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Draft Framework for Watershed-Based Trading

Purpose of This Framework

This framework is a companion to the Environmental Protection Agency*s effluent trading policy and has been developed to encourage trading and assist in evaluating and designing trading programs. Specifically, the framework provides:

- Background on what effluent trading is and the benefits it offers.
- A series of conditions that are necessary for trading, including those which ensure protection of water quality comparable to the protection that would be provided without trading.
- A template of regulatory, economic, data, technical, scientific, institutional, administrative, accountability, and enforcement issues that facilitates identification and evaluation of trading opportunities.
- Worksheets/checklists to evaluate whether potential trades meet threshold conditions.

Who Should Read This Document

This framework provides information to help all stakeholders establish successful trading programs that are protective of water quality:

- **Local and national community groups—** Private citizens, environmental organizations, and chambers of commerce.
- **Members of the regulated and nonregulated community—** Municipalities, business, industry, commercial enterprises, and those engaged in land use activities that can affect water quality, such as agriculture and forestry.
- **Governmental organizations—** Local governments, state agencies, regional organizations, and federal agencies involved in protecting the environment.

This document provides a framework on how best to implement the Clean Water Act and EPA's regulations to facilitate trading in watersheds. It also provides information to the public and regulated community on how EPA intends to exercise its discretion in implementing its regulations. This framework is designed to implement the President's policy of promoting, encouraging, and facilitating trading wherever possible. The document supplements, but does not replace, any existing guidance. It is not a substitute for EPA's regulations, nor is it a regulation itself. Thus, it does not impose legally binding requirements on EPA, states, or the regulated community. EPA may change this framework in the future, as appropriate.

For additional copies of the framework, you can fax NCEPI at (513) 569-7186; you must specify the publication number and title. Copies of the framework are also available on disk in WordPerfect 6.1 format or can be accessed on the EPA Office of Water Home Page (Internet address: http://www.epa.gov/OW/watershed.)

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EXECUTIVE SUMMARY

Two intertwined ideas are embodied in this Draft Framework for Watershed-Based Trading*: (1) the preservation of water quality progress made since the 1972 Clean Water Act; and (2) the importance of addressing remaining water quality problems in a way that recognizes the financial consequences and impacts of water quality control decisions.*

Why Is EPA Publishing This Framework Now?

In response to President Clinton's *Reinventing Environmental Regulation* (March 1995), EPA is strongly promoting the use of watershed-based trading. Trading is an innovative way for water quality agencies and community stakeholders to develop common-sense, cost-effective solutions for water quality problems in their watersheds. Community stakeholders include states and water quality agencies, local governments, point source dischargers, contributors to nonpoint source pollution, citizen groups, other federal agencies, and the public at large. Trading can allow communities to grow and prosper while retaining their commitment to water quality.

The bulk of this framework discusses effluent trading in watersheds. Remaining sections discuss transactions that, while not technically fulfilling the definition of "effluent" trades, do involve the exchange of valued water quality or other ecological improvements between partners responding to market initiatives. This document therefore includes activities such as trades within a facility (intra-plant trading) and wetland mitigation banking.

Trading and Water Quality

Trading is not a retreat from Clean Water Act (CWA) goals. It can be a more efficient, market-driven approach to meet those goals. EPA supports only trades that meet existing CWA water quality requirements.

Similarly, support for trading does not represent any change in EPA's traditional enforcement responsibilities under the CWA. EPA encourages innovation in meeting water quality goals but will not depart from its enforcement and compliance responsibilities under the CWA. Trades that depend on fundamental change in EPA's enforcement and compliance responsibilities will not be allowed.

EPA encourages trades that will result in desired pollution controls at appropriate locations and scales. Water quality standards must be met throughout watersheds. A buyer cannot arrange for reductions from a downstream discharger if violations of water quality standards would result. Generally, trades will shift additional load reductions to upstream sources. Thus, discharges will be reduced in the area between the sources.

Trading Provides Flexibility

Trading provides watershed managers with opportunities to facilitate implementing loading reductions in a way that maximizes water quality and ecological improvements. Managers can encourage trades that result in desired pollution controls, preferred reduction locations, and optimal scales for effective efforts.

Trading can fully use the flexibility of existing regulatory programs. The following examples illustrate this flexibility and demonstrate how trading can contribute to the cost-effectiveness of meeting water quality objectives.

- Selected publicly owned treatment works (POTWs) on North Carolina's Tar Pamlico Basin pay into a state fund that supports implementation of best management practices (BMPs) on farms. The plants achieve water quality goals less expensively than if each plant upgraded its facility independently.

- In a redevelopment area where space and cost constrain installing additional stormwater controls, the city of Tampa is considering collecting fees from developers and building a single facility that would control and treat more stormwater than feasible in the redevelopment area.

- To meet a nitrogen target, EPA's Chesapeake Bay Program considered whether several POTWs on a Chesapeake Bay tributary could pay others to install a higher level of technology than that required and thereby achieve the same water quality goal at a lower total cost than if each plant enhanced its own treatment. (To date, no trading program has developed.)

- A POTW in the western United States investigated the potential for some photofinishers discharging to the POTW to reduce their silver loading to zero in exchange for payments from others who would continue to discharge silver as a cost-effective way of meeting a new silver loading limit. It was thought that the photofinishers could meet the limit more cost-effectively as a group than if they acted independently. (To date, no trading program has developed.)

Trading Encourages Environmental Benefits

Regardless of who trades and how, the common goal of trading is achieving water quality objectives, including water quality standards, more cost-effectively. Some communities will use trading to meet their waterbodies* designated uses at a lower cost than the cost without trading. Other communities will use trading to expand a waterbody*s designated uses for the same amount they would have spent preserving fewer uses without trading. Communities can also use trading to maintain water quality in the face of proposed new discharges.

Trading might provide states and dischargers with new opportunities to comply with the anti-degradation policy. In the absence of trading, load increases for some of the nation's cleaner waters may be justified only on the basis of important social and economic growth. Trading provides an additional option for a new source, or a source proposing to add new pollution to a waterbody, to offset the new loading by arranging for pollution reductions from an existing source.

Trading can produce environmental benefits by accelerating and/or increasing the implementation of pollution control measures in a watershed. Sources have more flexibility in their selection of pollution controls when they also can consider options at other sources.

Where trading involves nonpoint source pollution reduction, it offers a mechanism to implement restoration and enhancement projects. Such projects improve water quality not only along chemical parameters, but also along physical parameters, such as temperature and flow, which can help preserve and expand designated uses. Moreover, such projects provide an array of other habitat benefits for aquatic life, birds, and other animals.

In particular, trading offers significant opportunities to expand nonpoint source pollution reductions beyond current levels. Point/nonpoint and nonpoint/nonpoint trading can facilitate nonpoint source reductions where they otherwise would not have occurred. In so doing, it can help address one of the sources of water pollution that is most persistent and difficult to reduce (economically, technically, and politically).

Beyond implementing trades, the process communities go through when they consider a trading option moves them toward more complete management approaches and more effective environmental protection. Identifying trading opportunities involves examining all pollution sources at once when evaluating technical and financial capabilities to achieve loading reductions. This brings regulated and unregulated sources together with other watershed stakeholders and engages them in a partnership to solve water quality problems.

The examples below illustrate some of the ways trading can provide environmental benefits.

- Four POTWs at Lake Dillon have the opportunity to purchase nonpoint source loading reductions and avoid more expensive plant upgrades. In addition, nonpoint sources sometimes may trade with other nonpoint sources to offset additional loading. Through the process of developing the trading program, the POTWs also identified inexpensive operational improvements. As a result, water quality standards are maintained.

- Boulder, Colorado*s POTW contributed funds to a riparian enhancement project on a nearby creek to alleviate ammonia problems, augment stream flow, and defer expensive plant modifications. Studies had shown that upgrades alone would be insufficient to reach water quality standards due to the degraded condition of the creek. Short-term results are promising for ammonia reduction, and the creek is receiving the ecological benefits from restoration.

- The State of Maryland accepts fee-based compensation for mitigation requirements if it determines that creation, restoration, and enhancement of small nontidal wetlands is not feasible. Fees are deposited into a trust fund that pays for larger restoration projects. The state believes consolidating otherwise small and isolated restoration projects into larger ones is a more environmentally effective approach to mitigation and water quality protection.

Economic Benefits of Trading

One of the most immediately visible benefits of trading is the money some sources save while meeting pollution control responsibilities. Sources that "sell" loading reductions can also benefit financially and can invest proceeds in research and development, for example, or use them to offset other costs.

These economic benefits reach beyond dischargers to consumers and communities. Trading can keep municipal wastewater treatment or stormwater utility charges from increasing as quickly or by as much as they might without trading. Trading also can keep costs to consumers down as industry and business save on pollution control costs.

The array of control options provided under trading often includes less expensive choices that can satisfy loading reduction responsibilities. Increasing the affordability of pollution control makes it possible for sources to achieve reductions more quickly and/or in greater amounts than without trading.

Reducing the total cost of achieving an environmental objective makes resources available for other uses. Industry may invest in research and development. Local government may invest in additional resource protection activities, or in community services such as education, welfare, and police protection.

Additionally, trading can facilitate economic development while protecting water quality. Some communities face growth constraints because nearby waterbodies already have water quality problems or could soon develop problems. Trading provides a mechanism for new and expanding sources to offset additional loading by obtaining reductions from other sources.

Who Might Trade?

Many sources or contributors to water pollution might consider trading. Point source dischargers, nonpoint sources, and indirect dischargers may all participate in trades.

Point sources are direct dischargers that introduce pollutants into waters of the United States. Examples of point sources include POTWs, private wastewater treatment facilities, industrial dischargers, federal facilities that discharge pollutants, active and inactive mining operations, aquaculture operations, and municipal stormwater outfalls (generally communities with populations over 100,000). Point sources are regulated under the National Pollutant Discharge Elimination System (NPDES) established under section 402 of the CWA. Many point source dischargers are required to comply with national discharge standards developed for industrial categories.

Indirect dischargers are industrial or commercial (i.e., nonresidential) dischargers that discharge pollutants to a POTW. Many indirect dischargers "pretreat" their wastewater prior to releasing effluent to POTW collection systems. Pretreatment includes pollution prevention and waste minimization practices, as well as on-site and off-site pollution control technology. Indirect dischargers are regulated under certain circumstances by POTWs according to CWA requirements. Many indirect dischargers also comply with national discharge standards developed for industrial categories.

Nonpoint sources are more diffuse, conveying pollution via erosion, runoff, and snowmelt to surface waters. Nonpoint sources also pollute groundwater via infiltration; this pollution can sometimes reach surface waters. Nonpoint sources include agriculture, silviculture, urban development, construction, land disposal, and modification of flow and channel structure. The CWA does not require federal controls for nonpoint sources. Instead, it requires that states, with EPA funding and technical support, develop and implement programs to control nonpoint sources.

Five Types of Trading in a Watershed Context

Generally, the term "trading" describes any agreement between parties contributing to water quality problems on the same waterbody that alters the allocation of pollutant reduction responsibilities among the sources. Such agreements also may include third parties, such as state agencies, local agencies, or brokerage entities. This framework groups trades into five categories:

1. **Point/Point Source Trading:** a point source(s) arranges for another point source(s) to undertake greater-than-required reductions in pollutant discharge in lieu of reducing its own level of pollutant discharge, beyond the minimum technology-based discharge standards, to achieve water quality objectives more cost-effectively.

2. **Intra-plant Trading:** a point source allocates pollutant discharges among its outfalls in a cost-effective manner, provided that the combined permitted discharge with trading is no greater than the combined permitted discharge without trading and discharge from each outfall complies with the requirements necessary to meet applicable water quality standards.

3. **Pretreatment Trading:** an indirect industrial source(s) that discharges to a POTW arranges for greater-than-required reductions in pollutant discharge by other indirect sources in lieu of upgrading its own pretreatment beyond the minimum technology-based discharge standards, to achieve water quality goals more cost-effectively.

4. **Point/Nonpoint Source Trading:** a point source(s) arranges for control of pollutants from nonpoint source(s) to undertake greater-than-required pollutant reductions in lieu of upgrading its own treatment beyond the minimum technology-based discharge standards, to achieve water quality objectives more cost-effectively.

5. **Nonpoint/Nonpoint Source Trading:** a nonpoint source(s) arranges for more cost-effective control of other nonpoint sources in lieu of installing or upgrading its own control or implement pollution prevention practices.

These categorizations are broad and might not reflect all possible trading combinations. As communities gain experience with trading and as EPA improves its understanding of the opportunities afforded by watershed-based decision making, the Agency will provide information about additional forms of trading**.**

Trading Arrangements

Trading arrangements can take many different forms. There are varying degrees of complexity related to the number of partners involved, the pollutant or reduction traded, and the form of the trade. Trading programs that involve point sources or indirect discharges require EPA's preapproval of trades.

Under trading arrangements, the total pollutant reduction must be the same or greater than what would be achieved if no trade occurred. A "buyer" and "seller" agree to a trade in which the buyer compensates the seller to reduce pollutant loads. Buyers purchase pollutant reductions at a lower cost than what they would spend to achieve the reductions themselves. Sellers provide pollutant reductions and may receive compensation.

Sources may negotiate trades bilaterally or may trade within the context of an organized program. Sources may negotiate prices or exchange rates for loading reductions themselves, or they may face those established by a market. A buyer and seller may be the only parties to trading, or third parties—public or private—may become involved.

The hypothetical examples below illustrate several of these possibilities.

- A food processor facing new reduction requirements (the buyer) contracts directly with another processor (the seller) to install additional new control devices to reduce the seller*s pollutant loads. The seller now maintains the level of control that provides the load reduction required of the seller as well as an additional load reduction credited to the buyer. The trade is incorporated into the NPDES permit and is approved by the permitting authority.

- Nonpoint source silviculture operations purchase "water quality improvement shares" from a nonprofit environmental organization. The organization uses the proceeds from the sale of shares to conduct stream and habitat restoration projects, which provide water quality improvements. The tree farmers receive pollutant reduction credits proportionate to their funding contribution to the water quality improvements.

More detailed examples of possible trading arrangements are provided in Chapters 5 through 8 of this framework.

Trading Mechanisms

EPA believes that two basic types of trading mechanisms exist if one of the trading partners is required to have an NPDES permit under section 402 of the CWA:

1. Trades can occur through development of a total maximum daily load (TMDL) or other equivalent analytical framework. A TMDL establishes the

loading capacity of a defined watershed area, identifies reductions or other remedial activities needed to achieve water quality standards, identifies sources, and recommends allocations for point and nonpoint sources. Parties to the trade then negotiate within the loading capacity determined under the TMDL.

Trades in the context of a TMDL can be between two or more partners, cover a range of geographic scales, and involve one or more remedial actions. Other analytical frameworks may be appropriate if, like TMDLs, they are approved by EPA. Analytical frameworks must link pollutant contributions to ambient conditions and determine the pollutant reductions needed from various sources to achieve water quality objectives.

2. Trades can also occur in the context of a point source permit. In this context, a permittee would arrange a trade with other sources of a pollutant, with approval of the permitting authority. Achievement of the required in-stream water quality would rely on the permittee meeting its limits and on actions by the trading partner. The permittee would retain the responsibility for achieving the required pollutant reductions.

In addition to direct trades between parties, trading partners could participate in public or private banks that could buy and sell pollutant reduction or other remedial action credits within a watershed. Each of these approaches works with individual buyers and sellers and public and private organizations.

Finally, any trading approach will rely on in-stream water quality data to help ensure that the trade is working as forecasted. Trading partners should be sure that the ambient monitoring necessary to evaluate the success or failure of the trade to produce the expected water quality impacts is part of any trading arrangement.

CHAPTER 1. INTRODUCTION

This framework provides readers with important questions that must be asked and answered to trade successfully.

Using This Framework

This framework supplements EPA's January, 1996 policy statement on effluent trading (Appendix A). It is intended to provide basic information to anyone interested in trading. Water quality managers, potential traders, environmental groups, and others will find assistance for identifying and evaluating trading opportunities. This framework can also be used as a resource when designing a trading project or program. Chapter 2, *Principles for Trading*, Chapter 3, *The Economics of Trading*, and Chapter 4, *Identifying and Evaluating Candidates*, are especially important for anyone reading this framework for the first time.

Chapters 5 through 8 describe several types of trading: point/point source and intra-plant trading, pretreatment trading, point/nonpoint source trading, and nonpoint/nonpoint source trading, respectively. These four chapters also address issues specific to each type in detail and are designed so they can be referenced individually. Regardless of your specific interest, a quick study of Chapters 5 through 8 will enhance your understanding of the concepts and issues presented in this framework.

Issues for the Future

This draft *Framework* will be a living document that EPA hopes will encourage innovation and open the door to new ideas.

Because the applicability of trading is so site-specific, this framework cannot solve all the implementation challenges that potential traders might face. EPA has tried to identify some areas where questions still remain. As you read this document, we hope you will consider the following:

- What type of analysis is sufficient to support a trading program?
- What has been/will be the impact on permit writers or POTWs from reviewing trades? What has been/can be done to minimize this impact or help defray any additional cost?
- When proposing new limits, what water quality-related information can be shared with industrial pollution sources that can lead them to initiate a dialogue to identify potential opportunities to trade?
- Who can help to broker the development of trading programs and/or the proposal of trades?
- Are there additional ways to ensure accountability is built into point/nonpoint source trades, beyond those discussed in Chapter 7?

- Are there any examples of local ordinances requiring nonpoint source controls that provide accountability/enforcement for point/nonpoint trades?

- Is the role of TMDLs sufficiently described in the document?

- Are there any examples of cross-pollutant trading that follow the principles presented in this document? (Please see Appendix B.)

- Are there other examples of effluent trading programs in place? (Please see Appendix C for a list of existing/proposed trading programs.)

- Can you identify specific locations (e.g., a watershed or sewer district) where trading could be applied or considered?

- Can you identify industries or facilities where intra-plant trading can be used or facilities that could use intra-plant trading to achieve water quality-based limits? (Please see Appendix B)

We would like to hear your comments, ideas, and suggestions on this draft. We especially invite you to share with us any experiences you might have had with trading in your own community as we develop the trading concept.

CHAPTER 2. PRINCIPLES FOR TRADING

The fundamental principle of trading within the Clean Water Act framework is that water quality standards must be met and technology-based requirements must remain in place.

Trading and the Clean Water Act

Proper design of a trading approach is essential for attaining environmental objectives. The applicability and usefulness of trading depend on water quality problems in a given area. Similarly, the benefits of trading tend to be site-specific in nature. For these reasons, trading is a tool that is most effective when well designed and administered when and where appropriate.

This chapter discusses ways in which trading can work. It is divided into two major sections: the first provides a brief overview; and the second discusses eight principles for trading. This chapter identifies statutory and regulatory requirements, analytical and planning constructs, and design and implementation considerations for effective trading.

Overview of Water Quality Rules and Management in the United States

The CWA is the backbone of water quality management in the United States. The act*s provisions and implementing regulations create a system to protect water quality and environmental health. A number of CWA provisions affect how trading can occur, including, water quality standards, effluent guidelines, and total maximum daily loads (TMDLs).

Water Quality Standards

Water quality standards consist of designated uses, numeric and narrative criteria, and antidegradation implementation policies.

Designated Uses. States designate uses (e.g., recreational contact, fishing, industrial discharge) for each body of water and establish water quality standards that protect, restore, and maintain designated uses.

Criteria. Water quality criteria, which describe the specific water quality conditions that will achieve designated uses, can be expressed in chemical, physical, or biological terms. Examples include: 10 mg/l BOD; 29E Celsius, indices of biological integrity, or narrative statements such as “no discharge of toxics in toxic amounts.”

Anti-Degradation Policy. The anti-degradation policy specifies that all existing uses of a waterbody must be maintained, whether or not they are designated uses. If the water is cleaner than necessary to support fishable/swimmable uses, that water quality must be maintained unless important economic and social goals dictate otherwise. A three-tiered anti-degradation policy is part of each state*s water quality standards:

- Tier 1: Maintain existing beneficial uses of surface waters and prevent degradation that could interfere with those uses.
- Tier 2: Protect water quality in “fishable/swimmable” waters (i.e.,

bodies of water in which water quality meets or exceeds the levels necessary to support (1) the propagation of fish, shellfish and wildlife and (2) recreation on and in the water).

- Tier 3: Provide special protection for "Outstanding Natural Resource Waters," such as waters of national or state parks, wildlife refuges, or other waters of exceptional recreational or ecological significance.

Effluent Guidelines, Categorical Pretreatment Standards, and Local Limits

To achieve water quality standards, governmental authorities typically rely on effluent guidelines, categorical pretreatment standards, and local limits for point sources and indirect dischargers, respectively.

A point source is any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, or vessel or other floating craft from which pollutants are or may be discharged.

The term "point source" includes stormwater discharges from municipal separate storm sewers generally serving communities with populations of greater than 100,000 and stormwater discharges associated with industrial activities, but does not include return flows from irrigated agriculture or agricultural stormwater runoff. Publicly owned treatment works (POTWs) are an example of a point source.

Indirect dischargers are industrial or commercial dischargers that discharge pollutants to a POTW. Many POTWs receive effluent from industrial and commercial sources that is indirectly discharged to waterbodies through the POTWs.

POTWs, other direct dischargers, and indirect industrial dischargers must meet national minimum technology-based effluent limits that EPA sets independent of receiving water quality.

Direct Dischargers. EPA has issued technology-based requirements for 51 categories of direct industrial dischargers, most of which are divided into subcategories. These "effluent guidelines" are based on assessments of the greatest degree of pollution control applicable technology can achieve that is economically achievable for the industry. In the case of POTWs, the national baseline is called "secondary treatment."

Point source dischargers are subject to a permitting system known as the National Pollutant Discharge Elimination System (NPDES). They receive NPDES permits from a permitting authority that reflect applicable technology-based requirements and any more stringent water quality-based effluent limits, along with monitoring and other requirements.

When technology-based requirements are not stringent enough for receiving waters to meet water quality standards, permitting authorities develop more stringent "water quality-based" effluent limits (WQBELs) that will result in the attainment of water quality standards. WQBELs are incorporated into point sources* NPDES permits. The process of establishing these limits varies across states and EPA Regions.

Indirect Dischargers. Pretreatment standards include specific pollutant discharge standards for 39 industrial categories, pollution discharge prohibitions for all indirect dischargers, and local discharge limits developed by POTWs for their systems. The national baselines for indirect industrial dischargers are called "categorical pretreatment standards." All indirect dischargers must comply with general prohibitions that address discharges that can cause pass through and/or interference, as well as specific prohibitions that address fire and explosive hazards in treatment works. Indirect dischargers are regulated by the POTW and do not require an NPDES permit themselves; they are required to meet applicable limits in accordance with pretreatment standards.

POTWs may develop requirements for indirect dischargers to supplement categorical pretreatment standards called "local limits." Local limits help POTWs ensure that they remain in compliance with their NPDES permits, as well as preventing indirect dischargers' wastestreams from interfering with plant operations or passing through POTWs untreated.

Diffuse Sources

The CWA does not regulate diffuse, or "nonpoint," sources through a federal permit program. Instead, it provides grants for states to establish plans for reducing pollution from nonpoint sources. Nonpoint source management plans must adhere to all applicable state and local regulations and policies.

Section 6217 of The Coastal Zone Act Reauthorization Amendments (CZARA) requires coastal states to provide for the implementation of nonpoint source management measures for land uses and critical coastal areas adjacent to impaired or threatened coastal waters. A variety of state laws and local ordinances also contain provisions that specify best management practices (BMPs) to control pollutants from nonpoint sources.

Total Maximum Daily Loads (TMDLs)

A TMDL is an analysis used to calculate the maximum pollutant load a waterbody can receive (loading capacity) without violating water quality standards. States are required to establish TMDLs for waterbodies where technology-based requirements alone are insufficient to attain water quality standards.

A TMDL includes allocations of pollutant loads among sources: wasteload allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources, background loadings from natural sources, and margins of safety to ensure achievement of water quality goals. The CWA requires that EPA review and approve TMDLs.

Anti-Backsliding Requirements

The anti-backsliding requirement of CWA section 402(o) generally prohibits reissuing a permit with a technology-based effluent limit that is less stringent than the existing technology-based limit. With respect to water quality-based effluent limits (WQBELs) the anti-backsliding clause in CWA section 303(d)(4) specifies that backsliding from a WQBEL can occur in only two situations:

1. Where a waterbody is not attaining its water quality standard, a limit may be relaxed only if a TMDL or WLA has been performed establishing a new limit and implementation of that

TMDL/WLA will ensure compliance with water quality standards.

2. Where a waterbody is attaining its water quality standards, a limit may be relaxed only if the requirements of the anti-degradation policy are being met.

Effluent Trading Principles to Meet Water Quality Objectives

To work within the framework of laws, regulations, and policies for attaining water quality in the United States, trading should follow eight principles:

3. Trading participants meet applicable CWA technology-based requirements.

4. Trades are consistent with water quality standards throughout a watershed, as well as anti-backsliding, other requirements of the CWA, other federal laws, state laws, and local ordinances;.

3. Trades are developed within a TMDL process or other equivalent analytical and management framework.

4. Trades occur in the context of current regulatory and enforcement mechanisms.

5. Trading boundaries generally coincide with watershed or waterbody segment boundaries, and trading areas are of a manageable size.

6 Trading will generally add to existing ambient monitoring.

7. Careful consideration is given to the types of pollutants traded.

8. Stakeholder involvement and public participation are key components of trading.

These principles are discussed in greater detail below.

Principle 1: Trading participants meet applicable CWA technology-based requirements.

Technology-based requirements are minimum national effluent standards imposed on POTWs and industrial dischargers by NPDES permits. These technology-based requirements, as defined by sections 301(b)(1), 301(b)(2), 304(b), and 306 of the CWA, establish the discharge standards to be achieved by all POTWs and designated categories of industrial dischargers. All dischargers must install appropriate treatment to achieve these required levels.

Implications for Trading

Establishing the principle that *all* trading partners meet applicable technology-based requirements preserves minimum levels of water quality protection mandated by the CWA. It also promotes fairness by allowing only those sources which have already met a baseline contribution to water quality protection efforts to benefit from trading. The result of implementing this principle is that sources that meet technology-based requirements may trade to achieve any more stringent water quality-based requirements.

Since national minimum standards are expressed as limits on the amount of a pollutant that can be in the effluent a facility discharges, it is not possible to arrange for comparable pollution controls at another source. This is why all traders must first meet technology-based requirements.

Principle 2: Trades are consistent with water quality standards throughout a

watershed, as well as anti-backsliding, other requirements of the Clean Water Act, other federal laws, state laws, and local ordinances.

Water quality standards articulate water quality goals. Standards comprise designated uses, water quality criteria, and an anti-degradation policy. Control mechanisms used to meet the goals include TMDLs, WLAs, LAs, WQBELs, other NPDES permit provisions, BMPs, and other local ordinances related to water quality protection. Regulatory agencies vary control mechanisms as necessary to achieve water quality objectives.

