in this article include: (1) lack of demonstrated success at improving water quality through trading, (2) a perception that selling credits for a cost-shared BMP for non-point sources is unfairly enriching those sources, and (3) concerns about high transaction costs associated with trades.	Establishing a water quality trading program that operates as a bank for non-point source credits within a state agricultural cost-share program would change these perceptions and present the best structure for channeling trading revenue to conservation measures.
Woodward, Richard T., "Structure and Practice of Water Quality Trading Markets," *Journal of the American Water Resources Association*, 2002.	This paper describes and compares four different market structures that have arisen in water quality trading: exchange markets, bilateral negotiations, clearinghouses, and sole source offsets. The California Grasslands Tradable Loads program is used as a case study to illustrate how a particular market structure arises (in this case, bilateral negotiations).	The paper argues that water quality trading, especially when it involves non-point sources, is often limited to bilateral negotiations because the credits being traded are generally non-uniform goods. Bilateral negotiations carry high transaction costs relative to other potential market structures that present a barrier to non-point source trading. High transaction costs are compounded by a need for extensive monitoring in non-point source trading since credits are often generated from implementation of BMPs, the effects of which must be verified.	Each market structure is appropriate in different settings. In developing WQT markets, regulators should keep in mind that the rules that are written will have important impacts on the structure of the market that results. This in turn will affect transaction costs, market efficiency and, in the end, the success of the program. Market structure should, therefore, be considered as part of the initial program planning.
Kerr, Robert L., Steven J. Anderson, and John Jaksch, *Crosscutting Analysis of Trading Programs*, Report prepared for the National Academy of Public Administration, 2000.	This study presents case studies of nine trading programs in air, water and wetlands that utilize three different market structures: cap-and-trade, open market and case-by-case approval. The study evaluates these programs to identify factors that make trading effective and account for differences in the use of trading in water, air and wetlands programs.	The authors conclude that progress in water quality trading has been limited by the Clean Water Act in that it (1) does not specifically authorize water quality trading, (2) requires pre-approval of changes to TMDL allocations, which confines trading to a "case-by-case system," and (3) requires pre-approval of permit modifications, which creates transaction barriers.	Congress should amend the CWA to (1) specifically authorize states to establish trading programs (2) specify that changes to TMDL allocations require no preapproval if the overall cap is met and (3) establish a basis for more flexible alternatives than case-by-case permit reviews and modifications.
Environomics, Inc., *A Summary of U.S. Effluent Trading and Offset Projects*, Report prepared for U.S. EPA, 1999.	This report summarizes 37 effluent trading and offset activities in the U.S. that occurred or were occurring between 1980 and 1999. A one-page overview of the key features of each trading or offset activity is presented.	The report identifies barriers specific to each individual trading initiative or policy; it does not include a discussion of the barriers to water quality trading in general. The most commonly identified barriers include (1) the ability to achieve low-cost pollutant reductions through traditional means, (2) agricultural non-point source concern that generating pollutant reductions may encourage regulations requiring load reductions, (3) operational issues such as determining the baseline for credit reductions or agreeing on trading ratios, and (4) the costs of studies to generate data for trading programs.	This report does not provide recommendations or draw conclusions from the individual program reports.