Implications for Trading

Similar to applying Principle 1, applying Principle 2 ensures a certain level of water quality prior to implementation of a trading program and promotes fairness by allowing only those sources which meet baseline requirements to benefit from trading.

Specific implications of Principle 2 for trading include:

- Trades must not produce water quality effects that constrain designated uses for a waterbody.
- Traders or administrative authorities must be able to demonstrate that trades will ensure attainment of water quality standards throughout the watershed.
- No trader may discharge a higher level of pollutants than what is specified in permits or rules.
- Trading cannot result in a reissued permit that has less stringent limits than the original permit except, in the case of a water quality-based requirement, where the new limit is covered by a TMDL or is consistent with the anti-degradation policy.
- Traders must comply with assigned WLAs and LAs, although trading may help to develop those WLAs and LAs as part of a TMDL.
- Prior to trading, traders should comply with BMP requirements, if applicable.

To avoid double counting, pollutant reduction credits associated with federal requirements are not available for trading. For example, reduction credits from new or revised effluent guidelines or BMPs required by the Coastal Zone Act Reauthorization Amendments (CZARA) cannot be counted again in a trade.

Trades may not shift pollutant load reductions within a watershed in such a way that water quality standards are attained at the downstream end of the watershed while causing standards to be violated within an upstream portion of the watershed.

An agency reviewing a trade should ensure that the pollution reductions required of a source reflect a margin of safety that is proportional to the uncertainty associated with load reductions over large spatial scales and is adequate to ensure that the reductions will actually attain water quality standards throughout the trading area. Complex issues of flow, hydrology, pollutant degradation, and related matters should be evaluated over a potentially large watershed.

Regulators can incorporate Principle 2 in trading programs by modifying or revising existing control mechanisms such as TMDLs, WLAs, LAs, WQBELs, and other NPDES permit provisions in a way that allows trading and is consistent with the CWA.

Principle 3: Trades are developed within a TMDL or other equivalent analytical and management framework.

Based on section 303(d) of the CWA, states establish TMDLs for waterbodies, or portions of waterbodies, where technology-based requirements alone are insufficient to attain water quality goals. TMDLs provide estimates of pollutant loadings from all sources, include a margin of safety, and predict resulting ambient pollutant concentrations. Data from a TMDL can be used to forecast how changes in various discharges will affect water quality.

Other analytical frameworks may be sufficient for trading purposes if they are approved by EPA. These analytical frameworks should also be able to determine the desired ambient condition, link pollutant contributions from sources to ambient conditions, and predict the effects of pollutant reductions from different sources on in-stream water quality. Examples of other appropriate frameworks include Lakewide Area Management Plans (LaMPs) and Remedial Action plans (RAPs), used in the Great Lakes.

In cases where a TMDL has already assigned load reductions, trades can occur in the context of a point source NPDES permit. With the permitting authority's approval, a permittee would arrange a trade with other sources of a pollutant.(See Principle 4.)

For pretreatment trading, the appropriate analytical framework is called the Maximum Allowable Headworks Loading (MAHL). A POTW determines the MAHL for specific pollutants, while preventing indirect dischargers' wastestreams from interfering with plant operations or passing through POTWs untreated. The POTW also determines the Maximum Allowable Industrial Loading (MAIL), which is the total daily mass that the POTW can accept from all permitted industrial users.

Implications for Trading

TMDLs and similar water quality management approaches provide a basis for successful trading for two reasons:

- TMDLs allocate pollution control responsibilities among covered dischargers using a process that can be easily adapted to incorporate trades.
- Data and analyses generated in TMDLs typically enable water quality managers to better understand and predict general effects of proposed trades.

The TMDL process establishes the baseline pollution reduction responsibilities necessary to achieve designated water quality standards. This provides a starting point to compare the costs of the baseline responsibilities necessary to achieve alternative allocations that also meet water quality goals. In this way, TMDLs facilitate identification of the economic and water quality benefits of various allocations of pollutant reduction responsibilities.

Trades can be incorporated into TMDLs in two ways. If sources are contemplating trading when a TMDL is being developed, final allocations can reflect traded loading reductions. This approach resembles a negotiated allocation process.

If sources begin considering trading after a TMDL is already in place, states may revise allocations to reflect proposed changes in load reduction responsibilities, i.e., trades. Such revisions may involve reopening NPDES permits or otherwise defining responsibilities for specific dischargers. The cost to the permitting authority should thus be considered in any trading program. Revisions to TMDLs require EPA review.

When a TMDL assigns pollutant reduction responsibilities to a nonpoint source, there must be reasonable assurance that nonpoint source controls will be implemented. "Reasonable assurance" generally means that the proposed nonpoint source controls are (1) technically feasible, (2) specific to the pollutant of concern, (3) to be implemented according to a schedule and within a reasonable time period, and (4) supported by reliable delivery mechanisms and adequate funding. Examples of reasonable assurance include state regulations or local ordinances, performance bonds, memoranda of understanding, contracts, or similar agreements.

Principle 4: Trades occur in the context of current regulatory and enforcement mechanisms.

All point source dischargers, regardless of involvement in trading, must comply with the CWA. Regulatory authorities use enforcement procedures as a tool for ensuring compliance with NPDES permit requirements, which are derived to achieve water quality standards.

Many types of enforcement tools are available to water quality agencies. These tools can vary in intensity and breadth of application. Several examples are notice of violation or administrative order; civil action, including assessment of fines; assessment of criminal penalties, including substantial jail sentences; and revocation of discharge permit.

Water quality agencies cannot use these enforcement tools unless individual dischargers are subject to and aware of specific requirements. These requirements are defined in the water quality regulations rules and management mechanisms (e.g., Clean Water Act, NPDES permits, local ordinances) discussed at the beginning of this chapter.

For nonpoint sources, some state regulations and local ordinances establish guidelines for selected nonpoint sources that are similar to technology-based requirements. Typically, states and localities specify several BMPs for each nonpoint source category as minimum measures to protect water quality. Jurisdictions require nonpoint sources to select options that offer economical pollution control given the characteristics of the land and the environment. (Jurisdictions "recommend" BMPs when commitments are voluntary.)

Implications for Trading

Trading should not lessen accountability for achieving water quality objectives. Trades must rely on existing regulatory and enforcement mechanisms where appropriate. For example, all trades involving point source dischargers should be reflected in a revised or reissued NPDES permit for each point source. A trade implemented through a permit is not a basis for extending the compliance period that would otherwise apply to the point source under a non-trade permit. Point sources are to meet compliance schedules as they would if no trade had been approved.

EPA anticipates that parties to trades will need to work with federal, state, tribal, and/or local regulatory entities on a case-by-case basis to ensure an appropriate level of accountability and enforceability in a trading arrangement. These entities can help traders incorporate traded pollutant loading reduction responsibilities into current regulatory and enforcement mechanisms.

Principle 5: Trading boundaries generally coincide with watershed or waterbody segment boundaries, and trading areas are of a manageable size.

Most detailed analyses of waterbodies that provide baseline data for trading programs examine entire waterbodies or defined segments of waterbodies. EPA and state water quality agencies use various systems that assign waterbody identification numbers to specific hydrologic units. These units, often called segments, have been delineated based on hydrologic features, such as the presence of a dam, the confluence of two rivers, or gradations of salinity in an estuary. Division of waterbodies into segments helps define where selected discharges are most likely to affect the water quality. Ideally, these segments comprise all land and water within the confines of a drainage.

Implications for Trading

Matching geographic trading areas with appropriate hydrologic units helps ensure that trades meet and maintain water quality standards throughout a trading area and in downstream or contiguous areas. For pretreatment trading, the trading boundary coincides with the collection system for an individual treatment plant.

Trading can involve shifting some amount of pollutant loading reductions from one location to another. A new location could be 100 yards away, across a lake, or half a mile upstream. Thus, selecting trading zone boundaries entails delineating the watersheds or segment(s) that might be affected by a set of dischargers.

Establishing the principle that trading boundaries and watershed or segment boundaries coincide ensures that the parties to a trade are affecting the same waterbody or stream/river segment. Implementing this principle protects the waterbody as a whole and guards against having adverse localized effects or specialized local problems, such as poor mixing.

The most appropriate hydrologic unit, and therefore geographic area, for trading depends on site-specific hydrogeologic conditions: water chemistry; ecological parameters; and the location, number, and types of sources. Often trading zone boundaries coincide with watershed or segment boundaries developed in TMDLs. These boundaries should be of a manageable size to ensure that assessments are reliable.

Delineation of these boundaries can vary for different pollutants, particularly those for which effects depend on biological or chemical processes that occur after the pollutant is discharged (e.g., decay rates). With such pollutants, shifting discharges from one point source to another can change the location of key downstream impacts.

The definition of a trading boundary also is affected by the governing body or management structure of the trading program. The trading boundary should prevent localized problems that could occur if trading boundaries overlap for different trading programs or kinds of trading.

Consider, for example, a situation where point/point source trades are beneficial across three segments, but point/nonpoint source trades are beneficial in only one segment. As a result, trading area sizes might vary from program to program and might involve any number of segments.

Principle 6: Trading will generally add to existing ambient monitoring.

Availability of data is important to all parties involved in maintaining water quality. Access to data on water quality and changes that result from pollutant loads allows analysts to evaluate proposed methods of meeting water quality standards.   Most of the data necessary to conduct such evaluations will need to be collected through ambient water quality monitoring. Such monitoring may be conducted by government agencies, pollutant dischargers, or other groups, using approved sample collection, analysis, and reporting methods.

Implications for Trading

An assessment of trading water quality impacts may involve water quality analysis and modeling. The data needed depend on the sophistication of the analysis, the pollutant(s) involved, and the nature of the receiving water. Three general categories of data are necessary to support trades:

- Current water quality conditions.
- Predicted effectiveness of pollution reduction options.
- Assessment of trading results.

Data describing current water quality conditions help evaluate types and levels of water quality improvements necessary to meet and maintain water quality standards. Together with data on current loadings and facility-specific information, regulatory authorities use water quality data in the TMDL and NPDES permitting processes to establish wasteload and load allocations and effluent limits that will yield in-stream pollutant concentrations that meet applicable water quality standards. Data also are needed to verify that trading obligations have been met and to build technical credibility. To evaluate the potential impact of trades on water quality, it is necessary to understand the probable effects of various pollutant load reduction options.

Predicting effectiveness involves obtaining data on factors present in the trading area that are not strictly related to water quality. Spatial (where), temporal (when), chemical (pollutant type/form), weather pattern, and geographic (e.g., slope, soil type) characteristics all can affect the level of pollution control achieved by trading. The necessary level of detail will vary depending on the complexity of the waterbody system and type of analytical techniques used.

Once trades are initiated, ongoing ambient and effluent monitoring data are needed to determine whether trades are meeting and maintaining water quality standards and whether traders are meeting applicable limits. As trading occurs, managers can conduct periodic evaluations to determine whether program design or administration adjustments are warranted.

Principle 7: Careful consideration is given to types of pollutants traded.

Different pollutants have specific chemical characteristics that interact with receiving waters and affect water quality in unique ways. A given pollutant*s effect on water quality depends on numerous factors, such as the source of discharge or the weather. Some pollutants can collect in receiving waters in relatively large quantities without causing ecological damage, whereas small quantities of other pollutants can be quite harmful. In addition, a pollutant that generates no harmful impacts in one area within a waterbody might generate harmful local effects in another area.

Implications for Trading

Selecting pollutants that are eligible for trading has implications for meeting water quality goals and avoiding unnecessary risks to ecological health. Localized effects of pollutants are a particular concern for trading programs.

Trading often changes the location in a watershed or segment where pollutant loading reductions occur. Thus, while some locations might receive smaller pollutant loads, other locations might not receive the additional reductions they would have received without trading. Analysis of such trades, including the potential impacts of spatial or temporal variations in loadings, is necessary to avoid localized violations of water quality standards. Further assurance is obtained by performing a site-specific cross check, ensuring that water quality criteria are met at the point where they apply.

Ensuring that water quality standards are attained throughout a trading area is easier for some pollutants than for others. Nutrients, for example, might be less likely to create serious localized effects. On the other hand, it could be difficult to prevent local violations of water quality standards when trades involve certain toxic pollutants.

When trading facilitates reduction of toxics, it could be valuable. The appropriateness of trading toxics, however, is dictated by the nature of the pollutants considered and site-specific conditions. For toxic pollutants that are persistent and bioaccumulative in nature, it might be inadvisable to supplement regulation of toxic pollutants with a trading option.

EPA does not currently envision a situation in which "cross-pollutant" trading could work under current regulatory conditions and technical limitations. Most (if not all) trades to date have involved the same pollutant, such as nitrogen for nitrogen or phosphorus for phosphorus. A few communities are considering trading involving different pollutants, such as nitrogen for phosphorus or nitrogen for zinc. (See Appendix B.)

Sufficient data are often unavailable to enable assessment of the impacts of different pollutants, and therefore the relative value of pollutant load reductions. Without such assessment, though, water quality managers are unable to predict the effects of trading. In the future, in cases where environmental benefits can be thoroughly demonstrated, EPA will consider the use of cross-pollutant trading.

Principle 8: Stakeholder involvement and public participation are key components of trading.

Trading brings watershed stakeholders—regulated sources, nonregulated sources, regulatory agencies, other interested organizations, and the general public—together and engages them in a partnership to solve water quality problems. All stakeholders, including partners to a trade and waterbody beneficiaries, can benefit from their involvement in trading processes.

Trades draw on the expertise and local knowledge of stakeholders to ensure that trading projects have their support. A trading option can serve as a consensus-building exercise, leading to more cooperative, comprehensive solutions. Such solutions can provide benefits that might not have been captured in a traditional regulatory approach, such as increased identification and control of cumulative effects (e.g., habitat degradation).

Implications for Trading

The Clean Water Act or EPA regulations require public notice and comment procedures or a hearing where trades involve point sources, NPDES permits, TMDLs, and other CWA programs.   State and local authorities also can implement public notice and participation procedures for proposed trades that do not involve point sources.

Stakeholder involvement and public participation in trading educate the community about the cost savings and environmental benefits obtainable through trading. They also educate those managing a trading program about concerns of the general public. Trading can build new alliances both among stakeholders and between stakeholders and the general public. These groups might have had few prior opportunities to work together, especially where watershed approaches are new or absent. Thus, the process communities go through when they consider a trading option moves them toward better management approaches and more effective environmental protection.

Communities that design and direct innovative alternatives, such as trading, for achieving environmental goals can be rewarded with greater efficiency or effectiveness than that possible under current regulatory approaches. Continued progress in achieving environmental quality and economic development will depend on greater involvement of communities in designing local solutions to local problems. Such involvement and outreach also can lead to greater involvement in water quality improvement projects beyond the scope of initial trades.

CHAPTER 3. THE ECONOMICS OF TRADING

Relative costs and expected water quality improvements among available pollution reduction options are key indicators of whether ***economic incentives*** *make trading feasible and whether expected benefits are sufficient to sustain successful trading.*

Introduction

This chapter describes economic concepts related to effluent trading and economic conditions necessary to support trading. The chapter presents two major discussions: descriptions of potential cost savings from trading and factors that affect trading economics. Several hypothetical examples are used to illustrate major points and clarify how economic comparisons are key to successful effluent trading.

Cost Savings

Cost savings are the primary economic benefit of trading among pollution dischargers. Dischargers will be interested in trading if it represents a way for them to reduce their costs to meet environmental objectives. Where such savings are unavailable, interest in trading is likely to be weak.

Market entry and production expansion also generate economic benefits that can be captured through trades. Dischargers, therefore, also will be interested in trading when it allows location of a new enterprise or expansion of an existing one that would not have been possible without trades.

Understanding the source of cost savings and/or other economic gains to potential traders is essential for identifying and evaluating opportunities to trade. Buyers benefit by purchasing pollutant reductions from others that are less expensive than their own costs of reduction. Sellers benefit from payments they receive to reduce loads below their own requirements.

Comparing Costs

When considering trades, sources will compare the cost-effectiveness of achieving additional pollutant reductions with that of other sources. The cost-effectiveness of load reductions is typically described in terms of cost per mass unit of pollutants reduced, such as dollars per pound or dollars per kilogram. Each potential trading partner could have one or more options to achieve additional pollutant load reductions, and each option will have a specific level of cost-effectiveness. In their practical application, different options may be additive or mutually exclusive.

In evaluating trading opportunities, it is often convenient to analyze costs on a per unit of pollutant load reduction basis. Two different unit cost measures are widely used in economic analyses: (1) average cost—the cost per unit of reduction across all units; and (2) marginal cost—the cost of one more unit of reduction. Neither cost measure, however, is a perfect choice for evaluating trades.

The relevant unit cost for a proposed trade is the average cost of only the additional reductions. This measure is sometimes referred to as the *incremental cost*. In its practical application, incremental cost is a hybrid of average and marginal cost; it is calculated by dividing the total cost of additional reductions by the quantity of additional reductions. Costs of, and reductions from, any pre-existing treatment are not factored into this calculation.

In comparison, average cost, strictly defined, is calculated by dividing the total cost of all a source's loading reductions (existing and proposed) by the total quantity of reductions. This calculation will over- or under-estimate unit costs for additional reductions, depending on whether the average cost of pre-existing controls is higher or lower, respectively, than additional controls. In contrast, marginal cost, by definition, assumes that pollutant load reductions can always be implemented in small units, for example, a pound at a time. Because this frequently is not the case, marginal cost is often incalculable.

Focusing on incremental cost is consistent with the scale of control/reduction options available to most sources. Generally, pollution controls are feasible to implement in relatively large installments that reduce multiple units of pollutants. Point sources in particular tend to purchase additional loading reduction capability in large increments. For example, a wastewater treatment plant upgrade or plant expansion may be designed to treat millions of gallons a day. Many nonpoint sources also implement runoff controls and best management practices in relatively large increments for sizable areas of land.

In some cases, a point or nonpoint source may be able to achieve load reductions in smaller increments than discussed above, For example, a point source could increase the amount of chemicals it uses in its treatment process without investing in additional equipment; similarly, a nonpoint source could install another ten feet of vegetative buffer strip. In such instances, it might be possible to calculate a true marginal cost. Incremental cost calculations will be a practical approach for most trading situations.

Exhibit 3.1 provides a simple illustration of the incremental cost concept. A more formal explanation of the relationship of incremental cost to average and marginal cost is presented in Exhibit 3.2

In Exhibit 3.1, a point source has three options to achieve additional reductions (and the options are mutually exclusive):

EXHIBIT 3.1: INCREMENTAL COSTS

Option	Pounds Reduced	Total Cost	Incremental Unit Cost
A	100	$2,000	$20
B	150	$2,250	$15
C	200	$2,600	$13

The point source in Exhibit 3.1 could reduce its costs to achieve additional load reductions if reductions were available from another source at a lower unit cost. Alternatively, this point source might sell load reductions to other sources if it could get a higher price per unit than its incremental costs. For example, if its reduction requirement is 100 pounds and the market price for reductions is $18/lb, it could select Option C and sell the additional 100 pounds to other sources at a profit of $5/lb.

Dischargers* motivation to trade will be strongest when the potential cost savings (economic benefits) associated with trading are high. Cost savings are achievable

EXHIBIT 3.2: WHY FOCUS ON INCREMENTAL COSTS?

Average cost (AC) is defined as the cost per unit of reduction, and marginal cost (MC) is defined as the cost of one more unit of reduction, where the unit is very small (even infinitesimally small). Their relationship to total pollution control costs (TC) and pollutant loading reduction quantities (Q) is described below (where AC and MC are cost functions and ∂ indicates a partial derivative):

1. $AC = TC / Q$

2. $MC = \partial TC / \partial Q$

The ability to calculate marginal cost assumes a continuous cost function representing cases where it is possible to continuously achieve pollutant load reductions on a unit-by-unit basis. This assumption does not always hold. Many pollution control options, in fact, are more accurately represented by step-functions, where marginal cost is undefined at some points and can be equal to average cost at others.

For this reason, focusing on the incremental cost of additional pollutant load reduction options will facilitate practical application of the concepts discussed in this framework to real-world trading opportunities. Incremental cost is defined as the *average cost of the additional incremental reductions,* as compared to the average cost of the overall total reductions achieved. This incremental cost computation is similar to a marginal cost computation where the unit of change is defined as a measurable unit (i.e., not very small), such as the units of additional load reductions achieved by an option.

when unit costs differ among dischargers. These cost differences can arise for a number of reasons. For example:

- The incremental unit cost of pollution control often *increases* as levels of control become more stringent and more sophisticated and expensive technologies are required to reduce pollutant loadings further. A discharger might be able to reduce the first 1,000 kg of pollutant from its effluent stream for $50 per kg, while reduction of the next 100 kg is $100 per kg, and reduction of another 100 kg costs $1,000 per kg. Thus, dischargers with varying levels of on-site control mechanisms may have different unit costs of pollution control.

- Economies of scale also result in different unit costs across sources. Economies of scale in pollution reduction occur when average unit costs *decrease* as the volume of effluent treated increases. For example, a source that treats extremely large quantities of effluent might have low unit load reduction costs compared to sources with smaller discharges to treat.

Differences in unit costs among pollution sources help identify potential trading opportunities. An important motivating factor for participation in trading, however, is the magnitude of cost savings that dischargers can realize. Therefore, potential traders will want to identify both the differences in unit costs across sources and the total amount of pollution reduction that can be traded across these sources.

Exhibit 3.3 illustrates how differences in unit load reduction costs provide an incentive to trade.

EXHIBIT 3.3: POLLUTION REDUCTION COSTS WITHOUT AND WITH EFFLUENT TRADING—A HYPOTHETICAL EXAMPLE

Lake Aqua, a popular recreation spot, has exhibited a steady decline in water quality over the past several years. Local fishermen indicate that catch rates have decreased in recent years. The State Department of Environmental Quality has conducted a water quality study revealing high nutrient levels, especially nitrogen (N). In fact, nitrogen levels in the lake exceed acceptable standards as defined by state statutes. The water quality study also determined that nearly 100% of nitrogen loadings into the lake are discharged from two sources, Mammoth, Inc. and the Spruce Wastewater Treatment Plant (WWTP). In response to this problem, the local water quality district has determined that nitrogen discharges into Lake Aqua must be reduced by 200 kg *per day*. The local water quality district divides responsibility for pollution reduction equally across both sources.

Mammoth, Inc. and Spruce WWTP have different unit load reduction costs. Spruce is able to remove nitrogen more cheaply because it processes much more effluent than Mammoth, Inc., resulting in an economy of scale. Unit load reduction costs for nitrogen are as follows:

Mammoth, Inc. = $30/kg
Spruce WWTP = $10/kg

In the absence of trading, Spruce WWTP and Mammoth, Inc. are each responsible for removing 100 kg/day of nitrogen from their own effluent streams. The chart below shows per day compliance costs for this scenario.

	Mammoth, Inc.	**Spruce WWTP**
Nitrogen Reduction Responsibility	100 kg/day	100 kg/day
Amount of N Removed In-House	100 kg/day	100 kg/day
Unit Load Reduction Cost	$30/kg	$10/kg
Compliance Costs Without Trade	$3,000/day	$1,000/day

Using a trading scheme, Mammoth, Inc. and Spruce can comply with the local water quality standards more efficiently. In the trade, Mammoth, Inc. purchases 100 kg of nitrogen reduction from Spruce WWTP for $20/kg. Thus, Mammoth, Inc. does not reduce its nitrogen discharge, and pays Spruce $2,000 to reduce its discharge by an additional 100 kg. This transaction is summarized in the table below.

Nitrogen Reduction Responsibility	100 kg/day	100 kg/day
Amount of N Reduced In-House	0 kg/day	200 kg/day
Unit Load Reduction Cost (N)	$30/kg	$10/kg
In-House Control Costs	$0/day	$2,000/day
Payment from Buyer to Seller	$2,000/day	$-2,000/day
Compliance Costs with Trade	$2,000/day	$0/day
In-House Savings from Trading	**$1,000/day**	**$1,000/day**

Watershed-wide Savings from Trading = $2,000/day

Factors That Affect the Economics of Trading

Several major factors can influence the economics of trading. This section examines the following factors, building on Exhibit 3.3 to illustrate key points:

- Trading ratios
- Transaction costs
- Uncertainty and its alleviation
- Number of trading participants
- Availability of cost data.

Trading Ratios

A trading ratio specifies how many units of pollutant reduction a source must purchase to receive credit for *one* unit of load reduction. Trading ratios incorporate one or more of the following scientific and policy principles:

- *Relative value*—Trading ratios can reflect the relative environmental benefit of reducing a unit of pollution from one source compared to another (or, conversely, the relative harm of not reducing a unit compared to another).

- *Address "leaks"*—Trading ratios can require buyers to offset the full water quality impact of their activities, for example when a residential development creates additional point and nonpoint source loadings.

- *Margin of safety*—Trading ratios can require buyers to purchase more units of reduction than they would have achieved without trading to account for uncertainties in the level of control needed to attain water quality standards, and to provide a buffer in case traded reductions are less effective than expected.

- *Differential water quality impacts*—Trading ratios can be set to achieve load reductions that maintain current water quality where improvements are not needed, or they can be set to improve water quality above a level that would have been achieved without trades.

Other important considerations include differences in location, timing, and/or chemistry of pollutant loadings that may be traded. These are discussed in more detail in Chapters 5 through 8.

Trading ratios affect the economics of trading primarily by changing unit load reduction costs and the prices negotiated for purchase of reductions. Ratios greater than 1:1 may raise trading costs to buyers and modify profits to sellers.

A ratio of 1:1 indicates an equal exchange between sources. In Exhibit 3.3, the trading ratio was 1:1, and Mammoth, Inc. paid Spruce WWTP to reduce 100 kg/day of nitrogen and received credit as if it had reduced 100 kg/day of its own nitrogen loadings.

As indicated above, there are several reasons for using a trading ratio other than 1:1. For example, a ratio of 2:1 could incorporate a margin of safety, while increasing that ratio to 3:1 could implement a net reduction strategy. In this case, the three units of reduction purchased for one unit of credit are considered as follows: the first goes toward the credit; the second provides a margin of safety for selling source reductions that are less certain than those from the buying source; and the third provides greater net loading reductions.

To analyze the economics of a specific trade, it is important to include the consequences of a mandated trading ratio. Exhibit 3.4 shows how a trading ratio can affect the economics of a trading situation.

Transaction Costs

Transaction costs are expenses for trading participants, including public and private participants and facilitators, that occur *only* as a result of trading. Examples of transaction costs include costs associated with:

- Identifying potential trading partners.
- Negotiations to implement a trade.
- Additional ambient water quality monitoring and analysis required for trading.
- Additional documentation of trading agreements.
- Government and/or private administration of trades.

Transaction costs normally affect trades by raising the effective price of pollutant reductions to buyers and/or the potential monetary compensation to sellers. Trading can at times reduce transaction costs for trading partners if environmental goals are achieved more quickly than without a trade. However, high transaction costs can also partially or totally offset cost savings associated with trading, thereby negating economic and environmental benefits that trading could otherwise achieve.