CITATION	DESCRIPTION	WATER QUALITY TRADING BARRIERS IDENTIFIED	KEY CONCLUSIONS/RECOMMENDATIONS
U.S. EPA, *Draft Framework for Watershed-Based Trading*, 1996.	This Framework is a companion to EPA's effluent trading policy and was developed to assist in evaluating and designing trading programs. It discusses how best to implement the Clean Water Act and EPA's regulations to facilitate trading in watersheds and how EPA intends to exercise its discretion in implementing its regulations.	The Framework addresses many factors that can create conditions that are unfavorable to trading, such as (1) a lack of cost differentials for pollutant reduction amongst dischargers, (2) transaction costs that are higher than cost savings from trading, (3) insufficient supply and demand (4) insufficient data to understand pollutant quantities and flows and to allow estimation of pollutant reduction and/or transaction costs, and (5) inadequate administrative arrangements to support trading.	Economic, regulatory, informational and administrative factors must all be carefully assessed to determine whether trading can be successful.
U.S. EPA, *The Benefits and Feasibility of Effluent Trading Between Point Sources: An Analysis in Support of Clean Water Act Reauthorization*, Report prepared by Industrial Economics, 1993.	This study reviews the theoretical benefits of water quality trading and assesses the extent to which trading between point sources might be employed to meet water quality standards. Based on interviews, public comments and a state questionnaire, the study also identifies potential barriers to implementing point source trading programs.	Potential barriers to implementation of point source trading programs discussed in this report include: (1) state agency concerns about insufficient resources for TMDL development, basin-wide permitting and increased permitting workloads, (2) lack of clear water quality standards for certain pollutants, (3) concern that the liability for trading participants for violations of trading agreements is unclear, (4) agency concern about increased legal challenges under a trading program, and (5) discharger concern about increased administrative burdens associated with permitting.	The lack of trading programs stems largely from implementation concerns. The potential benefits of trading (predicted annualized savings of $27,000 to $23 million per water body) are large enough to warrant efforts to encourage implementation of these programs. Efforts to encourage trading should focus on practical, "nuts and bolts" issues related to program design, implementation and operation, not on demonstrating the theoretical benefits of trading.

APPENDIX C

INTERVIEW GUIDELINES AND CROSSWALK WITH EVALUATION QUESTIONS

EXHIBIT C-1 INTERVIEW QUESTIONS ASSOCIATED WITH EVALUATION QUESTIONS[25]

EVALUATION QUESTIONS	PROGRAM-LEVEL INTERVIEW QUESTIONS				OTHER INTERVIEW QUESTIONS		
	PROGRAM COORDINATORS	PERMIT WRITERS	POINT SOURCES	NON-POINT SOURCES	ACADEMICS/ ECONOMISTS	NGOS	USDA
1) What are stakeholder attitudes towards water quality trading, and why?	1	1	1, 2, 3	1, 2	1	1	2
2) What are the location-specific conditions conducive to water quality trading?	2, 12	2, 3	2	1			
3) Have trading programs realized cost savings in meeting permit limits, and if so, how much?	8		4	3			5
4) What outcomes have water quality trading programs achieved?	3, 4, 5, 6, 7	5, 6			2	2	6
5) What are the educational, institutional, legal, technical, and economic barriers to water quality trading?	9	8	6, 7, 8, 9	5, 6, 7, 9	3, 4	3, 4	5
6) What effects do other federal and state programs, particularly those administered by USDA, have on water quality trading programs?	10, 11	9, 10		8			1, 5, 7
7) Do any environmental justice issues arise in the context of water quality trading? If so, how can they be addressed?	13					5	
8) Do any equity issues arise in the context of water quality trading? If so, how can they be addressed?	14		10		5	6	
9) How should EPA measure its own progress on water quality trading?	7				9	10	
10) Would more specific guidance or specific tools from EPA help state and local governments foster trading? If so, what kinds of guidance or tools are needed?	15, 16	12			6	7	6
11) What can EPA do to address legal, regulatory, or policy questions that impede trading?	17	13			7	8	
12) What can EPA do to create flexibility and incentives for states to support legal and enforceable water quality trading programs?	18	14					

[25] The numbers in the boxes correspond to questions in the interview guides for each individual stakeholder group.

EVALUATION QUESTIONS	PROGRAM-LEVEL INTERVIEW QUESTIONS				OTHER INTERVIEW QUESTIONS		
	PROGRAM COORDINATORS	PERMIT WRITERS	POINT SOURCES	NON-POINT SOURCES	ACADEMICS/ ECONOMISTS	NGOS	USDA
13) What can EPA do to support water quality trading among point and non-point sources?	16	12			6	7	6, 8
14) Have federal or state resources made a difference in establishing trading programs, or could they help make a difference?	19, 20	14			8	9	