Trade administrators can take a number of steps to minimize transaction costs, including:

- Establishing information clearinghouses.
- Helping potential trading partners identify trading opportunities.
- Providing information about relative water quality impacts of pollutant load reduction options of eligible sources.
- Setting and communicating clear procedures and criteria for evaluating trades.
- Initiating trading programs in areas that have numerous water quality analyses and abundant data.

Administrative resources must be used effectively since the cost of such resources represents a transaction cost of the trading process. For example, although it is up to the sources involved to propose trading options, permits that include a trade may be more challenging to develop than permits without trades. Decisions on how increased costs associated with trading will be divided by the permitting authority and sources will vary. Governmental organizations have the capability to help minimize transaction costs. They can efficiently fold trading programs into other water quality programs that require similar administrative resources.

Evaluation of transaction costs for a trading opportunity requires careful consideration of costs associated with alternative actions. In some instances, administrative costs for conventional water pollution control can be higher than those from trading. All effects of trading on

EXHIBIT 3.4: THE EFFECTS OF A TRADING RATIO—A HYPOTHETICAL EXAMPLE

The local water quality district is interested in enhancing water quality in Lake Aqua to the greatest extent possible. Thus, it wants to use trading to increase water quality more than it could with conventional control methods. The district has investigated the potential cost savings to trading participants, and believes that savings will be quite high. Therefore, the district mandates a trading ratio of 2:1, whereby a buyer must purchase 2 kg of nitrogen reduction to receive credit for 1 kg of reduction.

Nitrogen discharges into Lake Aqua must be reduced by 200 kg per day. Mammoth, Inc. and Spruce WWTP are each responsible for reducing 100 kg/day of in-house nitrogen discharges.

In the absence of trading, Spruce WWTP and Mammoth, Inc. are each responsible for removing 100 kg/day of nitrogen from their own effluent streams. The chart below shows the per day compliance costs for this scenario.

	Mammoth, Inc.	**Spruce WWTP**
Nitrogen Reduction Responsibility	100 kg/day	100 kg/day
Amount of N Reduced In-House	100 kg/day	100 kg/day
Unit Load Reduction Cost	$30/kg	$10/kg
Compliance Costs Without Trade	$3,000/day	$1,000/day

Total Nitrogen Removed from Lake Aqua = 200 kg per day

Under the district*s trading scheme with a 2:1 trading ratio, Mammoth, Inc. and Spruce can comply with water quality standards more efficiently, and less nitrogen will be discharged into Lake Aqua. In the trade, Mammoth, Inc. purchases 200 kg of N reduction from Spruce WWTP for $13/kg. Thus, Mammoth, Inc. does not reduce its N discharge, and pays Spruce $2,600 to reduce its discharge by an additional 200 kg. This transaction is summarized in the table below.

Nitrogen Reduction Responsibility	100 kg/day	100 kg/day
Amount of N Reduced In-House	0 kg/day	300 kg/day
Unit Load Reduction Cost	$30/kg	$10/kg
In-House Control Costs	$0/day	$3,000/day
Payment from Buyer to Seller	$2,600/day	-$2,600/day
Compliance Costs with Trade	$2,600/day	$400/day
In-House Savings from Trading	**$400/day**	**$600/day**

Total Nitrogen Removed from Lake Aqua = 300 kg per day

Watershed-wide Savings from Trading = $1,000 per day

administrative and other costs should be considered to determine the net transaction costs associated with trading.

Exhibit 3.5 provides a numerical illustration of how transaction costs can affect a particular trade.

Uncertainty and Its Alleviation

Potential trading partners and other stakeholders might be uncertain about some elements of trading and therefore view trading as risky. Uncertainty can take many forms. Several examples are presented below.

- Potential traders might be concerned that a regulatory agency would annul a trade. An agency could conceivably do this if a trade produced lower loading reductions than expected or resulted in increased potential for ecological harm.
- Potential traders might question the longevity of a trading option, resulting in an unwillingness to make investment choices that rely on trading.
- Potential traders might be uncertain about the accuracy of data on pollution control costs.

Minimizing uncertainty encourages interest and participation in trades. Reduced uncertainty often translates into lower long-term transaction costs, fewer adjustments in costs to account for uncertainty, and increased potential for cost savings. Note that a particular action to reduce uncertainty might incur costs, and might itself be counted as a transaction cost while serving to reduce overall transaction costs.

Clearly specifying roles and responsibilities in permits, memoranda of agreement, contracts, and other trading documents helps reduce risk and uncertainty. Other tools such as performance bonds can supplement trading documents and further reduce risk and uncertainty. A performance bond is a sum of money set aside by a seller at the time of a trade. If the seller reduces the amount of pollution it sold in the trade, it reclaims the money and any interest. If the seller is unable to reduce its pollutant loading adequately, it loses the money to a pollution abatement fund or some other suitable recipient. Other methods for reducing uncertainty also can be used by trading programs.

Number of Trading Participants

The number of participants involved in effluent trading can change the economics of trading in several ways. The specific effects of increasing or decreasing the number of participants are completely dependent on the circumstances of a particular trading situation. Several general conclusions, however, can be made about the impacts of increasing the number of participants.

As the number of participants increases, the availability of information about water quality impacts is likely to increase, resulting in less uncertainty among participants. Increasing the number of participants also heightens the probability of sustaining a trading program over the long term. This increased probability is due to the fact that if several participants decide to withdraw from the program, enough participants will remain to continue trading.

Trading programs can attract more participants by fostering a cooperative atmosphere, choosing a market area that is large enough to sustain trading while meeting water quality objectives, and

EXHIBIT 3.5: THE EFFECTS OF TRANSACTION COSTS ON EFFLUENT TRADING—A HYPOTHETICAL EXAMPLE

Recalling from Exhibit 3.3, Mammoth, Inc. and Spruce WWTP are mandated by the local water quality district to reduce nitrogen loadings into Lake Aqua. This example shows how transaction costs affect the attractiveness of trading.

For this trade, Mammoth, Inc. and Spruce have calculated their respective transaction costs, including the costs of negotiation, administration, sampling, inspections, and documentation. The total transaction cost for each participant is estimated to be $1,000/day. A price of $20/kg was negotiated for the trade.

	Mammoth, Inc.	**Spruce WWTP**
Compliance Cost without trading	$3,000/day	$1,000/day
Nitrogen Reduction Responsibility	100 kg/day	100 kg/day
Amount of N Reduced In-House	0 kg/day	200 kg/day
Unit Load Reduction Cost	$30/kg	$10/kg
In-House Control Costs	$0/day	$2,000/day
Payment from Buyer to Seller	$2,000/day	- $2,000/day
Transaction Cost	+$1,000/day	+$1,000/day
Compliance Costs With Trade	$3,000/day	$1,000/day
In-House Savings from Trading	**$0/day**	**$0/day**

In the above example, trading is not economically attractive because total compliance costs with trading (including transaction costs) are the same as compliance costs without trading.

Now consider the following example. In this case, an information clearing house has been established, thus reducing the transaction costs associated with trading. Transaction costs are $750/day per participant.

	Mammoth, Inc.	**Spruce WWTP**
Compliance Cost without Trading	$3,000/day	$1,000/day
Nitrogen Reduction Responsibility	100 kg/day	100 kg/day
Amount of N Reduced In-House	0 kg/day	200 kg/day
Unit Load Reduction Cost	$30/kg	$10/kg

EXHIBIT 3.5: (CONTINUED)

In-House Control Costs	$0/day	$2,000/day
Payment from Buyer to Seller	$2,000/day	- $2,000/day
Transaction Cost	+$750/day	+$750/day
Compliance Costs With Trade	$2,750/day	$750/day
In-House Savings from Trading	**$250/day**	**$250/day**
Watershed-wide Savings from Trading	***$500/day***	

promoting information exchange. Developing interest in trading from numerous dischargers and obtaining the benefits described above can be especially important for a new trading program.

Availability of Cost Data

To assess effluent trading opportunities, potential traders need to know their own pollutant reduction costs. This information enables dischargers to determine whether they want to enter the market as buyers or sellers. It also enables them to estimate their potential cost savings or monetary compensation from trading using the methods described in this chapter. Dischargers can estimate their own pollution control costs in the absence of trading. Obtaining information on the costs of other dischargers could be more problematic. Information can be shared in several ways:

- A discharger can advertise that it wishes to sell pollution reduction credits at a specified price, thus providing necessary data for other potential trading participants.

- Public agencies and/or private organizations can assist potential traders by simply facilitating the flow of information. They can use public information outlets to suggest typical costs of compliance within the watershed.

- Regulatory agencies and/or private parties can take responsibility for the flow of information by facilitating operation of a market, including helping to track prices for trades.

It is important to remember that favorable economic conditions alone are not enough to promote effluent trading. Trading will not occur unless potential participants have access to necessary cost data and other relevant information.

CHAPTER 4. IDENTIFYING AND EVALUATING TRADING OPPORTUNITIES

*A **screening approach** helps water quality managers, dischargers, and other stakeholders apply Clean Water Act and economic principles in a systematic way to take advantage of options, such as trading, that meet water quality objectives and improve cost-effectiveness.*

Where to Begin?

Chapters 2 and 3 introduced a series of CWA principles and economic concepts that lay the foundation for successful trading— from a single trade to a watershed-wide trading program. The question remains: How can someone apply those principles to real-world situations and identify places where trading could be a viable option? And once such candidates are identified, how should someone go about evaluating how well site-specific conditions and program choices meet those principles?

A screening process helps stakeholders focus on make-or-break issues first—those conditions which are difficult to change or accommodate—before moving on to other issues. For example, if no potential trades can meet CWA principles, economic and administrative issues are moot. A screening process also groups related issues together to streamline consideration of many issues.

The exact order in which someone addresses relevant issues in a screening process beyond starting with a water quality standard depends on who potential traders are and what their interests and priorities are. For example, dischargers might start with a given water quality objective first, examine preliminary economic questions second, revisit water quality issues, and then conduct more detailed economic analysis, and so forth.

A screening process can be conducted in iterations to provide the level of analysis necessary for evaluative and decision-making purposes.

A Screening Process for Trading

Determining the potential for trading hinges on three major questions:

1. Are trades consistent with water quality and other environmental objectives?

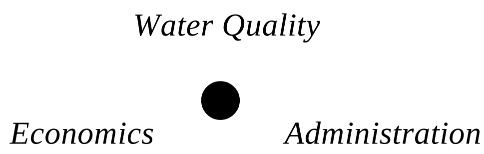
2. Will any potential trading partners benefit from trading?

3. Are administrative arrangements available to support trading?

Together, these questions form the basis of a screening process that can help identify and evaluate potential trading opportunities. Each of the CWA principles and economic concepts presented in Chapters 2 and 3 is represented in at least one of these questions.

Stakeholders first begin with a given water quality objective and then ask whether it is possible to reach that objective more cost-effectively. This approach represents a bottom-up development process that many existing trading programs and programs currently under consideration have followed.

In practice, the questions above can be conceptualized as points of a triangle:



After starting with water quality, the direction taken depends on who you are. Further, it might be necessary to go around the triangle (through the screening process) more than once to arrive at a final go/no go decision. The three issue sets described here are interrelated: how stakeholders answer and resolve any one set of questions affects, constrains, and creates opportunities for other issues.

This chapter provides two screening processes that help identify and evaluate trading opportunities. The first process is somewhat broad and can be used to streamline identification of viable trading opportunities. As described above, three broad levels of screening criteria can be used to identify and evaluate potential trading programs. Level 1 examines how trading will support water quality standards; Level 2 determines availability of economic benefits to trading partners; and Level 3 examines accessibility to administrative and institutional support.

The second process is essentially a checklist of threshold conditions that should be met for a trading program to succeed. Together, these screening processes also can be used to guide design of a trading program and to measure the probability of success.

Screening Level 1: Consistency With Water Quality and Environmental Objectives

The initial step is to determine whether a trade will support water quality objectives. Trading will be most attractive if (1) sources that already meet technology-based requirements are looking for an alternative way to meet more stringent water quality-based limits or (2) a number of sources are faced with further pollutant reductions to meet an in-stream water quality standard.

Clean Water Act provisions establish guideposts for trading that can be used to assess a proposed trading program*s consistency with the statute and regulations. Trading that is consistent with water quality standards generally meets the principles outlined in Chapter 2. The purpose of Screening Level 1 is to determine if and how these principles can be met.

Screening for consistency with water quality and environmental objectives can be accomplished in several ways, depending on available information. Three related screening tools are discussed below: (1) use of existing regulatory information (2) water quality monitoring data and simple analysis, and (3) more complex analysis and the use of computer simulation models.

After determining that a candidate for trading can satisfy CWA provisions, it is essential to note any adjustments in trading proposals that might be necessary to ensure compliance with the CWA. These adjustments should then be reviewed to ensure that economic benefits identified under Screening Level 2 are preserved.

Regulatory Information. A review of regulatory documents, such as NPDES permits, local ordinances, and compliance reports, helps determine whether technology-based requirements are in place where appropriate. The effective dates of enforceable requirements provide a context for evaluating where a potential trader stands with respect to applicable technology-based requirements. Permits and management plans usually indicate how long such enforcement mechanisms have been in place and when they are scheduled for review, renewal, or revision.

Reviewing the language and structure of such tools can help determine whether trading arrangements can be incorporated into existing enforcement mechanisms. This review also provides assurances that trades would be consistent with the anti-backsliding requirement. When regulatory documents and proposed trades are complex, discussions with appropriate permit writers and managers can clarify expected trading effects.

Data and Simple Analysis. Ambient and effluent water quality monitoring data and analysis can help determine if potential trades meet the principles outlined in Chapter 2. Where data and analytical tools are available, analysts can estimate impacts of reallocations of pollutant loading reductions or other water quality improvements in a manner that might occur under trading.

Various analyses can indicate what trades are likely to support water quality and enhance compliance with the anti-degradation policy. Analysis also can identify what types of trades might create localized effects and threaten ambient or local standards. Additionally, when assessing potential trades, dischargers* geographic locations should be identified, noting any special considerations, such as shallow streams, dissolved oxygen sags, or poorly mixed areas (e.g., embayments, lagoons).

Where ambient data are unavailable, or of suspect quality, it might be possible to identify and evaluate potential trading candidates using relatively simple calculations (e.g., mass balance). However, for trades involving nonpoint sources, it might be necessary to gather additional ambient data.

Complex Analysis and Models. While simple calculations using available data might be adequate, a variety of computer models are available to help understand the potential effects of trading on water quality (although some computer models might be too complex for screening purposes). Models are used to understand how pollutant loads and waterbody responses change with trades, considering spatial, temporal, and chemical parameters. In many cases, these models can provide the information needed to evaluate the compliance of trading actions with CWA provisions. More sophisticated analysis may be necessary where trading is considered for complex waterbodies, numerous potential traders, or pollutants for which precise safeguards are required. EPA*s *Compendium of Watershed-Scale Models for TMDL Development* (EPA 841-R-92-002, June 1992) provides detailed information on available models.

Screening Level 2: Economic Benefits to Trading Partners

As described in Chapter 3, cost savings are a primary attraction to trading among sources of pollution. Dischargers will be interested in buying or selling water quality improvements when such transactions reduce their costs to meet environmental objectives. They also will be interested if trading allows expansion of an existing facility or location of a new source that would not have been possible without trades. Where economic benefits are unavailable, interest in trading by pollution sources is likely to be weak.

To determine if dischargers might be interested in trading, stakeholders might want to estimate a unit load reduction cost for each potential trader. A list of these costs can provide a range of cost reductions. The size of unit cost differences among potential traders is a good indicator of the strength and stability of economic benefits from trading. Another useful indicator is the magnitude of cost savings that dischargers can realize. Therefore, stakeholders in trading should estimate the total amount of pollution reduction that can be traded among dischargers. This estimate, along with information on unit costs, can be used to compute the total cost savings available from trading.

If it is not possible to obtain preliminary estimates of incremental unit load reduction costs, stakeholders may examine many other characteristics of potential traders that indicate differences in unit costs. Several such characteristics are listed below.

- *Potential traders are numerous*—The probability of finding dischargers with different unit load reduction costs increases as the number of dischargers increases.

- *Potential traders treat varying amounts of effluent*—As discussed in Chapter 3, dischargers that treat larger amounts of effluent tend to have lower unit costs. Thus, if some dischargers treat different amounts of effluent than others, there are likely to be differences in unit costs.

- *Potential traders use different technologies to treat effluent (including older treatment equipment)*—Unit load reduction costs are dependent on the equipment and technology used to treat effluent. Usually, newer technology is more efficient and can achieve lower unit costs over the long term. Older treatment technologies, on the other hand, might be less efficient, resulting in relatively higher unit costs. Therefore, dischargers with different technology levels are likely to have different unit costs.

- *Potential traders treat effluent to different degrees*—As a discharger gets closer to removing 100 percent of a pollutant from its effluent, it is more likely to incur higher pollution control costs. In fact, the cost of pollution control tends to increase at an increasing rate the closer a discharger gets to full removal of a pollutant. Therefore, potential traders treating varying percentages of their pollutant loads are likely to have different unit load reduction costs (although similar facilities generally use similar technologies and treat to similar performance levels).

Screening Level 3: Coordination and Administrative Support

Where water quality objectives and economic benefits appear achievable, the last level of the screening process addresses the administrative feasibility of trading. Screening Level 3 asks the question: Do potential traders—public and/or private—have sufficient resources and a cooperative setting in which to administer a trading program? Important issues to examine are identified below.

- *Matching administrative capabilities to the scope of trading activities*—Careful attention should be given to matching the level of administration to the scope of trading. Overly complex or centralized administration establishes unnecessary technical and budgetary requirements that raise costs associated with participation. Alternatively, inappropriately weak or decentralized structures fail to provide necessary support and place a greater burden on participants to identify each other and establish trades. As the number of participants increases, trading might benefit from more formalized administration (which again, can be publicly and/or privately provided) that can provide clearinghouse and facilitation functions.

- *Information needs of participants*—When participants have adequate access to information about trading options and potential trading partners, cost savings can be maximized. Useful information relates to who is trading what, where and when, and at what price. Trade administrators should be able to facilitate information flow.

- *Institutional responsibilities*—Many organizations play a role in trading, necessitating clearly defined responsibilities. Assigning responsibilities requires creative use of existing institutional structures to maximize effectiveness and minimize the need for additional resources. Local institutions (public and/or private) are likely to be more effective than state or federal agencies alone for site-specific trading programs.

- *Consensus on the role of trading*—Achieving consensus is an important precursor to developing and implementing a trading program. Trade administrators should receive watershed-wide support for trading programs before development and implementation.

- *Tracking and documenting trades*—Trade administrators need to have the capability to track and document trades. Such capability is essential to ensuring compliance with traded responsibilities. Tracking also provides a storehouse of information that is important to potential traders. A number of options are available to conduct any necessary tracking. For example, trading parties and/or a regulatory agency could assume responsibility.

- *Ongoing monitoring*—In addition to tracking trades, administrators need to be able to track the impacts of trades on water quality. As discussed in Chapter 2, once trades are initiated, ongoing ambient and effluent monitoring data are needed to determine whether trades are meeting water quality standards and traders are meeting applicable limits.

- *Accountability and enforcement*—Organizations responsible for trading programs need to have access to enforcement mechanisms that allow them to uphold all provisions of the trading program and meet requirements of the CWA.

Template of Favorable Conditions

The three-level screening process described above can assist in determining whether a particular trading opportunity satisfies broad criteria for success. Moving from Level 1 to Level 3 sequentially provides an efficient way to screen out weak candidates and focuses attention on stronger ones.

Each broadly drawn criterion comprises several narrow, specific criteria. Many of these specific criteria represent CWA principles for trading identified in Chapter 2 and economic conditions described in Chapter 3. Others are separate conditions or situations that are important for successful trading. Together, these principles form a set of favorable conditions for trading. As more of these conditions can be met, a more solid opportunity exists to use trading as a cost-effective and ecologically sound water quality management tool.

These conditions can be incorporated into a screening process that may be applied to a potential trading program subsequent to the broad three-level process. The conditions might also serve as a valuable design checklist when preparing a trading program for implementation.

The conditions listed in the checklist below apply to all types of trading discussed in this framework. These general conditions provide a template that is the basis for the type-specific checklists provided in Chapters 5 through 8.

WORKSHEET FOR FAVORABLE CONDITIONS FOR TRADING

Legal and Regulatory Conditions	
General:	
• Is trading implemented within the context of Clean Water Act statutory and regulatory requirements ?	yes no
Specific:	
• Is trading consistent with applicable technology-based requirements?	yes no
• Are resultant conditions from trading expected to achieve water quality standards?	yes no
• Is trading consistent with the anti-degradation policy?	yes no
• Is trading consistent with anti-backsliding requirements?	yes no
Economic Conditions	
General:	
C Can dischargers save or make money by trading (i.e., are there economic incentives to trade)?	yes no
Specific:	
• Are total incremental costs for pollution reduction, which include direct incremental costs and transaction costs, different among dischargers?	yes no
• Do cost differentials among dischargers allow one discharger to reduce pollution more cheaply than another?	yes no
• Are transaction costs less than cost savings from the trade?	yes no
• Do cost savings from trading outweigh the uncertainty that dischargers face under trading schemes?	yes no
• Is there a sufficient supply of pollution reduction for sale, and a reasonable demand to buy reduction credits?	yes no
• Are potential aggregate savings to a trading candidate large enough to attract serious interest?	yes no
Data Availability Conditions	
General:	
• Are the data necessary to implement a trading program available or estimable?	yes no
Specific:	
• Are there are enough data to understand pollution quantities and flows within the watershed (e.g., have water quality authorities conducted a TMDL)?	yes no
• Can regulatory authorities monitor water quality across the trading area and points of discharge under trading?	yes no
• Can dischargers estimate their direct costs of reducing a specified unit(s) of pollution?	yes no
• Can dischargers estimate transaction costs that they would have to pay to conduct trades?	yes no

Administrative and Institutional Conditions	
General:	
• Are governmental authorities and potential trading participants capable of administering a trading program?	yes no
Specific:	
• Do governmental authorities have enforcement mechanisms to ensure trades are being implemented correctly and applicable limits are being met?	yes no
• Is information about trading partners readily available so that buyers and sellers can coordinate?	yes no
• Are responsibilities clearly defined for institutions and dischargers taking part in trading?	yes no
• Is the scope of administrative infrastructure compatible with the amount and complexity of the trading that is expected?	yes no
• Has the administering agency established who is accountable for implementing measures to reduce pollutant loading?	yes no
• Has the administering agency established who is accountable for water quality improvements?	yes no
• Is the agency that enforces trading provisions able to give necessary feedback to parties responsible for water quality?	yes no

CHAPTER 5. POINT SOURCE/POINT SOURCE AND INTRA-PLANT TRADING

***Point/point source trading** involves two or more dischargers, enabling one facility, in lieu of upgrading its own pollution controls, to arrange for greater than required controls at a second facility that can further reduce pollutant loads more cost-effectively. **Intra-plant trading** allows a single facility that maintains multiple outfalls to allocate pollutant discharges among them in a cost-effective manner.*

Introduction

Both point/point source trading and intra-plant trading involve trading between point sources. The Clean Water Act (CWA) defines a point source as "any discernible, confined and discrete conveyance ... from which pollutants are or may be discharged." Point/point trading involves two or more facilities, and intra-plant trading involves only one.

Point/point and intra-plant trading are unique among types of trading discussed in this framework in that all potential trading parties are subject to the same regulatory regime—National Pollutant Discharge Elimination System (NPDES) permits. As a result, many issues related to these trades are relatively straightforward and/or are addressed according to established protocols, compared to other types of trading. Nonetheless, site-specific water quality conditions and effluent characteristics of the particular trading partners involved will determine whether contemplated trades warrant any special considerations, analyses, or administrative arrangements to supplement NPDES permits.

Additionally, even though point sources are regulated by the same permit program, the cast of potential trading partners in any watershed or segment can be quite diverse. A watershed*s point sources could include discharges from municipal treatment plants, industrial facilities, federal facilities, active and inactive mines, and large concentrated animal feedlots, as well as any stormwater collected and discharged through a discrete outfall. The diversity of point sources in a watershed can create opportunities for trading, as illustrated in Exhibit 5.1.

Effluent characteristics, economic incentives, treatment options, financial capabilities, experiences with permit authorities, and/or familiarity with other

EXHIBIT 5.1: POINT/POINT TRADING SOUTH SAN FRANCISCO BAY

The San Francisco Regional Water Quality Control Board directed three POTWs and a stormwater management agency to negotiate how together they could achieve a 900-pound-per-year reduction in copper loadings needed to meet TMDL allocations. The 900 lb/yr reduction target exceeds reductions San Jose, Palo Alto, and Sunnyvale POTWs and the Santa Clara Valley Nonpoint Source Pollution Control Program have already achieved to meet their WLAs. The four parties will report back to the Board to specify how the additional reduction target will be met, including identifying specific responsibilities. Options include point/point trading between some or all parties.

Source: USEPA Region 9, personal communication, October 1995.

permittees will differ among point sources. When trading involves more than one type of point source, such differences might require some attention.

5.1 Regulatory Issues

Both point/point source trading and intra-plant trading may help achieve water quality standards when technology-based discharge limits are insufficient to do so. Under point/point source trading and intra-plant trading, all point sources would still meet technology-based requirements. The only instance in which EPA has authorized an intra-plant trade to meet technology-based requirements is in the iron and steel industry. (See Appendix B.) It is unclear whether future effluent guidelines will allow this form of intra-plant trading.

Beyond technology-based requirements, dischargers would be free to exchange pollution reduction requirements between outfalls, subject to criteria established by permit authorities. In point/point source trading, municipal and industrial facilities could buy and sell or otherwise exchange pollution reduction requirements, provided that resulting changes in allowable discharges are consistent with water quality standards and comply with the principles identified in Chapter 2. Revised limits are then incorporated into dischargers* permits by the permitting authority.

In intra-plant trading, a facility with multiple outfalls could negotiate revised permit limits with the permit authority, enabling it to allocate its total pollutant load across outfalls in a cost-effective manner while attaining water quality standards and complying with other trading principles.

As noted in the Executive Summary and Chapter 2, both point/point source trading and intra-plant trading take place within the context of the NPDES program. Like conventional NPDES permits, permits for point sources engaged in a trade contain specific effluent limits for each outfall. These limits must reflect the results of any trade.

In addition, terms of trades can be documented in the special conditions section of permits and incorporated into permit compliance schedules, though additional monitoring may be required. Incorporating results of trades into NPDES permits for each involved facility will ensure that permittees are clearly accountable for compliance. NPDES permits may be issued in the context of a total maximum daily load (TMDL). (The role of TMDLs in trading is discussed in more detail in Chapter 7.)

In addition to documenting trades in effluent limits, NPDES permits issued to point sources engaged in trades must be developed in a manner consistent with the anti-degradation policy and anti-backsliding requirements of the CWA. The implications of these requirements for trading are described below.

Anti-Degradation Policy

The extent to which point/point trading can enhance compliance with a state anti-degradation policy depends on whether receiving waters in question are Tier 1, 2, or 3. The implications of anti-degradation policies for trading also will depend on each state*s approach. It will be necessary to ensure compliance with the specific requirements of the state*s anti-degradation policy before enacting a trade.

- For waters where water quality is not better than fishable/swimmable (Tier 1), trading can be incorporated into the development of a new TMDL, providing a means of reducing pollutant loads, attaining water quality standards, protecting existing uses, and/or improving water quality to a Tier 2 level at less cost.

- For waters that are better than fishable/swimmable quality (Tier 2), point/point source trading might offer a means of accommodating important economic or social development and result in less degradation than a non-trading option, and/or provide other benefits to the community (e.g., lower wastewater treatment rates). In these areas, new dischargers could trade with existing dischargers to reach a cost-effective reallocation of pollutant loads.

- Similarly, for Outstanding Natural Resource Waters (Tier 3), trading might be the only means of accommodating new dischargers, provided that current high levels of water quality will be maintained.

Anti-Backsliding Requirements

CWA anti-backsliding requirements are met by point sources trading in waterbodies that are newly water-quality-limited, or where wasteload allocations (WLAs) are being revised downward. In such cases, point sources face loading reduction requirements above what they are already achieving. Point sources buying loading reductions could continue discharging at current limits with permits no less strict than those in place before trading. Point sources selling reductions end up with stricter limits.

The CWA, however, allows backsliding from a water quality-based effluent limit (WQBEL) in two situations:

1. Where a waterbody is not attaining its water quality standard, a limit may be relaxed only if a TMDL or WLA has been performed establishing a new limit and implementation of that TMDL/WLA will ensure compliance with water quality standards.

2. Where a waterbody is attaining its water quality standards, a limit may be relaxed only if requirements of the anti-degradation policy are being met.

Most trades will allow a point source to meet new pollutant reduction requirements more cost-effectively by arranging for treatment by another source. If a trade is implemented through a TMDL, a point source might receive a reduced WQBEL as a result of the trade. A reduced WQBEL would be part of a suite of pollution controls that would attain water quality standards.

Reopener Clause

As a further protection against the possibility that trading might cause adverse water quality effects, permitting authorities can invoke a reopener clause in any NPDES permit. This clause gives permit agencies the power to alter discharge limits at any time during the life of a permit if in-stream surveys, improved water quality modeling, or other factors indicate that a modification is necessary.

5.2 Economic Issues

The economic benefits of point/point source trading and intra-plant trading can be substantial. While experience to date with point/point source trading is limited, EPA estimates that potential pollution control cost savings associated with this form of trading might reach as high as $1.9 billion per year, according to an analysis of benefits and costs prepared for President Clinton*s Clean Water Initiative (USEPA, Office of Water, March 1994, EPA 800-R-002). Similar national estimates for intra-plant trading are not available.

Unit Cost Differences

Dischargers* motivation to trade will be strongest when the potential cost savings associated with trading are high. As discussed in Chapter 3, cost savings are possible when incremental costs of reducing pollution differ from source to source. In the case of point sources, differences in incremental costs might arise for a number of reasons.

Economies of scale—the tendency for average pollution control costs to fall as volumes of effluent to be treated increase—are one common factor. As noted in the introduction to this chapter, many types of point sources can exist within a watershed. Some types tend to discharge much greater amounts of effluent than others. For instance, a large wastewater treatment plant is likely to discharge higher volumes of effluent than a small paper mill. This situation creates opportunities to take advantage of economies of scale. The same situation also can exist for a single plant (i.e., intra-plant trading) in cases where a plant has outfalls that discharge varying volumes of effluent.

Another factor that is likely to create differences in incremental control costs is a tendency for the cost-effectiveness of pollution control to diminish as levels of control become more stringent and more sophisticated and expensive technologies are required. As a result, it might be more expensive per unit to reduce the effluent concentration of a pollutant from 2 mg/l to 1 mg/l than to reduce the concentration from 20 mg/l to 2 mg/l.

Potentially, point sources in a watershed differ significantly in the level of treatment currently achieved. Even though they all operate under the NPDES regulatory system, differences in technology-based requirements among different industries might result in different pollutant concentrations. Additionally, age of facility and treatment processes are factors in relative current pollutant loadings among dischargers.

Transaction Costs

As discussed in Chapter 3, transaction costs (the costs incurred in identifying potential partners, negotiating and documenting a trade, and soliciting and maintaining regulatory approval for a trade) can significantly affect trading. Methods available to reduce transaction costs can involve some level of governmental and/or private action (e.g., clearinghouse, facilitator). Since point sources are already regulated under the NPDES permit system, government agencies and industries may prefer a more market-like approach to trading that avoids significant government roles beyond the NPDES process.

Other Economic Considerations

A number of other economic considerations may influence point sources* interest in trading. Many point sources are profit-seeking businesses that work within the setting of the market economy. Given this setting, interest in trading might depend not only on the absolute magnitude of potential cost savings (net of all transaction costs), but also on the relative size of those savings compared to overall operating costs (e.g., total production costs for an iron and steel manufacturer). If the benefits of trading outweigh associated costs, but returns on investments in trading have little overall impact on a discharger*s total operating costs, the discharger might choose to devote its limited resources to endeavors that promise greater returns.

Further, trading programs might be most successful when they are organized to include a range of industries, or when neutral parties broker trades. Firms in the same industry could be reluctant to share sensitive information due to competitive pressures.

Point sources subject to financial regulations might face economic incentives for a particular trading scenario that are different from those of unregulated sources. An example of a financially regulated point source is a POTW that charges rates approved by a public utilities commission. Such POTWs undergo review processes in which commissions verify the authenticity of POTW-reported costs. The review process keeps POTW rates in line with costs.

Because such POTWs have to justify all costs and expenditures to be able to charge a given rate, they will want to discuss potential participation in a trading program with the appropriate utility regulator. Some rate boards might be averse to POTWs' participating in a new program such as trading; other rate boards might encourage trades if they are economically justifiable. Specific questions include whether a rate board would allow a POTW to pay another source for loading reductions credited to the POTW (POTW as buyer), and whether a rate board would allow a POTW to overcontrol and sell a portion of its additional reductions to other sources (POTW as seller).

For example, when EPA*s Chesapeake Bay Program identified potential point/point trading opportunities among six POTWs discharging to the lower Potomac River, several plants raised concerns about how they could incorporate trades into their capital planning process. Many operators felt that their rate boards and the public would view even a partial reliance on trading as risky, given the need to make financial investment decisions for future plant operations well in advance of an actual need for additional capacity or treatment capabilities.

5.3 Data-Related Issues

Dischargers and permitting authorities will be interested in obtaining a range of data in order to implement a trading program. To formulate a trading proposal, dischargers need information on current or proposed permit limits and pollution reduction goals; current pollutant discharges; and the cost, applicability, and effectiveness of alternative pollution control methods. To assess the acceptability of potential trades, dischargers also may want to evaluate potential effects of alternative discharge limits on water quality.

With the exception of cost data, permitting authorities will need similar information to evaluate proposed trades. Cost data may also be of value to permitting authorities if their interests include tracking the economic benefits of trading. This information might be particularly useful, for example, in documenting the accomplishments of an agency*s trading program and encouraging other agencies to initiate similar efforts.

EPA maintains a number of databases that can provide useful information in support of trading programs. For example, EPA*s Permit Compliance System maintains information on current pollutant loadings and permit limits. Similarly, the STORET system and EPA*s Waterbody System can provide information on water quality conditions, and the Agency*s Treatability Database is a source of data on applicable treatment technologies. These centralized sources might not, however, contain the most current information available or provide sufficient detail on site-specific conditions. Potential sources of more detailed and current information are described below.

Current or Potential Future Permit Limits

Some of the information that will support trading is readily available from public sources. For example, NPDES permits specify current permit limits, and information on these limits can be obtained from the permitting authority. Also, permitting authorities may publish documents related to TMDL development and proposed wasteload allocations that provide information on potential pollution reduction requirements beyond technology-based requirements and water quality impacts. More general data on applicable water quality standards should be available from the local permitting authority, the states, or EPA.

Loadings

Data on current point source loadings, like information on current or proposed permit limits, can usually be obtained from public sources—in this case, NPDES permittees* Discharge Monitoring Reports (DMRs). Dischargers typically file these reports on a monthly basis, providing data on effluent flows and the concentrations of each pollutant in their discharge that their permits require them to monitor. In some cases, DMRs might not include data on all pollutants of concern. Supplemental information might be obtained as part of the TMDL development effort or through special monitoring studies.

DMR requirements are a main difference between point/point and other types of trading with respect to data availability. DMRs provide by far the most complete pollutant release information in any medium and for any source. Furthermore, DMRs contain actual releases, rather than permitted releases, as some forms of reporting do. As a result, DMR provides a better picture of the real world than permits alone.

Control Options

Both dischargers and permitting authorities can obtain general information on the cost, applicability, and effectiveness of alternative pollution control methods from EPA effluent guideline development documents and similar sources, as well as from trade associations and other industry organizations. These sources, however, are designed primarily to provide rough estimates of the cost or effectiveness of alternative methods, not to provide detailed assessments for application to a particular facility. To avoid mischaracterizing the cost-effectiveness of control options available to them, dischargers or other interested parties can complete more detailed, plant-specific assessments before proposing a trade.

In conducting such assessments, dischargers are encouraged to consider pollution prevention practices as well as end-of-pipe treatment. In many situations, pollution prevention can be more cost-effective than end-of-pipe treatment in achieving pollution reduction goals. Facilities that explore pollution prevention opportunities might be better positioned to discharge at lower levels than those set in the NPDES limits they would have had in the absence of trading and to offer pollution reductions in trades with other dischargers. State and EPA regional pollution prevention coordinators might prove to be a good source of pollution prevention ideas.

Water Quality Impacts

An assessment of trading water quality impacts might involve water quality modeling and analysis. Data needed for such efforts will depend on the sophistication of the analyses, the pollutant(s) involved, and the nature of the receiving waters.

If trading is integrated into TMDL development processes, the analytic effort should be no different than that ordinarily required. If trades are negotiated following initial development of TMDLs, permitting agencies will likely evaluate proposed trades—or ask dischargers to evaluate proposed trades—using analytic techniques like those employed in developing the original TMDLs. If this is the case, data requirements for trading analyses should be similar or identical to those for the original TMDL efforts. Additional data should be necessary only if permitting authorities employ specialized approaches to analyze proposed trades.

Even so, several typical data gaps are notable and might necessitate special sampling. For example, despite an abundance of effluent data, little documentation of ambient water quality downstream from point sources exists. Additionally, mixing zone data are especially rare.

5.4 Technical and Scientific Issues

As noted earlier, technical and scientific issues facing point/point and intra-plant trading revolve around the fact that such trading produces additional load reductions at sellers* outfalls rather than at buyers' outfalls, where additional reductions would otherwise occur. As a result, assessing trading effects at the edge of mixing zones and downstream is a key part of any water quality analysis for trading.

Point source discharges must meet permit limitations. If the permit limit is based on the protection of the water quality rather than technology-based effluent guidelines, the limit is probably based on meeting water quality standards at the edge of the mixing zone. Mixing zone effects, as well as downstream effects, depend in part on spatial, temporal, and chemical differences between trading partners* loads.

Local Conditions

A key factor in evaluating trades is the need to ensure attainment of water quality standards and protect against adverse effects on the aquatic environment in the immediate vicinity of a point source outfall. This is a special concern in the case of pollutants that do not degrade or decay, such as metals, as well as with other pollutants that can bioaccumulate, with resulting toxic effects on aquatic life.

Careful analysis of such trades, including the potential impacts of spatial or temporal variations in loadings, will be necessary to ensure that the creation of local "hot spots" or "dead zones" is avoided. To facilitate this type of analysis, procedures for conducting local water quality evaluations can be based on those which permitting agencies currently employ in establishing water quality-based effluent limits (i.e., current state or regional policies on the use of mixing zones and the application of acute vs. chronic water quality criteria).

Spatial Considerations

The effect of trades on water quality will depend, in part, on where trading partners are located relative to each other in watersheds and segments. Distances between partners and existing water quality conditions (e.g., assimilative capacity, levels of non-traded pollutants) at, near, and between traders* outfalls are factors in how well additional reductions at sellers* outfalls will maintain or improve overall water quality in the area of concern.

Temporal Considerations

Many point source loads are relatively constant and predictable over time, as allowed by their NPDES permits. Among the different types of point sources, and even among same-type point sources, however, temporal characteristics of loads can vary dramatically. For example, loadings from combined sewer systems and sanitary sewers with inflow are highly influenced by rainfall. Feedlot and stormwater loadings also are weather-dependent. Loadings from other types of point sources, such as industrial dischargers and mining operations, can vary according to production cycles and processes. A given unit of pollutant will also have different water quality impacts, depending on the flow and temperature of receiving waters at particular times.

Several simple analytical techniques can help compare loads from different sources. Calculating daily, monthly, or annual average loadings (whichever period is most appropriate) is one approach. More sophisticated analyses involving time series data are also options. Such comparisons should factor in seasonal differences in loadings and/or assimilative capacity (e.g., dry seasons), as necessary.

Chemical Considerations

Chemical differences can exist between the same pollutant coming from different point sources. Point source pollutants typically reach waterbodies in dissolved form, but pollutants from sources where discharges have come into contact with land or other materials (including soils, asphalt, and other conveyances) might be attached or adsorbed to sediment. Such differences should be accounted for in water quality analyses conducted to support trading.

In reviewing proposed trades, permitting authorities might also need to evaluate the effects of trading arrangements on loadings of pollutants other than those explicitly traded, to ensure that no inadvertent violations of water quality standards result. For example, if trading of conventional pollutants shifts additional load reductions to a discharger whose effluent also contains certain toxics, the resulting effect on toxic loadings is worth examining. Permitting authorities can ask dischargers to reformulate trading proposals if the projected impact on other pollutants would threaten to violate permit conditions or water quality standards.

Addressing Considerations

A variety of tools are available to permitting authorities and dischargers to accommodate differences between trading partners* loadings and their effects on water quality. TMDL margins of safety, discussed in Chapter 7, are one approach. The use of trading ratios, introduced in Chapter 3, also can accommodate differences between loadings for the purposes of trading.

Trading ratios (also sometimes referred to as “offset ratios”) may be used to guard against the creation of hot spots, to provide a margin of safety against uncertainties in water quality modeling, or even to create a buffer to accommodate future discharge growth. It is important to note, however, that the use of trading ratios can dilute or possibly eliminate incentives to trade since the costs associated with achieving more stringent control through trading might outweigh potential cost savings that would otherwise be achieved. While permitting authorities can employ trading ratios in an effort to ensure that trades result in water quality improvements, they should recognize that stringent trading ratios might eliminate the potential economic benefits of trading.

5.5 Institutional Issues

Few, if any, institutional modifications for point/point source trading and intra-plant trading programs may be necessary. Both take place within the context of the existing NPDES program, which provides a well-established framework for interaction between the permitting authority and point sources that wish to participate in a trading initiative. In addition, the NPDES program provides established procedures for inviting environmental groups and other interested parties, including the general public, to comment on proposed permit conditions. These procedures can be employed to invite public review and comment on proposed trades.

The existence of a well-established institutional framework within which point/point source and intra-plant trading can occur simplifies the implementation of these types of trading programs. Nonetheless, permitting authorities might wish to modify current procedures to facilitate trading implementation. These modifications are likely to be modest when permitting authorities adopt informal trading programs, under which they encourage dischargers to propose alternative limits as an integral part of TMDL development processes.

As outlined below, the need for new procedures might be greater if permitting authorities choose to implement a more structured program for the review and approval of trades following initial development of a TMDL. Involving all interested parties—including dischargers, local government agencies, community and environmental groups, and the general public—in the development of these procedures will give trading programs the greatest possible chance of success.

5.6 Administrative Issues

The initial design of a point source trading program involves consideration of a number of issues. These include:

- The process by which the permitting authority establishes initial pollutant load allocations among contributing dischargers.

- Whether the permitting authority will require dischargers to employ trading ratios of greater than 1:1.

These issues are discussed in more detail below.

Initial Allocation

Trades should begin with identification of the pollutants of concern, the dischargers contributing to the pollution problem, and the total reduction in pollutant loads needed to meet water quality standards. This can be accomplished through the development of TMDLs and/or WQBELs. Once the state (or, if EPA disapproves the state*s TMDL, EPA) determines the TMDL for a specific pollutant, load reductions needed to reduce pollution to levels established in the TMDL are allocated among the contributing sources.

The initial allocation can have a significant effect on the economic positions of potential participants in a trade since it establishes discharge limits with which a source must comply if it cannot trade for additional discharge credits. All other factors being equal, the more expensive it will be for a source to comply with its initial allocation, the more the source will likely be willing to pay to acquire pollution reduction credits from other dischargers. Nevertheless, a discharger that can inexpensively comply with its initial allocation could be well-positioned to invest in additional pollution controls, thereby creating pollution reduction credits that it could trade to other dischargers.

Permitting authorities have several options in establishing an initial allocation prior to trading. From an administrative standpoint, a simple and equitable option is to allocate loads in a manner that is consistent with standard wasteload allocation procedures, such as requiring all dischargers to achieve a proportional reduction in current loads.

These procedures can vary significantly across states and EPA Regions. EPA*s *Technical Support Document for Water Quality-based Toxics Control* (EPA/505/2-90-001, March 1991) lists 19 allocation methods and indicates that regulatory agencies can apply any other strategy that meets applicable legal requirements. Under current practice, however, most states or EPA Regions allocate loads to dischargers using methods that impose similar effluent limits or require equivalent reductions in pollutant loads.

Based on initial allocations, the state can work with dischargers to determine if any point/point trades are appropriate.

Program Operation

Once the basic design of trading programs is defined, it will be necessary for permitting authorities to establish standard operating procedures. In particular, permitting authorities will need to establish conditions, standards, and procedures for:

- Submitting proposed trades for the authority*s consideration.
- Evaluating proposed trades.
- Establishing appropriate timeframes for review and approval/disapproval of proposed trades.
- Incorporating approved trades into permits and TMDLs.
- Ensuring public participation in trading program development and implementation.

For example, permitting authorities should specify information that dischargers will be required to include in trading proposals, as well as the form in which proposals should be submitted. In some situations, this may include asking dischargers to develop water quality analyses to support their trading proposals, and to provide documentation of approved analytic methods and results as part of their submission.

If permitting authorities make this request, they should identify in advance any recommended methods and standard assumptions (e.g., the minimum flow condition to be employed in evaluating achievement of water quality-based effluent limits). This will help to ensure that dischargers submit trading proposals that are well formulated and fully documented, and will facilitate the review of proposals by the permitting agency.

In addition, all parties will benefit if permitting authorities clearly define procedures and standards they will employ in evaluating proposed trades, including the methods by which they will verify results of dischargers* water quality analyses. If these standards and procedures are articulated clearly, both the dischargers* transaction costs and permitting authorities* administrative costs can be kept to a minimum. To the extent that permitting authorities incur additional administrative costs resulting from trading, they can examine opportunities to recover those expenses.

Trade Timing, Frequency, and Duration

An additional administrative issue is the establishment of conditions governing the timing, frequency, and duration of trades. One option that would help to reduce transaction costs is to tie trading to the permitting authority*s standard permit renewal cycle (e.g., every 5 years). This might be particularly attractive to permitting authorities that move toward watershed permitting strategies that synchronize the permit development process for all dischargers in a geographic region.

In addition, transaction costs may be minimized by tying the duration of trades to the duration of the involved dischargers* permits. Notably, the CWA currently prohibits permit terms of greater than 5 years. Granting trades the longest possible term would help dischargers to predict accurately the value of acquiring or selling discharge credits, and to make investments in pollution control accordingly.

As discussed in Chapter 2, trades may occur outside the TMDL process where permits are revised to adjust effluent limits and add permit conditions needed to comply with trading principles. Tying trading to a permitting authority’s standard permit renewal cycles offers advantages to both the permitting authority and dischargers. For this reason, EPA encourages dischargers interested in trades to submit proposals at least a year before their permit expires.

Consideration of trading proposals submitted in between permit cycles will be at each permitting authority*s discretion. Reopener clauses provide opportunities to accommodate dischargers that negotiate a trade after permit limits are issued by reopening participating dischargers* permits and incorporating revised limits. A disadvantage of this approach is the additional administrative burden on permitting authorities.

Nonetheless, the potential benefits of trading might justify the additional administrative cost. This could be particularly true if trading provides a means of accommodating growth, either to expand an existing facility or construct a new facility. In these circumstances, allowing expanding or new facilities to trade with dischargers that already hold permits might offer both a cost-effective means of controlling pollution and the regulatory flexibility needed to support regional economic growth, while still meeting the requirements of the CWA.

Steps to Encourage Trading

Permitting authorities or other groups can take a number of other steps to facilitate and encourage trading. For example, a permitting authority or third party could support the exploration of trading opportunities by forming a multiparty advisory committee or convening stakeholder forums. Alternatively, permitting authorities could take the lead by requiring negotiated solutions to pollution problems, which might include trades, as in the case of South San Francisco Bay (see Exhibit 5.1).

Actively engaging stakeholders at early stages will ensure that processes fairly consider all legitimate interests, fostering the development of trading proposals that are likely to receive broad support. In addition, the involvement of stakeholders might help to identify additional trading opportunities, and can provide a forum for identifying and overcoming potential obstacles to trading.

Another means of encouraging trading is providing dischargers with information relevant to possible trades. While most of this information is already publicly available, its organization into a useful and easily understood format would help dischargers that could legitimately benefit from trading to identify and pursue their opportunities more efficiently. For example, permitting authorities or interested third parties could develop and make available readily accessible databases listing point sources on a stream segment or within a potential trading zone, including data on the type and quantity of pollutants discharged, current or proposed permit limits, and relative water quality impacts.

The experience with tradable effluent allowances on the Fox River described in Exhibit 5.2 emphasizes the importance of designing a trading program in a way that will facilitate trades and what happens when a trading program is not well structured.

Permitting authorities also could provide information from past water quality studies that would allow dischargers to develop better trading strategies and improve the focus of their water quality analyses. Such information would save dischargers time and effort in investigating trading opportunities and identifying potential trading partners. Outside parties could also provide dischargers technical assistance in developing trading strategies. For example, an independent broker could work directly with a group of dischargers in performing a water quality study for a proposed trade or could act as an intermediary in negotiating a trading arrangement.

Steps like these could improve the efficiency of the negotiating process and further reduce transaction costs. While not essential in all cases, they could increase the likelihood that the potential benefits of

EXHIBIT 5.2: LEARNING FROM THE FOX RIVER EXPERIENCE

In a 1981 effort to reduce pollution in the Fox River, the state of Wisconsin initiated a point/point source trading program, focusing on the discharge of BOD by 15 industrial and 6 municipal facilities. A preliminary analysis suggested that trading of BOD allowances could lead to annual savings of up to $6.8 million. To date, however, only one trade has taken place, in which a paper mill closed its wastewater treatment plant and asked the state to shift its allocation to the municipal treatment plant that began treating its wastewater. The full predicted economic benefits of trading have not been realized.

Several factors might have limited the success of point/point source trading on the Fox River. For example, many of the industrial facilities eligible to participate in the program are paper mills. Competitive pressures within the paper industry might dampen willingness to trade between facilities. In addition, some researchers suggest that the potential cost savings from trading on the Fox River represent such a small share of total paper production costs (less than 1 percent) that corporations have little incentive to invest management time in negotiating trades. Moreover, Wisconsin staff believe that the facilities generally have been reluctant to "trade away" part of their BOD load allocation since many believe they will need the full allocation to accommodate future growth.

In addition to these factors, there are significant administrative impediments to trading under the Fox River program. In particular, dischargers are not allowed to trade unless they demonstrate need; i.e., they may trade if a plant is increasing production or is unable to achieve discharge limits using the treatment systems currently in place, but cannot trade solely to reduce treatment costs. Relaxing this constraint, as well as taking other steps to facilitate trading, could have had a substantial beneficial effect on the trading program.

Source: *The Benefits and Feasibility of Effluent Trading Between Point Sources: An Analysis in Support of Clean Water Act Reauthorization* , prepared for the Offices of Water and Policy, Planning, and Evaluation, USEPA, September 1993.

trading, both economic and environmental, would be realized.

5.7 Accountability and Enforcement

Incorporating results of point/point and intra-plant trades into NPDES permit limits ensures that permittees are accountable for compliance and creates a clear administrative mechanism for enforcement. Information on effluent limits that would have been issued without trading should be included in the fact sheet accompanying permits. As with any standard NPDES permit, permittees would be responsible for compliance with all permit conditions, including monitoring, record-keeping, and reporting. Violating permits might subject violators to administrative, civil, or criminal action. Exhibit 5.3 illustrates the development of a cumulative limit for a group of dischargers involved in a trade.

A potential concern of state and regional enforcement officials is that point source dischargers could prolong trading negotiations to postpone compliance with permit limits. To avoid this problem, permitting authorities can establish deadlines for trading proposals—for example, asking that a proposed trade be submitted for an authority*s review a year before an existing permit expires. If no proposal is received by the deadline, the permitting authority can begin standard review procedures for the purpose of issuing a new permit. The assurance that a conventional permit will be issued if trading negotiations become prolonged should provide an incentive for expeditious resolution of negotiations and a guarantee that dischargers will conduct such negotiations in good faith.

5.8 Worksheet/Checklist

The following checklist outlines key questions to consider in implementing a point/point source or intra-plant trading program.

EXHIBIT 5.3: USE OF THE BUBBLE APPROACH IN EPA REGION 2

For at least two waterbodies, Lake Champlain and Long Island Sound, EPA's Region 2 has established bubbles as part of setting discharge limits for selected point sources. Under this approach, New York State has issued nitrogen limits in permits for discharges within a defined geographic area—the bubble. A "group" permit contains a cumulative limit for all dischargers in the bubble, and individual permits contain limits for each discharger. As long as the cumulative limit is met, no action would be taken on individual performance. If the cumulative limit is exceeded, enforcement would be taken on a plant-by-plant basis based on the individual permits.