PROPOSED INTERVIEW QUESTIONS

STAKEHOLDER GROUP	TOPIC AREA	INTERVIEW QUESTIONS
PROGRAM INTERVIEWEES		
Program Coordinator	General	1. Before considering your specific program, what are your general views on water quality trading? Do you view it as a tool within a regulatory framework? As a way of promoting voluntary stewardship? Or as something else? [1] [26]
	Background and Context	2. Please verify/update our understanding of the program: [2][27] ▪ When was program initiated? ▪ Who were/are the major participants? Did you initiate their involvement in the program or did they approach you? ▪ Other than the direct participants, who else was/is involved with planning and implementing the program? ▪ What are the focal pollutants? Why were they chosen? ▪ What is the system by which trades are implemented or negotiated (e.g., exchange, clearinghouse, bilateral, third party broker, offsets)? Are these procedures described in the permit or other document? • What location-specific factors led you to consider water quality trading? For example, was establishment of a TMDL for the watershed/waterbody instrumental in motivating a trading approach?
	Success and Measurement of Outcomes	3. Do you consider the program to be a success? Why or why not? [4] 4. Has the number of participants met with your expectations? What factors have affected the number of participants? [4] 5. How many trades have taken place to date (if relevant)? Does this meet with your expectations? What factors have affected the level of trading activity? [4] 6. How do you determine that overall effluent limits are being satisfied? For example, do you have specific data/models/assumptions you apply to characterize effluent reductions achieved by non-point source BMPs? [4] 7. Do you try to determine the extent to which the program has realized positive environmental effects (e.g., reduced concentrations of target pollutants in surface waters)? Do you track specific data to make this assessment (beyond normal water quality monitoring)? [4, 9] 8. Have you (or other program partners) evaluated the cost savings realized through the trading program (relative to conventional effluent permitting approaches, (e.g., technology, pollution prevention, recycle/reuse)? [3] If so, what have you found?

[26] Numbers in brackets refer to evaluation questions.

[27] IEc tailored these background and context questions to the specific program and to our understanding of it; for example, we asked: "We understand the Red Cedar River program was initiated in 1997; correct?"

STAKEHOLDER GROUP	TOPIC AREA	INTERVIEW QUESTIONS
	Barriers and Institutional Factors	9. In planning and implementing the program, did you encounter any significant institutional, legal, technical, or economic barriers? If so, how did you attempt to address these barriers? Have any proven to be an ongoing impediment to the program? [5] 10. Does the program require collaboration with other agencies (e.g., agencies implementing environmental, land use planning, or agricultural programs)? If so, how would you characterize these collaborations (e.g., straightforward or problematic)? [6] 11. Are there specific federal or state programs that either complement or constrain the implementation of the program? [6] 12. Was recruitment required to engage some program participant? If so, what arguments or incentives did you emphasize to secure their involvement? [2]* 13. Did any environmental justice issues arise in the context of your water quality trading program? For example, during the planning stage, were there any concerns for "selling the right to pollute" or creating pollutant "hot spots"? [7] 14. Did any equity issues arise in the context of the program (e.g., concerns over how to define eligible participants or concerns over paying non-point sources for improved pollutant control)? [8]
	EPA Role	15. Did you receive any federal (particularly EPA) technical support for this program? If yes, describe. Did you utilize any existing EPA guidance on water quality trading (e.g., the *Water Quality Trading Assessment Handbook* or the earlier *Draft Framework for Watershed-Based Trading*)? [10] 16. Are there additional tools or guidance materials that EPA could supply to foster water quality trading? [10] If so, what specific issues should these materials address? For example, are there ways that EPA could help facilitate trading among point and non-point sources? [13] 17. Are there actions EPA could take to help address legal, regulatory, or policy questions that impede water quality trading? In particular, are there measures EPA can take to help you demonstrate permit compliance? [11] 18. Are there reporting or procedural requirements that EPA could modify to create incentives for states to pursue water quality trading? [12] 19. Did you receive any federal (e.g., EPA) funding for this program? What about specifically earmarked state resources? Was this funding important to initiating and/or implementing the program? [14] 20. If additional federal funding were available, are there ways it would help expand or improve the program? If yes, how so? [14]