WORKSHEET FOR EVALUATING SUCCESS OF POINT/POINT SOURCE AND INTRA-PLANT TRADING

Legal and Regulatory Conditions	
General:	
• Will point sources and administrative agencies implement trading within the context of NPDES permits?	yes no
Specific:	
• Can point sources and administrative agencies include conditions in NPDES permits?	yes no
• Can administrative agencies specify effluent limits for each outfall, if necessary?	yes no
• Can administrative agencies include reopener clauses in permits to allow alterations to trading arrangements?	yes no
Economic Conditions	
General:	
• Can point sources save or make money by trading (i.e., are there economic incentives to trade)?	yes no
Specific:	
• Do point sources* total incremental costs for pollution reduction, which include direct incremental costs and transaction costs, differ among point sources or outfalls?	yes no
• Do cost differentials among point sources or outfalls allow one point source or outfall to reduce pollution more cheaply than another?	yes no
• Are transaction costs less than cost savings from the trade?	yes no
• Do cost savings from trading outweigh the uncertainties that point sources face under trading schemes?	yes no
• Is there a sufficient supply of pollution reduction for sale, as well as a reasonable demand to buy reduction credits among point sources?	yes no
• Are competitive pressures among dischargers subdued enough to allow trades?	yes no
Data Availability Conditions	
General:	
• Are the data necessary to implement a trading program among point sources available?	yes no
Specific:	
• Are there enough data to understand pollution quantities and flows within the watershed (e.g., water quality authorities have conducted a TMDL), including local impacts at specific outfalls?	yes no
• Can regulatory authorities monitor point source discharges and water quality under trading?	yes no
• Can point sources estimate their direct costs of reducing a specified unit(s) of pollution (direct incremental costs)?	yes no
• Can point sources estimate transaction costs that they would have to pay to conduct trades?	yes no

Administrative and Institutional Conditions	
General:	
• Are governmental authorities and point sources capable of administering a trading program?	yes no
Specific:	
• Do governmental authorities have enforcement mechanisms to ensure that point sources comply with NPDES permit conditions under trading arrangements?	yes no
• Is information about trading partners readily available so that buyers and sellers can coordinate?	yes no
• Are responsibilities clearly defined for institutions and point sources taking part in trading?	yes no
• Is the scope of the administrative infrastructure compatible with the amount and complexity of the trading that is expected?	yes no
• Do NPDES permits establish accountability for both water quality and pollutant reductions among point sources?	yes no

CHAPTER 6. PRETREATMENT TRADING

Pretreatment includes physical, chemical, and biological processes used by industrial and commercial customers to reduce, eliminate, or alter pollutants in wastewater before its release to publicly owned treatment works (POTWs). ***Pretreatment trading*** *refers to agreements that affect the allocation of pollutant loads among facilities that discharge wastewater to POTWs.*

Introduction

Approximately 1,500 POTWs administer approved local pretreatment programs. Approved states administer local pretreatment programs for an additional 314 plants. Available data suggest that plants with pretreatment programs account for over 80 percent of the total national POTW wastewater flow, even though less than 20 percent of all POTWs operate pretreatment programs.

Unlike other regulatory programs, the concept of trading is not completely new in the pretreatment program. The term "trading" is relatively new. In the pretreatment program, trading is discussed in terms of allocation of local discharge limitations (i.e., local limits), which dictate what the indirect dischargers can send to the POTW. POTWs are required to develop local discharge criteria to protect plant workers, plant operations, receiving water environments, and the quality of the biosolids.

These criteria are called local limits. EPA has designed the local limits development process to facilitate the most appropriate allocation of pollutants as determined by the POTW, including trading, if desired by the POTW *(Guidance Manual on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program,* December 1987).

To date, POTWs have preferred the uniform concentration limit allocation approach for local limits. This allocation method results in a single discharge concentration limit for each pollutant that is the same for all users. This method provides POTWs with an allocation vehicle that has minimal burden in both development and implementation and is viewed as an equitable approach. For POTWs, a method with low burden that produces the desired environmental results is often preferable to other methods that are more resource-intensive.

As noted, the uniform concentration limit method does have advantages, but it also has shortcomings. Specifically, it provides allocations to industries that might not even discharge the pollutant in question. Also, the uniform concentration approach does not reflect any differences in dischargers' ability to reduce pollutants and costs in achieving a uniform limit.

In the future, if standards for water and biosolids quality become more stringent, or if industrial growth places increasing pressure on POTW operations, POTWs might want to consider other allocation methods (mass allocations) for their local limits.

EPA is not aware of any POTWs that have developed formal pretreatment trading programs to date. Some POTWs are, however, implementing methods of allocating local limits that incorporate certain aspects of trading, as illustrated in the case of Oxford, North Carolina, in Example 6.1.

EXAMPLE 6.1: PRETREATMENT TRADING IN THE TOWN OF OXFORD, NORTH CAROLINA

Oxford has used an allocation approach similar to trading. After determining the total pollutant loading capacity available, the POTW and industries agree on specific limits for the seven industries involved: three textile mills, a rubber manufacturer, an asphalt roofing manufacturer, a cosmetic manufacturer, and a china manufacturer.

POTWs or states administering local pretreatment programs may choose to allow indirect dischargers (also known as industrial users or IUs) that send their wastes to POTWs to exchange reductions of pollutant loadings. These exchanges should be formalized through the IU permit. In general, where a POTW has an approved pretreatment program and established procedures to allocate and track pollutant loadings *and* agrees to allow pollutant trades, one firm may coordinate with one or more other firms to implement improved controls, rather than reducing in-house loadings. Incentives for trades may include payments between firms for additional reductions.

In all cases, trades are subject to IU permitted pollutant limitations and requirements established by POTWs to protect operations as well as biosolid and water quality. EPA*s technology-based (categorical) limits for indirect dischargers must always be met and cannot be traded.

POTWs can implement trading programs at their discretion when developing local limits. EPA and states, however, may require that a POTW develop written procedures and appropriate legal authorities for implementing a trading program. For example, in cases where a POTW has instituted its local limits through a uniform concentration method, the POTW will probably need to change its local limits allocation to a mass allocation to implement trading. This will require a change to their legal authority since most local limits are contained within the POTW's ordinance.

6.1 Regulatory Issues

General pretreatment regulations establish a three-part approach to controlling discharges from nondomestic sources to a POTW:

1. *General prohibitions* forbid discharge of pollutants that cause pass through or interference, and *specific prohibitions* forbid certain discharges of concern, such as those posing fire or explosive hazards, and corrosive, solid, or viscous substances.

2. EPA promulgates categorical Pretreatment Standards, which are national technology-based standards, on an industry-by-industry basis.

3. Individual POTWs develop local limits (as well as Pretreatment Standards) when necessary to ensure compliance with their NPDES permits and biosolids use or disposal standards, and to protect worker health and safety.

Under current regulations, POTWs must develop local pretreatment programs if they have design flows (combination of all treatment works) exceeding 5 million gallons per day (mgd) and they receive discharges from industrial users that may cause “pass through” or “interference,” or are otherwise subject to pretreatment standards. At the discretion of EPA or state authority, POTWs with design flows less than 5 mgd may also be required to develop programs.

Pass through occurs when pollutants exit POTWs at levels above the limits or in violation of any requirement in their NPDES permits. Interference occurs when pollutants inhibit or disrupt POTW operations, thereby leading to violations of NPDES permits or preventing the use or disposal of biosolids (i.e., sewage sludge) in compliance with statutory requirements.

Trading applies only to allocated local limits. In no case may a categorical industrial user be allowed to discharge pollutants in excess of those limits specified in applicable National Categorical Pretreatment Standards promulgated by EPA.

The National Pretreatment Program provides POTWs with considerable flexibility in establishing local limits. EPA has established guidance to assist the POTWs in development of local limits (see introduction to this chapter). In addition, many EPA Regional offices and states have developed more specific guidance on development and implementation of local limits.

The legal framework for the pretreatment program splits responsibility for regulating industrial users across federal, state, and local authorities. In communities where POTWs have approved local pretreatment programs, the POTWs are responsible for direct regulation and oversight of industrial user compliance and enforcement.

Where a POTW does not have an approved program, industrial users must still comply with the general and specific prohibitions discussed earlier, and if an industrial user is subject to categorical standards, it must comply with the standards and report its compliance status to EPA or the state twice per year. In general, pollutant trading would be possible only in the cases where the state or EPA requires the POTW to establish local limits in addition to other legal authorities that may be required to support a trading program.

Approved pretreatment programs interested in developing and implementing trading programs will also need to review applicable local, state, and federal requirements to determine whether changes are needed to the approved program. In addition, POTWs will need to ensure that results of trades do not violate the terms of their NPDES permits or approved pretreatment programs, or otherwise interfere with POTW operations.

Some regulatory issues are of less concern for pretreatment trading than for point source trading. CWA anti-backsliding requirements and anti-degradation policy do not apply to IU permits issued by POTWs to their industrial users. As long as the net effects of trades allow POTWs to meet their NPDES permit limits and conform to parameters set out in pretreatment programs, these policies will not affect pretreatment trading.

6.2 Economic Issues

Pretreatment trading can reduce the costs of pollution abatement while promoting improvements in environmental quality. As explained below, trading also can encourage investment in new control technologies and local economic development.

Potential Cost Savings

Development of a trading program may be undertaken at any POTW where indirect dischargers face differing costs for pollutant reductions and the POTW feels implementing a trading program might be beneficial to the pretreatment program. Industrial users choosing pollutant trading may need to install flow monitoring equipment, where none exists, and monitor facility flows for determining compliance with IU permits.

Cost savings could be significant in cases where dischargers would need to purchase and install expensive new treatment equipment. For example, one industrial user might need to install new treatment equipment to reduce its pollutant loadings, while another might be able to simply increase its use of existing treatment capacity. In this case, the first firm (that would otherwise need to install new equipment) could save money by negotiating with the second firm to increase its level of treatment. If trading allocations allow some industrial users to avoid large capital investments, substantial savings might result.

Not surprisingly, incentives for engaging in trades will be larger in cases where control costs are a significant proportion of a firm*s total operating expenditures, including costs of manufacturing and distributing products. In such cases, firms will be highly motivated to seek opportunities for reducing pollution abatement costs. Firms for which pollution control costs are less significant may choose to focus their attention on other types of concerns.

Economic incentives for trading may be weaker in cases where industrial users are direct competitors in the same industry. Such dischargers might be reluctant to engage in trades if the financial benefits would provide a competitive advantage to other firms. Trading might still be desirable in these cases as long as it benefits all participating dischargers.

Transaction Costs

Transaction costs include costs of revising POTW legal authorities and IU permits, identifying opportunities for trading, negotiating trades, and completing any necessary analysis and reporting. These costs need to be accounted for in developing and implementing trades.

Trading primarily impacts the *way* that allowable pollutant loads are allocated to industrial users. When pollutant allocations (or re-allocations to reflect trades) are determined, POTWs must write the results into permits or other control mechanisms, much as discharge limits are imposed under the current program. Changes in approved pretreatment programs to accommodate trading would be expected to necessitate a program modification. Monitoring and enforcement activities may remain substantially unchanged.

Technological Innovation

Because trading may provide incentives for developing innovative technologies, it may encourage continued improvement in technology performance and/or reductions in control costs over time, as new technologies are developed and implemented. Firms could benefit by developing more cost-effective control technologies, then agreeing to increase their level of treatment (or pollution prevention) in exchange for payments from other firms. As more firms become interested in trading, markets for such technologies are likely to expand, and firms could work cooperatively to develop pollution prevention techniques or new treatment processes.

Local Economic Development

The current regulations and guidance allow the POTW to change to an alternative allocation method under selected circumstances: in cases where POTWs use a uniform allocation method for local limits implementation and the uniform allocation makes it appear that all of their capacity for accepting industrial pollutants has been exhausted; or where POTWs may want to increase surplus capacity.

The change in allocation may require a modification to the existing approved program, requiring a minor modification of the NPDES permit and public notice of the change. The choice of local limits allocation directly affects the allowable loadings from each contributing source. In many cases, during development of local limits the POTW builds in a safety factor and growth factor, allowing industrial growth without having to change existing allocations.

Local limits allocation, including trading, provides opportunities for POTWs to accommodate new indirect dischargers or facility expansions, even in cases where POTWs must reduce their own discharges or have little available capacity. This capability may foster local economic growth. Likewise, the local economy benefits if trading allows industries to reduce their pollution control costs, freeing resources to finance new capital investments.

For example, pollutant loads from a new or expanding firm can be accommodated by using the existing load allocated to the growth factor or allowing the firm to negotiate with current users for a share of the total industrial user allocation, with cooperation and prior approval by the local pretreatment program. The new or expanded firm could either compensate current users for reducing their discharges or develop more cost-effective treatment technologies and engage in trades to reduce the burdens on existing users.

Trading can also relieve financial pressures on individual firms by allowing them to pay or otherwise arrange with others for further pollution reduction rather than purchasing control technology. In these cases, trading may free funds for other types of investments, such as plant expansion or additional employment.

6.3 Data-Related Issues

To implement pretreatment trading programs, dischargers and POTWs need information characterizing opportunities for and effects of trades. Loading information for the pollutant(s) of concern, general wastestream characteristics, and treatment options and cost information are particularly important for developing pretreatment trading programs.

Pollutant Loadings

Local limits are developed to protect against pass through and interference (including adverse impacts on biosolids disposal), including the specific prohibitions specified at 40 CFR 403.5(b). A POTW will determine the Maximum Allowable Headwork Loading (MAHL) it may receive for specific pollutants, while protecting against pass through and interference. POTWs will subtract from the MAHL such things as reserved mass for expansion and safety from slug loads, residential and non-IU loadings, and other factors.

The resultant pollutant loading, expressed generally as pounds per day, is then the Maximum Allowable Industrial Loading (MAIL). This MAIL is the total daily mass that a POTW can accept from all permitted IUs and ensure the POTW is protecting against pass through and interference. POTWs wishing to develop a trading program will adopt the MAILs in its legal authority (often an ordinance or other regulation) as part of its local limits. The POTW will also develop a procedure to allocate the MAILs to its IUs.

As mentioned earlier, most approved pretreatment programs go one step farther when adopting local limits. They divide the MAIL by the total industrial flow to get a uniform concentration local limit for each pollutant of concern. This uniform concentration local limit is then adopted and applied to each IU.

Detailed information on pollutant loadings is needed to identify opportunities for trades and to determine whether a particular trade will result in a reallocation of loads through the IU permits, while ensuring that the MAIL is not exceeded.

Much of the information on pollutant loading is already available to the POTW from various sources.

- In cases where POTWs currently express local discharge limits as mass loadings, the current total permitted loading is available in the IU permits or other control mechanisms used by POTWs.

- In cases where POTWs express limits as concentrations, the POTW often collects information on IU wastewater flows and can convert the permit limits to mass loadings. For example, if a discharger*s limit for zinc is 1.5 mg/l and its flow is 10,000 gallons per day, its permitted daily loadings are 1.5 mg/l x 0.010 mgd x 8.34 = 0.125 lb of zinc per day. The POTW would perform this evaluation for all IUs that are permitted to discharge the pollutant(s) in question. The sum of these daily loadings would be compared to the MAIL that forms the basis for the local limits, to ensure that the MAIL is not exceeded. The POTW would generally be required to adopt the MAIL into its legal authorities for each pollutant for which trading is implemented.

When firms engaging in trades discharge the same pollutants, comparisons are straightforward; loadings can be summed and compared to the POTW MAIL. When industrial users have more than one pollutant involved in a potential trade, POTWs also will need to consider trading impacts on total loadings of other pollutants received.

Once trades have been implemented, information on loadings will be collected through IU permit (or other control mechanism) reporting requirements. Industrial users also provide reports or notifications in cases where self-monitoring indicates violations of applicable pretreatment standards or requirements, and report any substantial change in the volume or character of pollutants in their discharge.

Pollution Reduction Options and Costs

To determine whether opportunities for trading exist, individual industrial dischargers will, at a minimum, need information on whether their POTW has a trading program or is willing to develop such a program, their pollutant loadings, pollution reduction costs, and the price at which pollution reduction credits can be bought from or sold to other dischargers.

General information on pollution reduction costs also will be useful to POTWs considering whether an investment of management resources in promoting trading will be worthwhile. For example, if available information on a POTW*s industrial users indicates that administrative costs to the POTW are substantially less than savings to the industrial users, trading is likely to be beneficial and a POTW might be willing to cooperatively invest the resources.

Dischargers might be interested in detailed information on pollution reduction options and costs. This information would enable them to determine costs they would incur for increased pollution reduction (especially in cases where new technology must be implemented). It also would help develop their strategy for negotiating with potential trading partners.

General information on costs, applicability, and effectiveness of alternative pollution reduction methods is available from EPA effluent guideline development documents and similar sources. As noted in Chapter 5, however, these sources are designed to provide rough comparisons of costs and effectiveness of treatment methods identified during development of the applicable standards.

To avoid mischaracterizing the cost-effectiveness of pollution reduction options available to them, indirect dischargers can complete more detailed, facility-specific assessments before proposing a trade. In conducting such assessments, indirect dischargers are encouraged to consider pollution prevention practices prior to end-of-pipe treatment. In many situations, pollution prevention can be more cost-effective than end-of-pipe treatment in achieving pollution reduction goals.

As a result, facilities that explore pollution prevention opportunities will be better positioned to exceed pollution reduction performance standards requirements and to offer pollution reduction credits in trades with other dischargers. In addition, many POTWs may require pollution prevention opportunities to be explored prior to a request for pollutant trading.

6.4 Technical and Scientific Issues

POTWs interested in implementing trading programs may face two types of technical issues: the development and adoption of mass-based limits, and implementation of a program to permit and track pollutant loadings.

Mass- vs. Concentration-Based Limits

POTWs (or states operating pretreatment programs in lieu of approved local programs) develop local limits based on evaluation of local POTW operations and guidance provided by EPA, as explained in Section 6.3. Development of local limits may be based on a range of methods:

- *Uniform concentration limits for all industrial users*—For each pollutant, the maximum allowable industrial loading to the POTW is divided by the total flow from *all* industrial users.

- *Concentration limits based on industrial contributory flow*—This method is similar to the uniform concentration limit allocation except that the flow from only those users that actually have the pollutant in their raw wastewater at greater than background levels is used to derive a concentration limit for the pollutant.

- *Mass proportion for each pollutant*—The maximum allowable industrial loading to the POTW is allocated individually among each IU in proportion to the IU*s current loading. Mass limits (MAILs) are adopted for pollutants, and portions of the MAILs are allocated to the IUs.

- *Selected industrial reduction*—The POTW selects the pollutant loading reductions that each IU will be required to accomplish.

POTWs using the mass-proportion method, or other methods that specify mass loadings limits rather than pollutant concentration limits, will find it easier to implement trading programs than those using other methods. These POTWs will not need to convert concentrations into loadings (as discussed in the previous section) to evaluate the impacts of trades. In addition, POTWs using mass-based limits are already accustomed to incorporating this type of limit into their permitting, monitoring, and enforcement procedures.

POTWs currently using other approaches generally will be required to adopt mass-based limits to facilitate implementation of trading programs.

Unit of Exchange

POTWs can define units to be traded in various ways, for example, pounds per day of a particular pollutant. Regardless of whether trading is implemented, units used to develop local limits have at least two dimensions: the time period covered (e.g., day) and the unit of mass (e.g., kilograms or pounds). In addition, the unit may be expressed as an average, a maximum, or both.

Another issue to consider is whether to include batch dischargers in a trading program. Including batch dischargers increases opportunities for trades. If batch dischargers are included, a trading program needs to ensure that combined discharges do not exceed a POTW*s peak capacity. The timing of discharges may be particularly important.

6.5 Institutional Issues

Because the local limits development process already provides an institutional framework for pretreatment trading, relatively few institutional issues need to be addressed to implement trading programs. Issues to be considered include whether a POTW wants to develop a trading program, what changes to a POTW legal authorities are necessary (if any), what procedures must be developed for implementation, and availability of POTW resources to institute a trading program.

Some POTWs may not need to alter their current procedures substantially. Once local limits are adopted and procedural and resource issues addressed, POTWs could encourage dischargers to seek out trading opportunities, or could act as brokers, bringing together potential trading partners. POTWs would then review results of negotiations and incorporate them into permits and individual control mechanisms where appropriate.

A trading program that includes an established administrative structure will require more extensive development efforts. Such programs could include designating certain officials or organizations as responsible for encouraging trading and developing standardized procedures. A key consideration will be minimizing the costs of program administration and engaging in transactions so that such costs do not outweigh the pollution reduction cost savings that trading would provide.

To minimize transaction costs, criteria for approving trades, including relevant data and analysis submitted by dischargers interested in trading, could be specified in advance. This would decrease uncertainty and clarify responsibilities. POTWs are likely to maintain primary responsibility for oversight of program operations (subject to federal, state, and local government approval, as needed); ongoing involvement of other interested parties generally will be desirable.

Stakeholder Participation and Support

Trading programs are most likely to be successful if all stakeholders are involved in and committed to development of the program. Stakeholders include POTWs and industrial users, as well as EPA and the state agencies responsible for the pretreatment program; elected officials; federal, state and local agency staff; the general public; and environmental organizations.

Because POTWs are generally operated by local government agencies, they are likely to share community interest in environmental protection and economic development. As a result, they may support trading programs as a method of expediting compliance with pollution reduction requirements and reducing the potential corresponding costs. Industrial users may find trading programs desirable if they can reduce their pollution reduction costs by amounts that exceed any costs associated with participating in trading programs, particularly if these savings are a significant proportion of their total operating costs and can be gained without providing disproportionate benefits to their competitors.

Other interested groups may be supportive if they view programs as maintaining or improving environmental quality while providing economic benefits to local areas.

POTWs can encourage trading by providing information on topics of interest to each participating group. For example, information on environmental benefits and cost savings could be developed for review by industry and local community leaders, as well as all other stakeholders.

6.6 Administrative Issues

Administration of a pretreatment program that incorporates trading includes at least three primary activities: (1) the initial development of local limits and resultant allocation to the IUs through permits (2) review and approval of the trade by the POTW, and (3) reallocation of pollutant loadings (IU permit modification or reissuance). These components are discussed below.

Initial Allocation

Under a typical local limits development process, as discussed earlier, POTWs identify pollutants of concern, develop loadings to protect the POTW, incorporate these loadings into their legal authorities, and include appropriate discharge limits based on the loadings in IU permits.

Incorporation of pollutant limits into permits (whether mass or uniform concentration) can have a significant effect on industrial users, determining relative bargaining power when trading occurs and costs of required controls if dischargers cannot find opportunities for trades. The perceived equity of the initial allocation can also affect program implementation, particularly where industry protests the results.

Reallocation Through Trades

In a trading program, once an initial allocation is made (i.e., an IU permit is issued), industrial users could negotiate exchanges in pollutant reductions among themselves. These exchanges may be trades directly negotiated between two dischargers, or may include the development of a more formal market for buying and selling discharge allowances.

In the latter case, industrial users with high pollution reduction costs could acquire additional pollution discharge credits, while those with lower costs would be compensated for removing larger quantities of pollutants through the sale of their credits or through other forms of compensation. As noted earlier, such compensation need not be monetary; other types of mutually beneficial agreements may be reached.

Once exchange units are established, POTWs may require trading ratios (termed "offset ratios") greater than one-to-one (e.g., 1.25:1) to encourage further reductions in pollutant loadings. While such ratios might be desirable, they should be applied carefully to avoid constraining opportunities for trades.

Timing, Frequency, and Duration

Another issue in developing trading programs is establishing conditions governing the timing, frequency, and duration of trades. Frequent trades with short durations may be difficult for POTWs to track and control (and allocate sufficient resources), while infrequent trades with long durations may inhibit desirable changes from initial allocations and hence decrease benefits of trading.

Trading could be allowed on an ongoing basis. If trades occur too frequently or on an unpredictable schedule, however, POTWs may need to devote substantial resources to reviewing the effects of the trades and may find it difficult to track constantly changing allocations.

Conversely, if trades are allowed infrequently, industrial users will not be able to accrue the full benefits of trading. They may not be able to exchange allowances with other industrial users to reflect changes in pollution reduction costs or needs (resulting from changes in production processes, costs, or the scope of operations) as they occur.

One option is to allow trading whenever permits or other individual control mechanisms of participating industrial users are scheduled for renewal. In cases where POTWs renew permits or individual control mechanisms on a staggered basis, trading could be encouraged by grouping industrial users according to pollutants discharged, and addressing pollution reduction conditions for all members of a group simultaneously. As with other options, any change in trading would be allowed only after POTW approval and incorporation of the resulting allocation into a revised permit or other individual control mechanism.

Incorporating trading into standard review and renewal cycles provides the least disruption of current operations. It also reduces burdens on POTW staff, who can review implications of proposed trades at the same time they are reviewing other industrial user information. Time frames within which trading is allowed can best be determined through discussions between POTWs and participating industrial users.

Federal regulations limit duration of permits or individual control mechanisms to a maximum of 5 years. Therefore, incorporation of a trade into permits or other individual control mechanisms will necessitate renewing trading agreements at least once every 5 years. In addition, POTWs will be expected to retain authority to reopen and revise permits or other individual control mechanisms that incorporate trades. Such flexibility may be needed to respond to future changes in POTW operations or NPDES permit requirements.

It is important to realize that trading that results in less stringent local limits for one or more of a POTW*s industrial users may be a substantial program modification, and therefore would require approval of EPA or the state authority. This may not be the case where the Approval Authority has approved the MAIL and the reallocation is within the MAIL. It may be best to have trading activity occur along with the local limit reevaluation process, which is required at least every 5 years in connection with the POTW*s NPDES permit reissuance.

The duration of trading agreements could be determined by the trading partners and provided for approval to the POTW in advance. Dischargers may not be willing to engage in trades if the duration of agreements is too short, because of negotiation costs, uncertainty inherent in a need to renegotiate, and the risk that an investment in improved pollution reduction methods would be lost if a trade were discontinued after only a short period. In general, if POTWs are willing to allow trading agreements to remain in place for longer periods of time, it is more likely that trades will occur, particularly in cases where industrial users are investing in treatment equipment with relatively higher costs and long life spans.

Review and Approval of Trades

Once a POTW is able to consider trades and the industrial users agree to a trade, the next step is POTW review and approval. This review may be accomplished through the same procedures used in the existing permitting processes. Reviews will need to consider issues related to protecting POTWs from interference and ensuring that standards for POTW effluent and biosolids quality are met (i.e., MAILs are not exceeded). Once trades are approved, they must be incorporated into industrial users* permits or other control mechanisms to ensure all applicable limits and monitoring requirements are fully enforceable.

6.7 Accountability and Enforcement

POTWs have developed mechanisms to ensure that relevant pretreatment standards are met, regardless of whether trading is implemented. The principal mechanism used by POTWs to ensure the enforceability of local limits is the IU permit. All changes to allocated pollutant loadings and monitoring and reporting requirements must be enforceable by the POTW's pretreatment program. Therefore, whenever a POTW changes the allocation of pollutant loadings between IUs, such changes must be adequately reflected in the relevant IU permit. This will ensure the continued enforceability of local limits, as well as provide detailed information to each IU on what it is allowed to discharge.

6.8 Worksheet/Checklist

The following checklist provides examples of the types of issues a POTW should consider in determining whether and how to implement a trading program. The more positive responses, the more likely the trading program will be successful.