STAKEHOLDER GROUP	TOPIC AREA	INTERVIEW QUESTIONS
Permit Writer	General	1. What are your thoughts on trading as an approach for achieving water quality objectives? Do you see widespread opportunities for trading? [1] 2. What location-specific factors led you to consider water quality trading? Under what circumstances can water quality trading be part of the permitting process? For example, was establishment of a TMDL for the watershed/waterbody instrumental in motivating and allowing a trading approach? Similarly, were there aspects of the point source permit(s) that lent themselves to trading (e.g., a particular/common pollutant of interest)? [2] 3. In your view, what factors have influenced the success or lack of success of the program? [2]
	Procedures and Barriers	4. Does the permit specify the procedures and "ground rules" of the trading program? 5. How do you know if the program is improving water quality? In your assessment, has the program realized positive environmental benefits? [4] 6. How do you determine that overall effluent limits are being satisfied? For example, do you have specific data/models/assumptions you apply to characterize effluent reductions achieved by non-point source BMPs? [4] 7. Were specific trading ratios established for balancing reductions at one source with effluent from another? What analysis or assumptions did you use to establish trading ratios? 8. Were there aspects of the permit writing/negotiation that were problematic or time consuming? [5] 9. Are there specific federal or state programs that either complement or constrain the implementation of the water quality trading program? [6] 10. Does the program require collaboration with other agencies (e.g., agencies implementing environmental, land use, or agricultural programs)? If so, describe these collaborations. [6] 11. Has the program introduced new auditing requirements? For example, are there procedures for verifying that effluent controls (e.g., non-point BMPs) are implemented and properly maintained? Do you consider these auditing responsibilities manageable and reasonable?
	EPA Role	12. Are there tools or guidance that EPA could supply to encourage more widespread use of water quality trading? [10] If so, what specific issues should these materials address? For example, are there ways that EPA could help facilitate trading among point and non-point sources? [13] 13. Are there actions EPA could take to help address legal, regulatory, or policy questions that impede water quality trading? In particular, are there measures EPA can take to help programs demonstrate permit compliance? [11] 14. Are there work sharing arrangements, reporting or procedural requirements, that EPA could modify to create incentives for states to pursue water quality trading? [12,14]

STAKEHOLDER GROUP	TOPIC AREA	INTERVIEW QUESTIONS
Point Source	Background	1. How do you view water quality trading? As a tool within a regulatory framework? As a way of promoting voluntary stewardship? Or as something else? [1] 2. What was your primary incentive for getting involved in the water quality trading program? For example, was your participation motivated by a new wasteload allocation under a TMDL? Economic considerations? [1, 2] 3. Did you initiate the process of pursuing trading? Alternatively, were you approached by federal/state regulators about participating? [1] 4. Has the program been economically beneficial for you? (If the interviewee is a "buyer" of credits, have they estimated cost savings? If the interviewee is a "supplier" of credits, have they estimated net income?) [3] 5. Do you plan to continue participating in the trading program?
	Procedures and Barriers	6. What responsibilities do you have under the trading agreement? For instance, are you responsible for identifying partners? If you trade with non-point sources, are you responsible for certifying non-point source BMPs? How do these procedures work? Are you satisfied with these procedures or could they be improved? [5] 7. Has the program introduced new/additional reporting requirements for your facility? If so, are these requirements acceptable to you? Please explain. [5] 8. Were there aspects of the permit writing/negotiation that were problematic or time consuming for you? [5] 9. Do you have any insight as to why other point sources in the watershed choose not to participate in the program (if relevant)? [5]* 10. Do you see any equity issues in the context of water quality trading (e.g., concerns over payments for non-point source control)? [8]

STAKEHOLDER GROUP	TOPIC AREA	INTERVIEW QUESTIONS
Non-Point Source	Background	1. What was your primary incentive for getting involved in the program (e.g., potential for generating revenue, stewardship incentive, etc.)? [1, 2] 2. How was the program initially presented to you? For example, did you learn of it through a USDA extension agent or were you approached by water quality regulators? [1] 3. Has the program been economically beneficial for you? Have you estimated net revenue associated with your participation? [3] 4. Do you plan to continue participating in the trading program?
	Procedures and Barriers	5. Are you responsible for identifying and recommending BMPs, or is this handled by representatives of the point source or water quality agency? [5] 6. Do you consider the requirements for BMP design clear and reasonable? If not, how could they be improved? [5] 7. Do you have any responsibilities for certifying or monitoring BMPs? Do you find these requirements reasonable? [5] 8. Does your participation in the water quality trading program affect the benefits you receive under USDA programs? [6] 9. Do you have any insight as to why other non-point source managers choose not to participate in this program? [5]*