WORKSHEET FOR POTWS TO EVALUATE POTENTIAL FOR PRETREATMENT TRADING

Legal and Regulatory Conditions	
General:	
C Is pretreatment trading implemented within the context of the National Categorical Pretreatment Standards and NPDES permits?	yes no
Specific:	
C Are local POTW standards more stringent than National Categorical Pretreatment Standards?	yes no
C Do the results of pretreatment trading comply with conditions within the NPDES permits of POTWs?	yes no
Economic Conditions	
General:	
C Can dischargers to POTWs save or make money by trading (i.e., are there economic incentives to trade)?	yes no
Specific:	
C Do total marginal costs for pollution reduction, which include direct marginal costs and transaction costs, differ among dischargers?	yes no
C Do cost differentials among dischargers allow one discharger to reduce pollution more cheaply than another?	yes no
C Do cost savings from trading outweigh the risks that dischargers face under trading schemes?	yes no
C Is there a sufficient supply of pollution reduction for sale, and a reasonable demand to buy reduction credits?	yes no
C Are competitive pressures among dischargers subdued enough to allow trades?	yes no
Data Availability Conditions	
General:	
C Are the data necessary to implement a trading program available or estimable?	yes no
Specific:	
C Are there enough data to understand pollution quantities and flows to the POTW?	yes no
C If pollution limits are expressed in permits and ordinances as concentrations, are data on wastewater flow available to convert limits to loadings?	yes no
C Do industrial users of POTWs submit at least two compliance reports per year, which provide information on loading?	yes no
C Can industrial users estimate costs for pollution control and transaction costs that they would have to pay to conduct trades?	yes no

Administrative and Institutional Conditions	
General:	
C Are governmental authorities and potential trading participants capable of administering a trading program? (If **no**, do not proceed.)	yes no
C Does the POTW have an approved pretreatment program? (If **no**, stop and contact appropriate state/EPA Regional office.)	yes no
Specific:	
C Has the POTW developed and adopted technically based local limits and have the local limits been publicly noticed and approved by the approval authority? (If **no**, do not proceed.)	yes no
C Have the technically based local limits been allocated to industrial users?	yes no
C Has the POTW developed the necessary legal authorities and implementation procedures to implement trading?	yes no
C Does the POTW have enforcement mechanisms in place to ensure pretreatment trades (discharge limits) are being complied with?	yes no
C Does the POTW currently have adequate resources to expend on administration of the trade? (If **no**, do not proceed.)	yes no
C Is the economic benefit to the POTW, community, and industrial user greater than the transactional costs of implementing the trade?	yes no
C Are the data required from the industrial user(s) available or can the data be obtained?	yes no

CHAPTER 7. POINT SOURCE/NONPOINT SOURCE TRADING

*In **point/nonpoint source trades,** point and nonpoint sources agree on reductions. Typically, these agreements involve reductions in nonpoint source pollutant loadings in lieu of additional point source reductions. Point sources seeking trades with nonpoint sources have already met technology-based requirements and are seeking cost-effective ways to implement pollution controls needed to meet water quality standards and objectives.*

Introduction

There is significant interest in point/nonpoint source trading. It has been the subject of numerous academic studies, EPA-supported investigations, and pioneering attempts at successful implementation. Exhibit 7.1 identifies several of these efforts.

Differences between point and nonpoint sources create perhaps the most significant watershed management opportunities among the trading types discussed in this framework. Point sources are subject to NPDES permitting and include wastewater treatment plants, industrial dischargers, active and inactive mines, and ambient sewer overflow (CSO) or stormwater outfalls. Nonpoint sources are not subject to NPDES permits and can include landowners engaged in agriculture, silviculture, and development; public or private enterprises involved in small-scale construction or hydromodification; and owners/operators of degraded riparian habitat.

As a general rule:

- Considering *nonpoint* and *point source* reductions together advances the watershed-based approach to water quality management—prioritization, selection, and implementation of options on the basis of environmental effectiveness, cost-effectiveness, location, and other key factors occur in a watershed context.
- Nonpoint source management combined with point source controls in the trading context can provide broad ecological benefits such as stream, wetland, and habitat restoration.

EXHIBIT 7.1: POINT/NONPOINT SOURCE TRADING AROUND THE COUNTRY

Programs in place or operating:

- Boulder Creek, CO
- Chatfield Basin, CO
- Cherry Creek, CO
- Dillon, CO
- Tar Pamlico, NC

Programs under consideration/investigation:

- Chehalis River, WA
- Clear Creek, CO
- Denver Metro/South Platte, CO
- Flat Head Lake, MT
- San Joaquin Basin, CA
- South San Francisco Bay, CA
- Tampa Bay, FL
- Truckee River, NV
- Yakima River, WA
- Selected Midwest communities (atrazine for drinking water concerns)
- Several Chesapeake Bay Basin tributaries

EPA-sponsored studies/simulations:

- Boone River, TN; Honey Creek Watershed, OH; and Wicomico River, MD

- Nonpoint source loads may be less expensive to reduce per unit of pollutant than point source loads.

- Nonpoint sources significantly outnumber point sources in most watersheds, resulting in a wide pool of potential trading partners.

- Where greater than 1:1 pollutant loading reduction ratios are achieved, nonpoint trades can result in greater reductions than those achievable without trades.

Differences between point and nonpoint sources also present challenges in designing trades. Potentially complex issues related to technical, scientific, regulatory, and institutional issues must all be considered when trades are designed.

7.1 Regulatory Issues

Point/nonpoint trading may help to achieve water quality standards when technology-based discharge limits for point sources are insufficient to do so. Point sources which are in compliance with technology-based effluent limitations could trade with nonpoint sources to achieve additional pollution reductions needed to meet water quality-based effluent limitations.

Water Quality Standards

Point/nonpoint source trading, as with other types of trading, may shift the location of additional reductions in pollutant loading from the point source mixing zone to one or more zones adjacent to nonpoint sources. For each trade, a permitting authority should specify critical locations in the watershed to conduct site-specific cross checks. These cross checks will ensure that water quality standards are met throughout the watershed. Where point and nonpoint sources are far apart, trades are limited by the extent to which they can comply with water quality standards, including applicable mixing zone policies.

Technical and scientific issues associated with water quality standards and analyses are discussed in more detail in Section 7.4.

TMDLs

States establish total maximum daily loads (TMDLs) when technology-based requirements do not or are not expected to meet water quality standards. TMDLs recommend a mix of pollutant reductions (often reflecting a variety of regulatory and nonregulatory controls) necessary to attain and maintain water quality goals, and they include a margin of safety to account for technical uncertainty. TMDLs must be approved by EPA and are established by EPA if state TMDLs are disapproved. As part of each TMDL, wasteload allocations (WLAs) and load allocations (LAs) establish target loads or load reductions for pollutants that point/nonpoint source trading can help meet. LAs may be developed for individual nonpoint sources, but are more commonly developed for several or all nonpoint sources within a TMDL*s geographic area.

WLAs are developed for specific point sources and incorporated into NPDES permits. LAs are implemented through state and local nonpoint source control programs, which rely on a mix of local, state, and federal requirements, contractual arrangements established by federal and state farm programs, and voluntary measures. EPA believes that only trades between sources covered under the same TMDL or similar assessment and remediation plan are appropriate.

Trading Situations for Point and Nonpoint Sources

Given the differences in statutory and regulatory foundations, point/nonpoint source trading is sometimes viewed as difficult to implement in practice. EPA believes that point/nonpoint source trading, including consideration of the technical and legal uncertainties normally associated with the control of nonpoint sources, is practical and feasible in **at least three situations**.

In all three of the situations described below, agreed-upon activities may involve a number of parties, cover a range of geographic scales, and involve a number of remedial actions. Participation in a trade is voluntary and subject to the approval of the appropriate regulatory authority. Like any other trade, a point/nonpoint trade should comply with the principles articulated in Chapter 2.

1. Trades may occur in the context of a TMDL. TMDLs establish the loading capacity of a watershed, identify needed reductions and related remedial activities necessary to meet water quality standards, identify sources, and recommend allocations for point and nonpoint sources. TMDLs, because they focus on achieving, maintaining, and protecting water quality standards, necessarily require knowledge of ambient water quality conditions. Parties cooperating in a trade negotiate within the loading capacity of the TMDL, and the TMDL is reviewed and approved by EPA.

2. Second, trades may occur in the context of other analyses and remediation plans similar to TMDLs. These are appropriate frameworks for trading if they, like TMDLs, link pollutant contributions to ambient conditions and determine needed reductions and remedial activities necessary to meet water quality standards. Like TMDLs, other analyses and remediation plans require knowledge of ambient water quality conditions and must be approved by EPA. Examples include Lakewide Area Management Plans (LaMPs) and Remedial Action Plans (RAPs) used in the Great Lakes. The relationship of federal and state NPDES requirements and requirements applicable to nonpoint source controls is important. Each party to a trade is responsible for fulfilling its obligations.

3. The third situation for a trade is when an NPDES permittee arranges a trade in order to meet the ambient water quality conditions expected to result from implementing its effluent limits. This again is a voluntary arrangement between parties. In this situation the permittee looks for other sources of the pollutant being controlled in its effluent and arranges for the other sources to remove a specified amount of that pollutant. The proposed trade is submitted by the permittee with the permit application. After the permit writer has approved the trade, the permit writer uses the trade information to derive the point source's permit requirement and documents those requirement in the permit fact sheet.

Thus, in situations 1 and 2 described above the regulatory authority approves a trade via approval of a TMDL or similar analysis and an NPDES permittee is responsible for meeting effluent limits established for its facility as part of the trade with other partners. EPA and state enforcement authority applies to NPDES permits, and the effluent limits are agreed on as part of the trade.

Compliance for any nonpoint sources in 1 and 2 is determined by the appropriate existing regulatory authority and is based on reasonable assurance that the nonpoint sources will comply with the provisions of the trade. It is likely to rely on a mix of state, local, and other federal authorities. Reasonable assurance means that the proposed nonpoint source controls are technically feasible, specific to the pollutant of concern, to be implemented according to a schedule and within a reasonable time period, and supported by reliable delivery mechanisms and adequate funding. The permit fact sheet for the point source participating in the trade should document the basis for reasonable assurance.

For situations 1 and 2 described above, accountability and enforcement for the point and nonpoint source are not linked. If a permittee fails in its obligations, applicable federal and state enforcement, based in the CWA, occurs. If the nonpoint source fails in its obligations, appropriate corrective action, most likely rooted in local, state, or contracts law, occurs. A failure of a nonpoint source partner does not trigger an enforcement action against the point source trading partner, but it may result in a revision to the TMDL or a modification to the point source's current permit limitations and conditions to ensure water quality is protected.

In the third situation described above, some of the permittee's effluent limits may be less stringent than they would have been without trading because the nonpoint source will remove some of the specified pollutant. The permit-issuing authority includes conditions in the permit that specify the nonpoint pollution controls to be implemented and reopener clauses to provide for recalculation of the point source's effluent limits if nonpoint sources fail to meet their obligations over a reasonable time period.

Unlike situations 1 and 2 described above, in situation 3 a permittee arranging a trade remains accountable for the reductions agreed to by the nonpoint source(s). Reductions agreed to by the two partners are linked through the NPDES permit, and failure of a nonpoint source partner results in enforcement actions against the NPDES permit holder. In this situation, it is the responsibility of the permit holder to ensure that other parties to the trade can meet obligations undertaken as part of the trade.

7.2 Economic Issues

Several economic issues are specific to point/nonpoint source trading. They relate to differences in unit control costs, ancillary benefits from nonpoint source controls, comparability of costs, transaction costs, cost sharing, and piggybacking.

Unit Cost Differences

As noted in Chapter 3, the economic attractiveness of point/nonpoint source trading depends on differences between unit costs of pollutant reductions for point sources compared to such costs for nonpoint sources. Often, nonpoint source reduction is cheaper than point source reduction on a per unit basis, although incorporating a margin of safety into a trade may affect the cost differential.

The reason for this cost variance is that point sources often require expensive technological methods to control pollution in their effluent. Most types of nonpoint sources, on the other hand, can often rely on cheaper, nonstructural best management practices (BMPs) to reduce pollutant loading. Structural BMPs are those which require construction efforts or physical changes to a site, whereas nonstructural BMPs change the way people (and/or animals) use a site and do not otherwise change physical site conditions.

Point sources, therefore, can often save substantial sums by arranging for pollution control from nonpoint sources. In turn, nonpoint sources can receive compensation for implementing desirable BMPs, such as planting riparian vegetation. These measures also may have value for the nonpoint source, for example, reduction of soil erosion for farmers.

Additionally, the CWA regulatory structure has focused on point sources for over 20 years. As a result, the less expensive point source control methods have already been implemented. While states and nonpoint sources have made good progress in reducing nonpoint pollution, significant nonpoint pollution reduction opportunities remain.

Ancillary Benefits

As stated above, nonpoint sources generally use BMPs to decrease their pollutant loads. These BMPs can provide benefits along chemical, physical and biological parameters, and can be a way to implement restoration and enhancement projects. For instance, wetland restoration may be prescribed to prevent agricultural runoff. While this BMP improves water quality, it also may provide habitat functions for wildlife.

Comparability of Costs

Point sources and nonpoint sources contemplating trading may calculate their costs in different ways. Such differences can originate in accounting procedures that are more likely to be employed by point sources than by nonpoint sources. In some cases, it may be necessary to adjust point and/or nonpoint source costs to account for these differences. For example, point source controls are in many cases more capital-intensive than those for nonpoint sources and so are depreciated over multiple years. Many BMPs, however, are less capital-intensive, often involving operational techniques, and so are deducted as current year expenses.

Transaction Costs

Transaction costs associated with point/nonpoint source trading can be biased upward because potential nonpoint source partners are often numerous, but the potential to reduce loadings from any individual nonpoint source may be low. This situation can result in point sources having to coordinate with multiple nonpoint sources to achieve loading reduction targets. Additionally, nonpoint sources may have few regulatory incentives to trade. So unless nonpoint sources benefit largely from trading, point sources and other stakeholders may have to lobby nonpoint sources to create trading opportunities.

Stakeholders can help reduce transaction costs by supplying both point and nonpoint sources with information on potential trading partners. Point sources and other parties seeking nonpoint source trading partners may contact local governments and state agencies involved in nonpoint source pollution management. Nonprofit environmental organizations also may be able to direct interested parties to candidate nonpoint sources. Additionally, watershed management, growth management, and local comprehensive plans often identify unaddressed nonpoint source pollution problems.

Cost Sharing

Cost sharing is an aspect of nonpoint source management that affects point/nonpoint source trading. Many governmental programs offer cost sharing options to nonpoint sources to install BMPs for pollution control. These cost share programs are often essential to meeting nonpoint load reductions in an approved TMDL.

Cost-share BMPs may be more attractive than non-cost-share BMPs to point sources since cost sharing may result in lower prices for trades. Therefore, state officials approving a trade should consult with the state nonpoint and cost-share programs (including U.S. Department of Agriculture programs) to ensure that any existing commitments to implement nonpoint load reductions will not be compromised by a trade.

Piggybacking

Often point/nonpoint source trading can achieve cost savings by expanding nonpoint source pollution control projects that are already being implemented. Such projects are often implemented by organizations that do not themselves cause pollution (e.g., nonprofit environmental protection groups). Trading partners achieve cost savings because expansion of such projects is usually cheaper on a unit cost basis than implementation of a new nonpoint source control project. Thus, point sources achieve required loading reductions for less money than they could otherwise, even through a more standard trading arrangement.

Piggybacking also can reduce transaction costs. For such arrangements, stakeholders share information about existing or planned projects where point sources could contribute additional funding to expand a project*s scope. This lowers costs to point sources associated with trade identification, evaluation, implementation, and monitoring. An example of piggybacking appears in Chapter 8.

7.3 Data-Related Issues

Data in two general areas provide important information for identifying, designing, and implementing trading programs: (1) water quality and pollution control effectiveness and (2) economic and geographic information. Some of these data will be on hand as part of regular water quality management activities where TMDLs and similar analyses have been performed. Where unavailable, some data, such as control cost and effectiveness information, can be obtained from other watersheds or published literature and customized to areas considering trading. Water quality data are most useful when they are specific to waterbody segment(s) where trading is proposed.

Water Quality and Pollutant Loadings

To help ensure trading principles are upheld, agencies should have sufficient water quality monitoring in place to support loading estimates from point and nonpoint sources, establish water quality objectives, and measure needed pollutant reductions. Adequate data will provide confidence in presumed cause-and-effect relationships between pollution control measures and water quality responses.

Many data limitations exist for point/nonpoint source trading. An abundance of effluent loading data for most point sources exists, but loading data for nonpoint sources are rarely available for individual nonpoint sources. Instead, nonpoint source loading data are typically available only for whole tributaries, or more generally, as estimates of background loading.

Data documenting point source discharge effects in the mixing zone and on local ambient water quality are not generally widely available. Also, there is little documentation of ambient water quality downstream from point source dischargers. Additionally, mixing zone data are especially rare. (Ohio is an exception.) However, models are available to assist in the estimation of nonpoint source loadings, both before and after the application of various BMPs.

Data documenting nonpoint source effects on water quality are even more inconsistent across nonpoint source categories, states, and individual waterbodies. The often large numbers of nonpoint sources and the variance of their loadings according to spatial (e.g., location relative to water edge) and temporal (e.g., seasonal) factors further complicate the task of attributing specific environmental effects to identifiable pollution sources.

Nonetheless, reliable estimates of expected loading reductions from nonpoint source BMPs and restoration efforts are key to predicting water quality improvements under trading. A variety of water quality analyses can be used to estimate nonpoint source loading reductions and evaluate their effects on receiving waters.

The best information on potential reductions will come from local water quality data collected before and after implementation of BMPs or restoration projects. Good field data also are needed to verify compliance with NPDES permit conditions, and agreements between point and nonpoint sources, and to build technical credibility. Some agencies, like the U.S. Geological Survey's National Water Quality Assessment program, are beginning to systematically monitor nonpoint source contributions to water quality problems in particular waterbodies.

To be most helpful, such analyses should be linked to specific characteristics of the nonpoint source control measures (e.g., scale, scope, method). Where local data are not available, it may be possible to use effectiveness estimates from other nearby areas, adjusting for any differences in rainfall, topography, soil type, and other factors influencing effectiveness. One source for BMP effectiveness information is *Guidance Specifying Management Measures For Sources of Nonpoint*

Pollution In Coastal Waters (EPA840-B-92-002, January 1993).

Trading program organizers can conduct their own field research to provide better data when needed for design and evaluation purposes. Both the Lake Dillon and Tar Pamlico River point/nonpoint source trading programs relied, in part, on effectiveness data generated by local demonstration projects. Additionally, monitoring of nonpoint source pollutant loadings can be expanded as part of a trading program to provide information about BMP effectiveness as trading occurs.

Data-Related Role of TMDLs

TMDLs can play an important role in linking the selection and implementation of trades to the attainment of water quality standards by providing a framework for data collection and analysis. The TMDL process results in estimates of pollutant loadings from all sources and predicts the resulting pollutant concentrations in receiving waters. As a result, a framework for evaluating water quality implications of various trading scenarios will generally exist where TMDLs have been developed.

Economic and Geographic Data

As discussed in Section 7.2, cost-effectiveness estimates for reductions in point source and nonpoint source pollutant loadings will help to identify where sufficient cost differentials, and therefore potential trading opportunities, exist. Cost estimates specific to sources or source sub-categories, such as secondary treatment plants and livestock feedlots, in a trading area will be preferable to less specific estimates or estimates from other areas.

An understanding of the spatial distribution of potential trading participants and their characteristics within a trading area is a key component of evaluating water quality effects of trading. Point and nonpoint sources can be identified and listed by location, e.g., River Mile 34. Knowledge of local topography and soil conditions, as well as rainfall, snowmelt, and evapotranspiration, also is important because these factors influence nonpoint source loadings.

Maps indicating sources and locations where additional reductions are possible (e.g., where BMPs are not fully implemented) can be simple but powerful tools to help water quality managers and other stakeholders visualize potential trading scenarios. Geographic information systems (GIS) provide sophisticated mapping capabilities and can combine sets of information based on various decision factors and display results in map form.

7.4 Technical and Scientific Issues

Spatial, temporal, and chemical differences between point and nonpoint source pollutant loadings pose challenges to understanding and predicting effects of point/nonpoint trading on water quality. Accommodating these differences in the conditions of a trade can help attain environmental objectives.

Spatial Considerations

Because point/nonpoint source trading shifts additional loading reductions from point sources to nonpoint sources, understanding how nonpoint source loadings behave relative to point source loadings as they enter a waterbody helps predict trading effects on water quality. Point sources are more likely to discharge a load continuously at specifically identifiable points. In contrast, concentrations of pollutants in nonpoint source discharges vary considerably and are released intermittently over the length of the water-land boundary.

In some cases nonpoint sources may be located within the same watershed but upstream or distant from the point source and/or waterbody of concern. Examination of the implications of the relative locations of trading partners and impacts on receiving waters is necessary.

Temporal Considerations

Substituting reductions in nonpoint source loadings for further point source reductions also changes the timing of when those reductions occur. Most point source loadings are more predictable, as allowed by daily and monthly average limits in their NPDES permits. Nonpoint source loads are typically more random and variable, being influenced by daily and seasonal weather conditions.

Nonpoint source loadings generally increase during rainy seasons and decrease during dry seasons. (One exception is nonpoint source pollution conveyed by irrigation return flows.) Since rain also dilutes nonpoint source runoff with higher waterbody flows, the short term effects of nonpoint sources may be mitigated to some extent. In many northern and high-altitude climates, spring snowmelt is a major source of nonpoint source pollution. Point source loadings are relatively constant across seasons; exceptions include combined sewer overflows (CSOs) and sanitary sewers with high inflow.

During dry seasons, point source loadings are higher relative to a waterbody*s assimilative capacity; although loadings remain constant on average, waterbody flows are reduced. For this reason, estimating loads coming from a point source during low flow periods after a trade is critical to protecting water quality year-round.

Chemical Considerations

Chemical differences can exist between the same pollutant coming from a point source compared to a nonpoint source. Pollutants from point sources typically reach waterbodies in a dissolved form, making them readily available to plants and animals. For example, only inorganic forms of nitrogen are bioavailable.

In contrast, some pollutants from nonpoint sources can be attached or adsorbed to sediment when they reach water. (Although in some situations, point source loadings can also be attached to sediment.) In this form, chemical pollutants are less available to create water quality problems. Elevated concentrations of sediment can directly cause water quality problems due to increased turbidity (decreasing the amount of sunlight available to aquatic life), clogged fish gills, and increased levels of sediment oxygen demand.

Accommodating Differences

Several approaches are available to account for differences between point and nonpoint source loadings and address uncertainty about how to exchange point source for nonpoint source loading reductions in such a way that water quality standards are achieved throughout watersheds.

For example, using long-term average loadings for both point and nonpoint source loadings allows the loadings of each to be compared over time periods where variance is acceptable (i.e., where adverse effects are chronic but not acute). This comparison should be made based on an evaluation of the load during periods of "critical" conditions appropriate to the waterbody; e.g., low flow, high loadings, etc. Margins of safety offer a way to protect water quality. They reflect uncertainty about the relative effectiveness of point source and nonpoint source controls where trading is an option. Establishing exchange rates between point and nonpoint sources that reflect known and unknown differences in effect should also be considered.

Exchange rates, or trading ratios define the number of units of nonpoint source pollutant loading reduction that are equivalent to one unit of point source loading reduction. Where nonpoint source loading reductions are less certain than point source reductions, point sources would pay for more than one unit of loading reduction for every unit of credit received. This "extra" reduction represents a margin of safety that should be proportional to the uncertainty associated with predicted nonpoint reductions and will help ensure that expected water quality improvements actually occur. The use of trading ratios for two programs is briefly described in Exhibit 7.2.

EXHIBIT 7.2: TRADING RATIOS IN THE DILLON AND TAR PAMLICO PROGRAMS

Point sources in the Lake Dillon program trade at a ratio of 2:1; that is, they reduce two pounds of nonpoint source phosphorus loadings and receive credit for one pound. Dillon Lake established this ratio because it was estimated that one additional pound allowed to be discharged by the POTW due to growth would lead to two additional pounds from nonpoint sources. New developments are required to install erosion controls that are at least 50 percent effective. As a result, the one additional pound from the POTW leads to one additional pound from nonpoint sources. Therefore, a 2:1 ratio was applied. (In general, various averaging periods can accompany trading ratios.)

Using a slightly different approach, the Tar Pamlico River Basin point/nonpoint source trading program*s fee for nonpoint source loading reductions is based on a weighted average of a trading ratio of 3:1 for cropland BMPs and 2:1 for animal BMPs. (The different crop and animal ratios reflect differences in effectiveness and certainty of the different activities and suitable BMPs.) In this program, point sources contribute a specified amount to an agricultural cost-share fund for every kilogram of nutrient reduction they want to buy.

7.5 Institutional Issues

Support from institutions and organizations that have relationships with point and nonpoint sources is critical to developing a successful trading program. Trading programs involving point and nonpoint sources build new alliances between stakeholders that may have had few prior opportunities to work together, especially where watershed approaches are new or not yet used.

Identifying Potential Stakeholders

The list of potential stakeholders in point/nonpoint source trading programs is long and diverse. The point source community is relatively small (compared to the nonpoint source community), comprising mostly municipal and industrial sources holding NPDES permits along with their regulators and affiliate associations. In contrast, many different types of nonpoint sources are potential trading partners. As a result, numerous organizations with ties to nonpoint sources may play a role in supporting point/nonpoint source trading. Additionally, each category of nonpoint source typically represents a distinct constituency and communication between constituencies is often infrequent.

A first step in addressing institutional issues for point/nonpoint source trading involves identifying the specific institutions and organizations—even down to the departmental office or branch if necessary— that currently regulate, manage, assist, or act as watchdogs for the specific point and nonpoint sources in the area where trading is being considered. Some of these state, regional, and local organizations are identified in Exhibit 7.3.

EXHIBIT 7.3: POINT/NONPOINT SOURCE TRADING INSTITUTIONAL STAKEHOLDERS

- Environmental Protection Departments
- Natural Resource Management Agencies
- Public Health Departments
- Public Works Departments
- Public Utility Commissions
- Fish and Wildlife Agencies
- Forest Service Offices
- Mining Offices
- Local Conservation Districts
- State Soil and Water Conservation Districts;
- State Agriculture and Forestry Departments
- Natural Resource Conservation Service, Other USDA Affiliates
- Watershed Organizations
- Transportation Planning and Road Construction Organizations
- Land Use Planning and Zoning Organizations
- Flood Control Districts
- Navigation Districts
- Water/Irrigation Districts
- University Cooperative Extension Services
- Array of Nonprofits and trade associations related to above

Matching Trading Support Needs to Existing Roles and Responsibilities

Key support needs of any trading program include:

- Regulatory oversight
- Providing information
- Brokering and facilitation
- Tracking and documentation
- Technical assistance.

The appropriate level of support in any area is directly related to the scale and scope of trading. Since point/nonpoint source trading has the potential to involve a large number of traders, many trades, and a large geographic area, information, facilitation, and tracking may be particularly important. Because many unregulated nonpoint sources are accustomed to receiving technical assistance to help them implement voluntary pollution reduction efforts, this too may be a key support need of any point/nonpoint source trading program.

Generally, entities that already provide support to trading partners will be the best candidates to perform these functions for a trading program. By matching roles and responsibilities in a trading program to current ones, point/nonpoint source trading can be more easily integrated into the existing water quality management framework of a given area.

7.6 Administrative Issues

Administrative issues relate to the nuts and bolts of trading between point and nonpoint sources. Generally, they include the following activities:

- Guidelines for trading (e.g., eligibility, trading ratios)
- Information management and dissemination
- Facilitation and brokering
- Tracking and documentation
- Technical assistance.

Experience to date with point/nonpoint source trading, other types of effluent trading, and trading in other media has shown that the most successful trading programs are those which minimize administrative requirements for trading parties and their governmental partners.

For example, the lead banking and trading program that helped reduce lead content in gasoline has been cited as the most successful trading program in the United States. (Banking describes arrangements where pollutant reductions may be taken as credit some time after they are purchased.) Its success has been attributed in large part to simple trading arrangements and reporting requirements.

In contrast, many electric utilities have cited burdensome administrative requirements as reasons for not participating in the acid rain allowance auction established under the Clean Air Act and held through the Chicago Board of Trade. Further, it is widely believed that the Fox River point/point trading program faltered due to a poorly designed trading scheme (as described in Chapter 5).

Matching Administrative Arrangements to Trading Arrangements

The type of trading arrangements between point and nonpoint sources, as well as the number of trades and traders, will influence how much and what kind of administrative support is needed and whether point and nonpoint sources would benefit from administrative assistance from other stakeholders. For example, if a single point source is trading with a handful of nonpoint sources, administrative activities will likely be limited and additional assistance unnecessary. On the other hand, if a dozen point sources are trading with a hundred potential partners, administrative activities will likely be broad and assistance from selected agencies and watershed groups could greatly facilitate trading and keep transaction costs down. In fact, successful trading schemes are most likely to occur where there is a watershed group committed to overseeing the effort.

Specific arrangements point and nonpoint sources can use to carry out their trades are as varied as the possible combinations of point and nonpoint sources. They range from simple, single-trade arrangements to highly structured programs designed to support an active trading market.

Information Management

To facilitate trading, potential point and nonpoint source partners need to be able to identify each other. This can be accomplished by the sources independently or through a centralized service. Regulatory agencies, resource management departments, watershed groups, trade associations, and nonpoint source organizations are examples of candidates that can provide information about point and/or nonpoint sources to interested parties.

Point sources and other parties attempting to identify potential nonpoint source trading partners can consult a wide variety of resources, depending on the type of pollutant loading reduction sought and the profile of nonpoint sources in the trading area. Agencies and departments responsible for managing nonpoint source pollution can identify where nonpoint source BMPs are not required and/or have not been implemented. They also can describe the type of pollutants that nonpoint source BMPs and restoration projects can reduce.

Land use maps and property owner lists are often kept by local planning departments and/or state agencies. Regional planning and watershed organizations also may be a source of land use information. Where available, geographic information systems (GIS) also are a useful resource.

For nonpoint sources and other parties seeking point sources interested in trading, agencies regulating point sources generally have a considerable amount of readily available public information. This information describes applicable technology-and water quality-based limits, pollutant loadings, compliance records, and facility descriptions. Plant managers, public works officials, corporate environmental managers, and trade associations are contacts to solicit point source interest in trading.

Selected print and electronic media provide forums for communication about many aspects of trading. This can be especially important because point/nonpoint source trading involves many individuals and groups that may be unfamiliar with each other outside trading programs. For example, local newspapers, existing environmental and association publications, trading-specific newsletters, and electronic bulletin boards offer avenues for disseminating information about trading programs and publicizing opportunities.

Facilitation and Brokering

In some cases, point and nonpoint source trading partners can benefit from facilitation or brokering assistance to identify, evaluate, and/or transact trades. Traders will likely look for two things in a facilitator or broker: a familiarity with participants and issues and independence. Watershed associations, conservation districts, nonprofit groups, private firms, and some government agencies would meet these criteria.

Tracking and Documentation

At a minimum, tracking and documentation of trades should provide feedback to regulatory agencies and natural resource managers to ensure that trading is consistent with water quality objectives. Additionally, following implementation of BMPs and restoration projects would enable lists of candidate nonpoint source projects to be kept up-to-date. Tracking can provide valuable information to support estimation of the overall effectiveness of trading programs. For larger trading programs, regular (e.g., annual, quarterly) summaries of trading activities can be an important administrative tool.

Information that point and nonpoint traders, as well as other stakeholders, might find of interest includes:

- Parties to a trade
- Number of loading reduction credits available/needed
- Terms of trade (e.g., type of arrangement, price, trading ratio, monitoring/ maintenance conditions, etc.)
- Location and type of point and nonpoint source(s).
- Type of management planned or implemented.

Tracking and documenting trades also will develop information that can be used to enhance trading opportunities and can be shared with others to assist their consideration, design, and implementation of trading programs.

Technical Assistance

Because many potential nonpoint source trading partners mighthave had limited experience with BMPs and other pollution prevention measures, appropriate technical assistance can increase chances for successful trading. Many stakeholders listed above in Exhibit 7.3 have traditionally provided assistance to nonpoint sources to help them implement and manage BMPs. Identifying any necessary assistance is particularly important when nonpoint source owners or managers, rather than third parties, are responsible for operating and maintaining BMPs providing loading reduction credits.

7.7 Accountability and Enforcement

The contrast between accountability and enforcement authorities and approaches between point and nonpoint sources is a critical consideration for point/nonpoint trades. Point sources are controlled by federal and state regulations, whereas nonpoint sources are generally managed through local, state, and other federal regulatory, nonregulatory, and voluntary programs. EPA anticipates that parties to a trade will need to work with federal, state, tribal, or local regulatory entities on a case-by-case basis to ensure that there is an appropriate level of accountability and enforceability in a trading arrangement.

Reasonable Assurance Within a TMDL or Equivalent Assessment and Remediation Plan

In the first two situations for point/nonpoint source trading described above (section 7.1, Regulatory Issues), a trade will occur in the context of a TMDL or an equivalent assessment and remediation plan. A trade agreement between partners and the state agency must include a reasonable assurance that all parties will be able to implement the conditions of the trade. Point sources are subject to direct federal and state regulatory NPDES requirements. This direct enforcement authority provides a reasonable assurance that agreed-upon activities will be implemented and that if implementation does not occur there is a regulatory recourse available to compel compliance.

Reasonable assurance in the context of nonpoint source commitments is very different. Nonregulatory, non-federal reasonable assurances are appropriate bases for trades under the following conditions

1. The first condition for reasonable assurance for nonpoint sources is that proposed controls are technically feasible. Expectations for reductions included as part of a trade must be consistent with actual field information or commonly accepted modeling or textbook values. Performance expectations of BMPs must be consistent with past practice or expectations based on the application of the specific practice to similar situations. Thus, for example, expected reductions in sediment from agricultural activities must be based on similar soils, hydrology, crop practices, and associated pesticide and fertilizer application and usage.

2. The second condition for meeting reasonable assurance is that the appropriate local, state, or federal agencies have a reasonable expectation that a nonpoint source will implement specified controls. Reasonable assurance of implementation can be based on recent history of implementation and experience with similar types of activities. It may include local or state regulatory authority, or agreements between different parties to provide financial or technical assistance to finance implementation, especially where these agreements include contractual arrangements with a federal or state cost-share provider.

Examples of reasonable assurance vary. Some include:

- Performance measures for controlling and mitigating effects of development or other land-disturbing activities.

- Local ordinances, state laws, or written agreements or contracts that require implementation of best management practices for construction, agriculture, forestry, road construction, etc.

- Local ordinances for erosion control and flood protection.

- Local ordinances or state laws that rely initially on voluntary compliance, but provide for direct action in the event voluntary approaches are ineffective.

- Existence of financial mechanisms to support implementation of these and other voluntary and regulatory measures.

Exhibit 7.4 illustrates several examples of state laws to implement nonpoint source controls.

Meeting the Reasonable Assurance Test

In determining whether these types of programs meet the reasonable assurance test, designers of a trade need to consider a number of factors. First, are the proposed measures regulatory or voluntary? Unlike NPDES permits, these types of measures are rarely subject to direct federal oversight. They may be subject to local or state regulation. Examples of local regulation are zoning or construction runoff requirements applied to developers. These requirements typically have high rates of compliance, contain penalty provisions if violated, and are generally

EXHIBIT 7.4: STATE LAWS FOR IMPLEMENTING NONPOINT SOURCE CONTROLS

- The Rhode Island Coastal Resources Management Council has broad authority to enforce standards to reduce pollutant loadings from new development, redevelopment, and new and relocated roads, highways, and bridges. Violators may be subject to administrative fees, fines, and in some cases, criminal prosecution.

- The state of Delaware requires stormwater practices for new development to reduce total suspended solid loadings to surface waters. The state has responsibility for enforcement, exercised through referral from delegated agencies or citizen complaints. Delaware sediment and stormwater regulations provide the authority to levy penalties for violations.

- Maryland's *Forest Conservation Act* requires that local jurisdictions with planning and zoning authority adopt forest conservation programs that address how forests will be retained or planted in priority areas. The Department of Natural Resources has the right and authority to intervene in any local approvals of a forest conservation plan. The statute establishes enforcement authority through DNR for violation, stop work orders and penalties.

- Wisconsin law allows the state's Department of Natural Resources to directly remedy sites of significant pollution. The law applies to any nonpoint source category, including agriculture, urban, construction sites, and forestry, except for animal waste. DNR may order the abatement of any water pollution deemed to be significant. Examples of covered water pollution include a violation of water quality standards, a significant impairment of aquatic habitat or organisms, and restrictions of navigation due to sedimentation.

- North Carolina's "Nondischarge Rules" require certain categories of new and expanded animal waste systems to apply for and receive an approved management plan. In certain cases, where the state determines that a facility has an adverse impact on water quality, the rules also allow the state to require systems to apply for and receive an individual nondischarge permit from the Division of Environmental Management.

- The Kentucky Agriculture Water Quality Act requires that surface water and groundwater resources be protected from pollution from agriculture and silviculture activities. It also creates the Agriculture Water Quality Authority, which is a 15-member peer group made up of representatives from various agencies, organizations, and farmers. The Authority reviews water quality data and evaluates BMP effectiveness. The law also establishes a "Bad Actor Clause" that sets out a procedure to follow in the event that contamination occurs.

- Vermont has a law and regulations that implement and enforce land use practices designed to reduce the amount of agricultural pollutants entering state waters. Violators may face injunctions or administrative penalties if they do not follow recommended corrective actions.

- The state of Oregon requires some landowners engaged in agricultural activities to develop water quality management plans. If, under these plans, reasonable attempts at voluntary solutions have failed, applicable parties may be subject to enforcement procedures such as civil penalties as high as $10,000.

enforced. In addition, regulatory authorities need to provide for direct action in the event that voluntary approaches fail.

In the absence of a specific regulatory requirement, past practice, intent, and ability to pay for the agreed-upon activities may be considered. In this regard, voluntary programs with good records of past implementation may be considered. Similarly, existing programs with poor records of implementation may not meet the reasonable assurance test.

Reasonable assurance may depend on the existence of effective or assured financial support mechanisms. Voluntary programs with a past history of good compliance and a guaranteed source of funding probably meet the reasonable assurance test. Similarly, voluntary or regulatory programs eligible for funding support from assured sources of financing, such as low interest, government-guaranteed loans or assured payment streams, should be carefully evaluated for purposes of determining whether the measures being proposed meet the reasonable assurance test.

Contracts between nonpoint sources and federal or state agencies provide financial assistance in return for the owner or operator*s commitment to install and maintain particular practices and also may meet the reasonable assurance test. Certain programs provide, for example, economic incentives for voluntary action to reduce nonpoint pollution (e.g., USDA and state cost-share, loan programs from State Revolving Funds (SRFs), capitalized under the CWA).

Finally, reasonable assurance should consider the consequences if an implementation activity fails to occur. Specific performance contracts, incorporating performance bonds and other individual financial incentives, provide a very strong incentive for continued implementation. Lack of dedicated funding or specific financial incentives may indicate that reasonable assurance will be extremely difficult to demonstrate.

The third consideration in determining reasonable assurance is the time frame for implementation. Reasonable assurance would not apply, for example, to a local ordinance expected to be acted on by a city or county government in the near future. It would apply, however, if the ordinance had been passed and contained explicit implementation time frames consistent with any trade.

Reasonable assurance must be demonstrated for all these factors before EPA approves a TMDL based on reductions expected as a result of nonpoint source controls.

Reasonable Assurance and Actual Performance

Point sources must meet an individual discharge limit, i.e., an NPDES water quality-based effluent limit. Nonpoint source controls have higher degrees of technical uncertainty. A well-designed nonpoint source BMP, based on accepted modeling, data from similar applications, and commonly accepted professional expectations, may nonetheless fail to perform up to those expectations. In this situation, the TMDL might need to be revised or additional BMPs developed and implemented.

EXHIBIT 7.5: WATERSHED BANKS

A watershed bank enters into binding legal agreements (including Consent Agreements, Administrative Orders, or other legal contracts) with sources that will be implementing pollution controls in exchange for financial payments. The value of a bank is determined through the development of a TMDL or other equivalent analysis that allocates assimilative capacity and pollutant loads. The bank can be operated by a regulatory entity such as a state authority or can be operated by another public, private, or nonprofit entity. To compensate for any possible nonperformance by the watershed bank, the regulatory entity can require the bank to post a bond or related financial instrument in an amount sufficient to ensure that the regulatory entity would be able to implement needed pollution control measures. In setting prices for pollutant load reduction credits, a watershed bank will need to consider:

- The availability of nonpoint pollutant load reduction opportunities in the watershed.
- The likely future effects of implementing federal grant and other state nonpoint pollution control programs and the resulting effect on the availability of nonpoint pollution control opportunities.
- The likelihood of point sources seeking to initiate independent trades with nonpoint sources and the resulting effect on the availability of nonpoint pollution control opportunities.
- The need to generate cash income sufficient to cover the costs of the banking activity and to cover any unexpected costs associated with implementation of pollution control measures over time.
- The technical feasibility and time constraints of developing multiple pollution control programs at the same time.

Reasonable Assurance for Permit-Based Trades

In the third situation described in section 7.1, in which point sources identify trades with nonpoint sources that provide for cost-effective implementation of controls in lieu of treating their effluent to the degree specified in a water-quality based effluent limit, responsibility for determining reasonable assurance rests primarily with the NPDES permittee. In this situation, responsibility for meeting effluent limits, and ensuring that nonpoint source controls are implemented and effective, remains with the permittee. This trading arrangement must be explained in the fact sheet submitted when a permit is issued or reissued. EPA believes that the same consideration of reasonable assurance applied within the context of a TMDL is appropriate between the permittee and nonpoint sources for permit-based trades.

Watershed Banks

In addition to direct trades between parties, trading partners could participate in public or private banks, which could buy and sell pollutant reduction or other remedial action credits within a watershed. Each of these approaches works with individual buyers and sellers and public and private organizations. (See exhibit 7.5.)

7.8 Worksheet/Checklist

The following checklist outlines key questions to consider in implementing a point/nonpoint source trading program.

WORKSHEET FOR EVALUATING SUCCESS OF POINT/NONPOINT SOURCE TRADING

Legal and Regulatory Conditions	
General:	
C Is point/nonpoint source trading implemented within the context of NPDES permitting, local ordinances for nonpoint sources, TMDLs, and/or other applicable water quality regulations?	yes no
Specific:	
C Can specific effluent limits be assigned to each point source, if necessary?	yes no
C Do reopener clauses in NPDES permits allow trading arrangements to be altered if water quality standards are not met?	yes no
C Does the regulatory climate for nonpoint sources create trading opportunities?	yes no
Economic Conditions	
General:	
C Can point and nonpoint sources save or make money by trading (i.e., are there economic incentives to trade)?	yes no
Specific:	
C Do total incremental costs for pollution reduction, which include direct incremental costs and transaction costs, differ among dischargers?	yes no
C Do cost differentials among dischargers allow point sources to reduce pollution more cheaply than nonpoint sources?	yes no
C Do cost savings from trading outweigh the uncertainty that dischargers face under trading schemes?	yes no
C Are transactions costs less than cost savings from the trade?	yes no
C Is there a sufficient supply of pollution reduction for sale, as well as a reasonable demand to buy reduction credits?	yes no

Data Availability Conditions	
General:	
C Are the data necessary to implement a trading program available or estimable?	yes no
Specific:	
C Are there enough data to understand pollution quantities and flows within the watershed (e.g., have water quality authorities conducted a TMDL or similar analysis)?	yes no
C Can ambient water quality be monitored under trading?	yes no
C Are the physical characteristics of the watershed and waterbody appropriate to accommodate trading?	yes no
C Can point sources estimate their direct costs for reducing a specified unit(s) of pollution (direct incremental costs)?	yes no
C Can a direct cost or a watershed-wide average cost be calculated for nonpoint sources to reduce a specified unit(s) of pollution?	yes no
C Can dischargers estimate transaction costs that they would have to pay to conduct trades?	yes no
Administrative and Institutional Conditions	
General:	
C Are governmental authorities and potential trading participants capable of administering a trading program?	yes no
Specific:	
C Do governmental authorities have enforcement mechanisms to ensure trades are being implemented correctly and applicable limits and water quality standards are being met?	yes no
C Is information about trading partners readily available so that buyers and sellers can coordinate?	yes no
C Are responsibilities clearly defined for institutions and dischargers taking part in trading?	yes no
C Is the scope of administrative infrastructure compatible with the amount and complexity of the trading that is expected?	yes no
C Are accountability for implementation of measures to reduce pollutant loading and accountability for water quality improvements clearly established?	yes no
C Can the agency responsible for enforcing trading provisions give necessary feedback to parties responsible for water quality?	yes no

CHAPTER 8. NONPOINT/NONPOINT SOURCE TRADING

***Nonpoint/nonpoint trading** describes situations where nonpoint sources that have a responsibility or a commitment to reduce pollutant loads arrange for reductions at other nonpoint source sites.*

Introduction

Nonpoint/nonpoint trading occurs where nonpoint sources meet state or local requirements by installing best management practices (BMPs) or conducting restoration at another location. The terms *on-site* and *off-site* describe where BMP and restoration projects occur relative to the nonpoint source property in question. As a result, nonpoint/nonpoint trading is a somewhat new term to describe off-site activities. (To be consistent with other chapters, this chapter uses the term "nonpoint source" to mean landowners and contributors to nonpoint source pollution).

This chapter focuses on arrangements where at least one nonpoint source faces a voluntary commitment or mandatory, enforceable requirement to implement BMPs or reduce loadings by some amount and the buyer pays at least part of the cost to the seller in cash or in services. Exhibit 8.1 describes two such trades.

Off-site options and trading programs are not alone in increasing the effectiveness of nonpoint source pollution control. Many watershed management and related programs provide cost-sharing, low-interest loans and grants, and technical assistance to support nonpoint source controls. Some of these programs embody the same cost-effectiveness principles as trading.

EXHIBIT 8.1: NONPOINT/NONPOINT TRADES AT LAKE DILLON, COLORADO

Several nonpoint/nonpoint source trades have been implemented at Lake Dillon, Colorado, under a framework originally established for point/nonpoint source trading that has been in place since 1984. The four POTWs discharging to the lake have not needed to trade to meet their loading allocations due to high plant operating efficiencies and slower-than-anticipated population growth. Instead, controlling nonpoint source loading is now a major objective in the lake's phosphorus mitigation strategy.

In one trade, the Town of Frisco plans to use phosphorus loading reductions the Frisco Sanitation District achieved with stormwater controls to offset additional phosphorus loadings a proposed new golf course is expected to generate. (This trade also is an example of banking reductions for future application.) In another trade, Keystone Resort paid for sewering individual septic systems in specific areas to produce reductions it could use to offset new nonpoint source loads projected to come from future resort development. In both trades, additional nonpoint source loads were fully offset with nonpoint source loading reductions (i.e., no net gain in nonpoint source loadings).

Sources: *Incentive Analysis for Clean Water Act Reauthorization: Point Source/Nonpoint Source Trading for Nutrient Discharge Reductions* prepared for the EPA Offices of Water and Policy, Planning, and Evaluation, April 1992; and Northwest Colorado Council of Governments, personal communication, May 1996.

An important reason nonpoint sources, regulators, and watershed managers exercise off-site options is to capture cost savings or additional environmental benefits unavailable from on-site options. A number of factors can influence costs and expected effectiveness of nonpoint source control, including site characteristics; available BMP options; proximity to incompatible land uses (e.g., a wetland in the middle of an urban area); and location-specific technical considerations related to implementation, operation, maintenance, monitoring, and other actions. Trading, which can result in more selective siting of BMPs, can minimize costs and maximize environmental results.

8.1 Regulatory Issues

The major distinguishing regulatory feature of nonpoint/nonpoint source trading is that trading parties are rarely regulated by federal implementation of the CWA. Instead, the federal government relies on state programs, operated in part with federal dollars, to manage nonpoint source pollution by vesting the states with management responsibility. This situation gives states flexibility in how they exercise that responsibility and enables them to defer to local land use authorities.

Examples of this approach are found in section 319 of the CWA and the Coastal Zone Act Reauthorization Amendments (CZARA). Under these laws, coastal states develop and implement comprehensive management plans (subject to EPA approval) that address nonpoint source pollution. Federal grant eligibility under the nonpoint source and coastal zone management programs is contingent on EPA approval of such plans.

States and local governments rely on a wide variety of regulatory and nonregulatory tools to manage nonpoint source pollution. The specific approach taken in any given jurisdiction reflects a combination of local economic and environmental priorities and preferences, as well as historical treatment of land uses and other local considerations. As a result, regulation of nonpoint sources varies greatly across jurisdictions, and readers interested in trading are encouraged to familiarize themselves with local nonpoint source management approaches.

Three strategies for managing nonpoint source pollution that state and local governments employ are discussed below:

- State and local regulatory programs
- Quasi-regulatory programs
- Voluntary programs.

In addition, wetland mitigation banking is available as a management tool under the CWA section 404 permit program. It also is discussed below.

State and Local Regulatory Programs

State and local governments can use permitting, licensing, or other prior approval processes to protect water quality, natural resources, and public health from land uses that generate or have the potential to generate nonpoint source pollution. State and local governments also can operate permit programs in which an activity*s location triggers permit review. Exhibit 8.2 describes key features of state and local permit programs and provides examples of activities and geographic areas that most often receive attention from such programs.

EXHIBIT 8.2: STATE AND LOCAL PERMIT PROGRAMS FOR NONPOINT SOURCES

State and local permit programs involving nonpoint sources can be extremely diverse due to the fact that they are optional and lack federal guidance. These programs, however, do have some common features. Permit programs also tend to apply to a common set of activities and a common set of geographical areas.

Key features:

- Enabling legislation and/or ordinance
- Definition, description, delineation of area subject to regulation
- Identification of uses and activities allowed, permitted, and prohibited
- Permitting criteria, design, and performance standards (sometimes specified by state statute)
- Required and/or voluntary BMPs
- Monitoring requirements
- Requirements for prevention or mitigation of adverse impacts
- Penalties for noncompliance

Examples of regulated activities *(many of which can also fall under regulation by the NPDES program)**:***

- Building and development, including roads
- Timber harvesting
- Landfills
- Livestock management
- Pesticide and fertilizer application
- Marina siting
- Golf courses
- Septic system siting and operation

Common special permit areas:

- Wetlands and adjacent uplands
- Shorelines
- Floodplains
- Wellhead protection areas
- Coastal zones
- Special management areas
- Riparian zones
- Erosion-prone areas such as hillsides
- Aquifer recharge areas
- Drinking water supply sources
- Sensitive-designated areas

Unregulated sources can be trading partners with regulated or unregulated sources. Activities may be exempt from permit review, always permitted, or omitted in ordinances. “Grandfather” clauses also provide exemptions for land uses that existed prior to enactment of enabling legislation.

Jurisdictions exempt certain activities from permit programs for a number of reasons, including the following: use compatible with water quality protection; use provides substantial and broad economic benefits; and/or use provides substantial public benefits. Such unregulated nonpoint sources are generally addressed in one or more management plans that depend on quasi-regulatory programs or voluntary implementation of BMPs.

Flexibility at the local level creates significant opportunities for trading among nonpoint sources. Combinations of permitted and unregulated nonpoint sources may exist within a watershed. Both types of sources, however, may trade with each other.

Local planning departments and other agencies with permitting authority often have wide-ranging choices of what BMPs and restoration requirements they include in permits. Minimum standards establish baseline conditions for permits. Beyond those, local officials typically specify conditions based on a balance between environmental protection considerations and economic development objectives.

Local officials concerned about balancing economic impacts typically seek ways to minimize compliance costs while maintaining target levels of environmental protection. Many local governments accept off-site options after permittees show that on-site options are economically or technically less desirable or infeasible. Some jurisdictions also offer permittees the option to pay a fee to support public and private environmental restoration projects in lieu of on-site action, particularly where on-site actions are less beneficial to the ecosystem or watershed than a more holistic approach.

Since many local governments have experience administering permits that allow for off-site BMPs and restoration or fees in lieu of on-site action, implementing nonpoint/nonpoint source trading is not a new concept. Those interested in expanding existing options for such nonpoint/nonpoint source trades should first review ordinances, memoranda of agreement, management plans, and other relevant documents to determine whether revisions are necessary to allow more frequent consideration of off-site or fee-in-lieu contributions.

Quasi-Regulatory and Voluntary Management Programs

A variety of quasi-regulatory approaches create incentives for nonpoint/nonpoint source trading and a framework for implementation of trades. These approaches include nonpoint source management plans, cost-share agreements, and load allocations (LAs) that result from TMDL development.

Management plans that address nonpoint source pollution are often developed for watersheds, jurisdictions, special areas, or specific source categories. Plan sponsors encourage voluntary BMP implementation through a variety of mechanisms, including low interest loans, direct grants, cost-sharing, technical assistance, outreach and public education, provision of benefits contingent on BMP implementation (e.g., program eligibility, financial support), and linking other regulatory and economic decisions to implementation.

A TMDL or other watershed project that identifies contributing sources and develops target loads also may provide incentives to trade. TMDLs develop LAs to allocate portions of the total load to selected nonpoint sources. LAs are implemented through state and local nonpoint source control programs that vary in their reliance on regulatory requirements and voluntary measures to achieve loading reductions.

Wetland Mitigation Banking

The CWA section 404 permit program regulates discharges of dredged or fill material into waters of the United States, including wetlands. The section 404 program relies on compensatory mitigation to offset unavoidable impacts to wetlands and aquatic resources. Mitigation typically involves the restoration, creation, enhancement, or, in exceptional circumstances, preservation of wetlands.

Federal guidance on wetland mitigation "banking" encourages the consolidation of small, fragmented mitigation projects into large, contiguous sites that are more beneficial to the environment. Units of restored, created, enhanced, or preserved wetlands are expressed as "credits," which may subsequently be withdrawn to offset impacts, or "debits," incurred at a project development site.

While traditionally used to offset wetland losses, a mitigation bank also can be used to compensate for other impacts to aquatic resources, such as point and nonpoint sources of pollution, where wetlands in the mitigation bank serve to enhance or protect water quality. In this way, nonpoint/nonpoint trades may take place within the context of wetland mitigation banking.

8.2 Economic Issues

Like other types of trading, cost and cost-effectiveness are primary economic considerations for nonpoint source trades between on-site BMPs and off-site alternatives. There is a significant distinction in costs for nonpoint source control, however, that affects nonpoint/nonpoint trades: costs for nonpoint source controls are highly dependent on site-specific characteristics.