STAKEHOLDER GROUP	TOPIC AREA	INTERVIEW QUESTIONS
OTHER INTERVIEWEES		
Academic/ Economist	General	1. What are your general views on water quality trading? Do you view it as a tool within a regulatory framework? As a way of promoting voluntary stewardship? Or as something else? Do you see widespread opportunities for this approach? [1] 2. What is your overall impression of the achievements of existing water quality trading programs? [4]
	Barriers	3. To the extent that you see shortcomings in the water quality trading experience thus far, what do you believe are the contributing factors? [5] 4. Do you have any insight as to why potential participants (point and non-point sources) choose not to participate in water quality trading? [5] 5. Do you see any equity issues in the context of water quality trading (e.g., concerns over payments for improved non-point source control)? [8]
	EPA Role	6. Do you think that EPA should supply additional technical guidance to promote water quality trading, especially point/non-point trading? If so, why, and how would these materials help? [10, 13] 7. Do you have thoughts on what EPA could do to clarify legal, regulatory, or policy questions that impede water quality trading? [11] 8. If additional federal funding were available to promote trading, how would you recommend spending it? [14] 9. Can you suggest ways in which EPA could measure its progress on water quality trading? [9]

STAKEHOLDER GROUP	TOPIC AREA	INTERVIEW QUESTIONS
NGO/ Environmental Advocacy	General	1. What are your general views on water quality trading? Do you view it as a tool within a regulatory framework? As a way of promoting voluntary stewardship? Or as something else? [1] 2. What is your overall impression of the achievements of existing water quality trading programs? [4]
	Barriers	3. To the extent that you see shortcomings in the water quality trading experience thus far, what do you believe are the contributing factors? [5] 4. Do you have any insight as to why potential participants (point and non-point sources) choose not to participate in water quality trading?* [5] 5. Do you see any environmental justice issues associated with water quality trading, (e.g., "selling the right to pollute" or creating pollutant "hot spots")? [7] 6. Do you see any equity issues in the context of water quality trading (e.g., concerns over payments for improved non-point source control)? [8]
	EPA Role	7. Do you think that EPA should supply additional technical guidance to promote water quality trading, especially point/non-point trading? If so, why, and how would these materials help? [10, 13] 8. Do you have suggestions on steps that EPA could take to clarify legal, regulatory, or policy questions that impede water quality trading? [11] 9. If additional federal funding were available to promote trading, how would you recommend spending it? [14] 10. Can you suggest ways in which EPA could measure its progress on water quality trading? [9]

STAKEHOLDER GROUP	TOPIC AREA	INTERVIEW QUESTIONS
USDA	General	1. How would you describe USDA's general involvement and approach to water quality trading? [6] 2. What are your general views on water quality trading? Do you view it as a tool within a regulatory framework? As a way of promoting voluntary stewardship? Or as something else? [1] 3. Do you have any insight as to why some farmers choose to participate while others choose not to participate in water quality trading when offered the opportunity [5]? 4. Regarding USDA programs that fund BMPs: what funding is available? Does this funding reduce incentives to participate in water quality trading? [6]* 5. Does participation in a water quality trading program affect the benefits that farmers receive under USDA programs? If so, which programs? [5, 6]
	EPA Role	6. Do you think that EPA should supply additional technical guidance to promote water quality trading, especially point/non-point trading? If so, why, and how would these materials help? [10, 13] 7. Do you see differences in the way that USDA and EPA approach water quality trading? If so, please explain. [6] 8. Do you see potential for closer collaboration between EPA and USDA on water quality trading? What form might this collaboration take? [13]

* An asterisk (*) indicates lower-priority questions that could be eliminated if time constraints are a concern.

APPENDIX D

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