Awareness of site-specific factors that influence BMP cost, and likewise cost-effectiveness, allows identification and comparison of specific BMP options. These factors, which include physical site conditions, nature of BMP required, scale of BMP implementation or restoration efforts, availability of cost-sharing, and presence of transaction costs, are discussed below.

Before addressing each of these factors, though, it is important to note that nonpoint sources and communities in which they exist may have different objectives. Nonpoint sources are primarily concerned with minimizing costs for BMP implementation and typically are concerned about cost-effectiveness only where performance standards are applicable. Communities sponsoring trading also are interested in providing cost savings to nonpoint sources, but not at the expense of environmental goals. They are more concerned with achieving environmental goals as cost-effectively as possible. Reconciling stakeholder objectives and providing clear incentives are critical to designing successful trading programs.

Physical Site Conditions

Trading provides nonpoint sources with opportunities to select the least costly BMP implementation option that will achieve their environmental objective. This may involve taking an action off-site that is less expensive than it would be on-site. It also may involve selecting a different, less expensive off-site BMP that is appropriate. BMP suitability depends on site conditions, so options and costs vary from site to site.

The cost of a specific BMP varies with local physical conditions, such as slope, soil type and permeability, vegetative coverage, micro-climates, land uses, size of drainage area, and depth to bedrock. This is especially true for structural BMPs because their design, construction, operation, and maintenance must be tailored to site conditions. The terms *structural* and *nonstructural* refer to two types of BMPs. Structural BMPs are those which require construction efforts or physical changes to a site. Nonstructural BMPs do not change physical site conditions. Instead, they change *how* humans use a site.

Nature of BMP Required

Measures available to control nonpoint source pollution include a range of physical structures and natural systems, as well as nonstructural behavioral changes and protection efforts. Often, nonstructural BMPs are less expensive than structural BMPs to implement because they involve less engineering design, site preparation (e.g., grading), and construction, all of which can be relatively expensive. Thus, a site that would require structural BMPs to achieve desired loading reductions can arrange a trade that uses less expensive off-site nonstructural BMPs.

Even though nonstructural BMPs tend to be less expensive than structural BMPs, they can be costly when they require land purchases or other resource-intensive actions. Alternative techniques, such as conservation easements, are often available to supplement or replace expensive land purchases and other actions.

Scale of BMP Implementation

Nonpoint/nonpoint source trading can provide opportunities to take advantage of economies of scale (which occur when average unit cost decreases as scale increases). Larger BMPs and restoration projects are generally less expensive per unit than smaller ones of the same type. Certain kinds of costs, such as those related to design and equipment, are relatively stable regardless of size, and smaller projects have fewer units (e.g., feet, cubic feet, acres) over which to spread such costs. However, proximity to existing activities and effective scheduling of resources can make small-scale BMPs more cost-effective.

Several types of trading arrangements help nonpoint sources take advantage of economies of scale. Many involve *piggybacking* or *pooling*. Piggybacking describes arrangements where a nonpoint source contributes additional funding to expand a project*s scope beyond what would have been implemented without the trade. Pooling describes arrangements where several nonpoint sources responsible for implementing individual BMPs or mitigating wetland losses implement a single project together. Exhibit 8.3 illustrates these concepts.

Both approaches offer advantages to nonpoint sources, project sponsors, resource managers, and watersheds by lowering unit costs and increasing the frequency and size of well-designed and managed restoration projects. These approaches also can reduce or eliminate transaction costs associated with trade identification, evaluation, implementation, and monitoring.

Availability of Cost-Sharing

Several nonpoint source management programs offer assistance for BMP implementation in the form of cost-sharing, direct grants, loans, and technical assistance. Cost-sharing opportunities are especially prevalent in agricultural programs, and other situations in which affordability of BMPs is a concern. The availability of cost-sharing plans for certain types of nonpoint sources may make them

EXHIBIT 8.3: TWO EXAMPLES OF POOLING AND PIGGYBACKING : FEE-BASED WETLAND MITIGATION PROGRAMS IN MARYLAND AND LOUISIANA

The Maryland Department of Natural Resources (DNR) may accept fee-based compensation for mitigation requirements if it determines that creation, restoration, or enhancement of nontidal wetlands is not feasible. In most cases, monetary compensation is acceptable if the size of the nontidal wetland loss is less than one acre and mitigation is not feasible on-site. DNR determines the mitigation acreage requirements as a function of the size of the permitted impact and an established mitigation ratio—3:1, 2:1, or 1:1. Per acre mitigation fees are determined based on the cost to buy land in the affected county, plus design, construction, and monitoring costs. (In 1993, they ranged from $11,000 to $52,000 per acre.) The fee option enables DNR to collect and pool compensatory mitigation fees from small development impacts to fund larger nontidal wetland restoration, creation, and enhancement projects. DNR presented the fee option as a mechanism not only to reduce the administrative burden on the regulatory process, but also to serve as a means of fulfilling its responsibility to mitigate for impacts of less than 5,000 square feet, for which it does not require individual mitigation projects.

The Nature Conservancy*s Louisiana field office (LNC) administers a program in which it accepts fees in compensation for unavoidable losses of wetlands stemming from development activities located in southeastern Louisiana. LNC uses compensation fees for off-site preservation and long-term management activities of degraded pine flatwood wetlands. In all cases, the U.S. Army Corps of Engineers (Corps) determines whether fee-based compensatory mitigation is acceptable after potential impacts have been avoided, unavoidable impacts have been minimized, and feasible on-site mitigation measures have been determined to be impracticable. The Corps also determines the amount of acreage that must be mitigated through a standardized process that quantifies the overall natural quality of the wetlands in the area. Compensatory fees payable to the trust fund take into account the appraised ecological value of the developed property and the estimated loss of ecological value as a result of the development. Valuation calculations are primarily the Corps *s responsibility.

more likely to install BMPs. It also will make some BMPs subsidized with cost-share funds less expensive to the nonpoint source than other BMPs. Thus, these sources may be good candidates for off-site partners in trading programs.

Transaction Costs

Nonpoint/nonpoint source trading involves some transaction costs that are different from those identified with other trading types. The major difference stems from the fact that nonpoint sources tend to be less conspicuous—by definition they are diffuse. They are also typically smaller and more numerous. These tendencies can make identifying suitable trades costly. In addition, a nonpoint source can experience transaction costs in evaluating off-site options. Transaction costs vary based on factors including:

- Ability to identify other nonpoint sources.
- Number and proximity of off-site options.
- Similarity of nonpoint source candidates.
- Complexity of physical conditions at area nonpoint sources.

- Availability of preexisting data at off-site sources.

- Efforts required to compare off-site options to on-site options.

Local governments and state agencies involved in nonpoint source pollution management can help reduce transaction costs by supplying information about potential trading partners. Nonprofit environmental organizations also might be able to direct interested parties to candidate nonpoint source trading partners. Additionally, watershed management, growth management, and local comprehensive plans often identify unaddressed nonpoint source pollution problems.

8.3 Data-Related Issues

Nonpoint/nonpoint trading may require several types of data. Pollutant loads and water quality data provide an indication of the ability of BMPs to control nonpoint source pollution and enhance watershed ecology. Economic information enables cost comparisons between BMP options, while geographic data helps understand the types and distribution of land uses that contribute to nonpoint source pollution in watersheds.

Pollutant Loads and Water Quality Monitoring Data

In many places, nonpoint/nonpoint trading relies on creative strategies, simple techniques, and approximations to identify opportunities and evaluate results because the quantity and quality of pollutant loading and water quality data vary considerably. Unlike point sources, nonpoint source loads are not typically monitored at the source. When loads are measured at the water*s edge, it is often difficult to attribute loads to specific near-shore and upland sources.

Data may be of sufficient quantity and quality to support trading where data collection and analysis efforts exist as part of other programs. As a result, data quantity and quality is a site-specific issue that requires careful consideration. In urban areas, ambient monitoring conducted for stormwater programs and by point sources as part of their NPDES permit requirements can provide useful information for nonpoint/nonpoint source trading. In urban and rural areas, U.S. Geological Survey monitoring stations also provide some data. Other sources of data include:

- TMDL waterbody analyses, especially where load allocations are made.

- Section 319 monitoring programs.

- National Estuary Program estuaries.

- Great Lakes, Chesapeake Bay, and Gulf of Mexico programs.

- Federal, state, regional, and local special management areas.

- Nonpoint source-specific agencies and programs.

- Demonstration and pilot projects.

- Academic studies.

In the absence of site-specific data, nonpoint/nonpoint trading can be supported by a variety of techniques that are available to estimate BMP pollution control efficiencies. These techniques range from simple runoff and soil loss equations to more complex ecosystem modeling and simulations.

These techniques have been applied with good results to structural BMPs, such as infiltration basins, vegetative filter strips, sediment barriers, and detention ponds. Their applicability to nonstructural BMPs, such as street cleaning, air pollution control, public education, and land use planning, is still an emerging science. As a result, relatively few data are available that characterize the effectiveness of nonstructural BMPs.

Nonpoint/nonpoint source trading can be initiated with the best available data, using estimates if necessary. As trading occurs, managers can conduct periodic evaluations to determine if program design or administration adjustments are warranted. Additionally, as trading evolves, monitoring improvements and other advances can be used to increase the data precision and enhance environmental results.

Economic and Geographic Data

Economic and geographic data related to nonpoint sources are typically available from state and local government agencies, special regional and university-based programs, and federal publications. Cost estimates for BMP implementation in specific areas are not always available, but a variety of sources provide estimates of incremental unit costs and describe how to adjust such general estimates for source, location, climate, and other site-specific factors.

Maps and other records indicating location of potential trading partners and existing BMPs are generally available from state and local planning departments. These same departments, universities, or regional governmental and watershed organizations sometimes have geographic information systems that can produce detailed maps showing, for example, zoning, land use, soil conditions, and topography.

8.4 Technical and Scientific Issues

Nonpoint source pollution occurs when rain, snowmelt, or irrigation return flows move over and through the ground, transporting pollutants from the land to surface water. Nonpoint source pollution also results from atmospheric deposition (i.e., pollution from rain or airborne contaminants) and hydrologic modification (e.g., channelization and channel modification, dams, and streambank and shoreline erosion). Nonpoint sources contribute to water quality problems associated with nutrients, pesticides, metals, organics, bacteria, low dissolved oxygen, and suspended sediment.

The way in which nonpoint source pollution occurs raises several scientific issues that must be considered to undertake nonpoint/ nonpoint trades. These issues include:

- Natural watershed conditions (local soils and precipitation, for example).
- Effectiveness of BMPs.
- Spatial, temporal, and chemical differences among nonpoint source loads.

Natural Conditions

Since nonpoint source loads are highly dependent on natural, random, and mostly uncontrollable events, understanding and predicting the results of trades may be difficult. Climatic events, such as precipitation, wind, and temperature, greatly affect delivery of nonpoint source loads. Geologic and hydrologic conditions, including surface soil types, underlying geologic structure, and watershed hydrology, also influence nonpoint pollution.

Nonpoint/nonpoint trading programs require flexibility to handle the variability of nonpoint source loads. For example, above-average rainfall might cause increased nonpoint loads, even after BMPs have been implemented through a trading program. This situation does not necessarily reflect ineffective BMPs. Use of scientific models or other analytical tools can help program administrators understand the effects of random watershed conditions and verify the effectiveness of trading programs.

Effectiveness of BMPs

The effectiveness of a BMP at a particular site is subject to a variety of factors that interact in sometimes complex and/or hidden ways. Some factors are human-influenced, while others are natural or otherwise uncontrollable. They include:

- Proper installation, operation, and maintenance.
- Suitability of BMP selection and design for source and pollutants.
- Physical site conditions such as slopes, soils, and water table.
- Climate, including precipitation, temperature, and wind.

Because such variability exists, available estimates for BMP effectiveness are usually expressed in the form of ranges or averages. But measuring the effectiveness of non-structural BMPs is more problematic than measuring the effectiveness of structural BMPs. Effectiveness can be expressed in terms of reduced loads, improved water quality, and/or other benefits such as habitat or flood protection. Scientific models are also used to evaluate potential effectiveness of BMPs under a range of conditions. Departments of agriculture and local planning departments are two potential sources of BMP effectiveness information along with *Guidance Specifying Management Measures For Sources Of Nonpoint Pollution In Coastal Waters* (USEPA, Office of Water, 840-B-92-002, January 1993).

One way to address such variability is to index pollutant loading reductions to a baseline year, as was done for the Lake Dillon Program. By doing this, program managers would not penalize BMPs that removed relatively small amounts of pollutants during dry periods or over-credit BMPs that removed significant amounts despite poor performance during heavy rainfall conditions.

Side effects are an important consideration in evaluating and comparing trading options. For example, management practices that intercept pollutants leaving a source (e.g., installation of infiltration basins) may reduce runoff, but also may increase infiltration to groundwater. Such BMPs may not be suitable for trading in areas with high groundwater tables.

Again, flexibility is the key for administrators of nonpoint/nonpoint trading programs to manage variability. Just as they account for variability in natural conditions, trading programs must account for variations in BMP effectiveness.

Spatial, Temporal, and Chemical Considerations

Spatial, temporal, and chemical differences and uncertainties can exist among loads from nonpoint sources. This can be true within as well as across source categories. Estimating relative impacts of load reductions from one nonpoint source compared to that from another helps predict the potential effects of trading on water quality.

Nonpoint/nonpoint source trading shifts additional load reductions from one site in a watershed to another site. As noted above, nonpoint source loads are site-specific and vary according to a number of factors. Thus, changing the spatial configuration of nonpoint source loads to waterbodies can produce results for water quality that are difficult to predict.

Substituting reductions in nonpoint source loads from one site for another also can change the timing of loads to waterbodies. The major reason for these changes in the temporal arrangement of loads is that discharges from different nonpoint sources occur at very different rates. For example, a sharply sloped, paved urban area can discharge much higher quantities of runoff than a flat, vegetated septic system field during a single rain event. Thus, trading may alter the rate at which selected pollutants are discharged, producing uncertain effects on water quality.

In addition to effects from spatial and temporal configurations of nonpoint source loads, trading can change the overall chemical composition of loadings. This facet of nonpoint/nonpoint trading occurs for two reasons: (1) different nonpoint sources produce different types of pollutants; and (2) the same pollutant from different types of nonpoint sources may produce different reactions in receiving waters.

Some nonpoint source loads are associated with dissolved constituents (e.g., those carried by irrigation return flows and leaking septic systems). Others are associated more closely with solid phase constituents (e.g., urban runoff and soil erosion losses from cropland). Trades that affect the proportion of various constituents in nonpoint loads can significantly modify water chemistry.

Managing Load Differences

Given the fluctuating nature of nonpoint source loads, nonpoint/nonpoint trading programs can be relatively difficult to quantify and more uncertain than other types of programs. Various methods for managing this uncertainty, however, are available to water quality authorities and other stakeholders in a trading program. These methods help to ensure that water quality objectives are achieved.

One approach is to compare nonpoint source loads using average loads over a specific time period, such as a season, year, or low-flow period. Average loads for various nonpoint sources can highlight the relative magnitude of spatial, temporal, and chemical differences.

TMDL margins of safety are another approach to ensure achievement of water quality objectives in trade situations by setting aside a portion of pollutant allocations. Margins of safety may reflect uncertainty about the relative effectiveness of nonpoint source controls where trading is an option. Using margins of safety to structure individual nonpoint/nonpoint trades can decrease the uncertainty associated with load reductions from nonpoint source controls.

Exchange rates, or trading ratios, define the reduction in pollutant loading at one site needed to match reductions in loading at another. Trading ratios can be used for nonpoint/nonpoint trades where loading reductions are less certain at one site than at another (or result in less water quality improvement). In such situations, a nonpoint source purchases more than one unit of off-site load reductions for every unit of credit received. This “extra” reduction acts as an insurance policy to make sure that expected water quality improvements actually occur.

8.5 Institutional Issues

Institutional support for nonpoint/nonpoint source trading is key to successful trades. Institutions involved can be as numerous and diverse as the types of nonpoint sources in a watershed. Typically, management of nonpoint sources is based on the economic sector (e.g., farming, forestry, etc.) and/or jurisdiction (e.g., city, county, special district).

The result is often a patchwork of oversight and assistance, which requires coordinated efforts among institutions. Overlaps occur frequently where two or more institutions are involved with the same nonpoint sources in the same areas. Just as frequently, different institutions can be involved in nonpoint source management on adjacent parcels, but not coordinate their activities. Further, gaps in coverage exist for selected categories in some areas.

Identifying Supporting Institutions

Listing the types of nonpoint sources located in a trading area helps identify those institutions which could play a role in supporting trading. Although specific institutional structures vary from state to state, and even at the local level, Exhibit 8.4 lists agencies and departments that typically manage different types of nonpoint sources.

Any organization involved with nonpoint sources that might be trading candidates should be invited to participate in early discussions about trading. Other stakeholders can benefit from their knowledge and expertise about particular nonpoint sources and BMPs. Additionally, such participation ensures that nonpoint trading is examined as broadly as possible before eliminating any sources or locations from consideration.

Once it becomes clear which nonpoint sources are likely to be trading partners (e.g., agriculture with agriculture, septic with agriculture), institutions not currently involved with those sources opt out of playing a significant role in trading. Nevertheless, keeping them informed about trading developments provides opportunities for them to identify future trading possibilities.

Coordinating Institutions

Achieving sufficient coordination among participants may be particularly challenging for nonpoint source trading. Many organizations involved in nonpoint source management work with specific nonpoint sources; communication among the organizations is limited. Therefore, when trading partners are similar with respect to category, activity, location, and

EXHIBIT 8.4: INSTITUTIONS THAT MANAGE VARIOUS TYPES OF NONPOINT SOURCES	
Nonpoint Sources	**Institutions**
Agricultural runoff	Natural Resource Conservation Service, state agriculture or soil and water conservation agencies, water conservation districts
Silvicultural runoff	National Forest Service, state forestry agencies
Urban runoff and construction activities	State and local permitting authorities, including land use planning and zoning departments/boards
*Septic systems**	State and local public health departments
Residential urban runoff	State and local environmental protection departments, consumer protection and education offices
*Marinas and recreational boating**	U.S. Coast Guard, state and local natural resource offices
Hydromodification	U.S. Army Corps of Engineers, delegated Section 404 states, local governments, navigation districts
**Although nonpoint sources, these can fall under regulation by the NPDES program.*	

jurisdiction, coordination is relatively easy; when trading partners are dissimilar with respect to these factors, coordination is more challenging.

Coordination challenges often can be met with minimal additional effort. Stakeholders can identify a lead organization to facilitate coordination and clarify responsibilities.

Candidates for this role include organizations with permitting authority or with management responsibility for areas where traded BMPs will be implemented, as well as umbrella institutions such as watershed organizations and regional planning commissions. Nonprofit environmental organizations also typically are involved with many different sources. Other mechanisms to enhance coordination include work groups, task forces, and information sharing. Exhibit 8.5 illustrates roles in one nonpoint/nonpoint trading case study.

8.6 Administrative Issues

In most areas, regulatory and nonregulatory nonpoint source management programs provide a framework for trading. Trading is most successful when it is integrated into existing regulatory and management frameworks, making changes or adding new responsibilities when necessary. Nonpoint/nonpoint source trading may require the following types of administrative support:

- Establishing guidelines for trading (e.g., eligibility, trading ratios).
- Information management and dissemination.
- Facilitation and brokering.

EXHIBIT 8.5. INSTITUTIONAL ROLES IN A POTENTIAL SELENIUM TRADING PROGRAM

In a study examining the feasibility of using economic incentives to control nonpoint source pollution from subsurface farm drainage in California*s Central Valley, the Environmental Defense Fund (of a) proposed a program that relies on trading. The Regional Water Quality Control Board would specify a TMDL for selenium in the San Joaquin River and then assign allocations (essentially LAs) to regional drainage districts, or directly to water districts (in the absence of a regional district) in the form of discharge permits. The regional districts would then allocate LAs among contributing water and drainage districts. The trading program would provide an additional opportunity to adjust load allocations. Through trades, districts could achieve a cost-effective distribution of pollution reduction responsibility (which may change from year to year) and resolve any equity issues resulting from the initial allocation. The regional drainage districts would assist member districts by identifying potential trades, recording transactions, and enforcing permit limits.

Source: *Plowing New Ground: Using Economic Incentives to Control Water Pollution from Agriculture* Environmental Defense Fund (T. Young and C. Congdon), 1994, pp 126-127.

- Tracking and documentation.
- Technical assistance and outreach.
- Coordination among participants.

Administrative needs differ for nonpoint/nonpoint trades that involve at least one permitted party compared to trading strictly among unregulated partners.

Administration When One Party Is Regulated

When at least one party to nonpoint trading operates under the conditions of a state requirement or local ordinance, trading can be fully or partially administered through the applicable requirements.

Usually, construction, operating, and other types of requirements that cover nonpoint sources include the following information that is useful to support trading:

- Name and address, and site address if different.
- Required BMPs (identified as performance- or design-based), performance standards, and mitigation/restoration.
- Location of BMP/restoration project if off-site.
- Special off-site conditions (e.g., two acres off-site equal one acre on-site, monitoring, reporting).
- General conditions for compliance.
- Inspection rights.
- Enforcement measures.

If programs already offer off-site options under certain circumstances (and in effect have a trading program), nonpoint/nonpoint trading can be administered easily through this existing option. If off-site options are currently unavailable, areas considering trading can look to other jurisdictions offering off-site options as models. It might be appropriate to supplement existing requirements with additional site-specific information to ensure that water quality managers and nonpoint source owners are aware of trading activities.

When BMPs are implemented at different sites than they would be in the absence of trading, authorities and nonpoint sources can involve appropriate organizations in a variety of ways to facilitate trading and maximize effectiveness. Options to involve other organizations include sharing information, engaging them in identifying trading opportunities, and assigning them responsibility for oversight, monitoring, and/or technical assistance.

Administration When Both Parties Are Unregulated

Trades involving unregulated nonpoint sources may generally rely on existing technical and financial assistance networks to help administer trading. In many areas, assistance is available to nonpoint sources that implement BMPs voluntarily.

Trading is easier to administer between nonpoint sources covered by the same program. Cross-source trading is more difficult to administer since partners may be unfamiliar with each other, and different programs may be incompatible.

8.7 Accountability and Enforcement

Trading programs function differently depending on the regulatory status of partners involved. For example, when regulated nonpoint sources trade with each other, permitting authorities want to be sure that each party to a trade fully meets applicable permit conditions. Permitting authorities can specify trading arrangements as permit conditions for nonpoint sources involved in trading.

Where regulated nonpoint sources trade with unregulated nonpoint sources, permits could specify that regulated parties are responsible for off-site BMP implementation. This provides the permit authority control over water quality. Alternatively, nonpoint source owners/managers or third parties can accept responsibility for BMPs through contracts or other agreements.

One way nonpoint/nonpoint trading can increase the effectiveness of BMPs is by targeting implementation at a place and/or source where the level of accountability and enforcement is higher than it is on-site. BMP effectiveness is dependent, in part, on proper installation and maintenance. This includes holding nonpoint sources accountable when implementation is poorly executed and enforcing that accountability.

Nonpoint Source Accountability and Enforcement Are Limited

One distinguishing feature of nonpoint/nonpoint source trading is that pollutant control requirements are almost always technology-based or performance-based, as opposed to water quality-based. Nonpoint sources satisfy requirements by implementing and maintaining required BMPs. If BMPs are properly implemented and maintained but do not provide the expected level of pollutant control, nonpoint sources are generally not required to take additional measures.

Other limitations also may decrease the accountability of nonpoint sources involved in trading. Many regulatory programs have insufficient resources to conduct inspections to ensure that BMPs and restoration projects are properly installed and maintained over time. As a result, full advantage is not always taken of existing enforcement authority.

Additionally, when problems are identified, it may be impractical or infeasible to initiate enforcement actions for a number of reasons (e.g., business closure). Even when enforcement occurs, remediation can take a long time. Sometimes, the only leverage managers have over nonpoint sources that install or maintain BMPs improperly is to reduce or eliminate certain technical assistance, financial support, or eligibility for other programs.

Several approaches, listed in Exhibit 8.6, can be used to enhance existing accountability and enforcement for nonpoint/nonpoint trading. Accountability is also discussed in more detail in Chapter 7.

EXHIBIT 8.6: APPROACHES FOR ENHANCING ACCOUNTABILITY AND ENFORCEMENT

- Select sites where BMPs are visible and easily monitored.
- Select sources where a commitment to operation and maintenance exists.
- Require the posting of a performance bond.
- Execute contracts or agreements that specify responsibilities and enforcement consequences.
- Vest accountability in the off-site landowner.
- Vest accountability in a third party.
- Monitor BMP performance periodically to detect problems and provide assistance.
- Use economic, political, public relations, and other incentives to ensure full implementation.
- Provide interested volunteers with information on BMP location maintenance.

8.8 Worksheet/Checklist

The following checklist outlines key questions to consider in implementing a nonpoint/nonpoint source trading program. It is not necessary for each of these questions to be answered favorably for trading to succeed. The chances for success will be greatest, however, if all interested parties are aware of these issues and take them into account as they pursue the potential benefits of a trading program.

WORKSHEET FOR EVALUATING SUCCESS OF NONPOINT/NONPOINT SOURCE TRADING

Legal and Regulatory Conditions	
General:	
C Is nonpoint/nonpoint source trading implemented within the context of state or local regulations and management plans?	yes no
Specific:	
C Are certain types of nonpoint sources required to implement specific BMPs to control pollutant discharges?	yes no
C Are local or state permits flexible enough to allow trading among nonpoint sources?	yes no
C Do trades comply with the conditions in permits?	yes no
C Are there unregulated nonpoint sources available to trade with regulated sources?	yes no
Economic Conditions	
General:	
C Can nonpoint sources save or make money by trading (i.e., are there economic incentives to trade)?	yes no
Specific:	
C Do total incremental costs for BMPs, which include direct incremental costs and transaction costs, differ among nonpoint sources?	yes no
C Do cost differentials among nonpoint sources allow one discharger to implement BMPs more cheaply than another?	yes no
C Are transaction costs less than cost savings from a trade?	yes no
C Do cost savings from trading outweigh the uncertainties that nonpoint sources face under trading schemes?	yes no
C Is there a sufficient supply of BMP implementation for sale, ras well as a reasonable demand to buy BMP credits?	yes no
Data Availability Conditions	
General:	
C Are the data necessary to implement a trading program available or estimable?	yes no
Specific:	
C Are there enough data to understand pollution quantities and flows within the watershed (e.g., have water quality authorities conducted a TMDL that includes load allocations)?	yes no
C Can regulatory authorities monitor water quality under trading?	yes no
C Can nonpoint sources and regulatory agencies calculate or estimate the water quality effects of BMPs?	yes no
C Can nonpoint sources or regulatory agencies calculate or estimate the costs of implementing various types of BMPs?	yes no
C Can a regulatory agency calculate the average cost of all BMPs for a watershed, if a banking system is planned?	yes no
C Can nonpoint sources estimate transaction costs that they would have to pay to conduct trades?	yes no

Administrative and Institutional Conditions	
General:	
C Are governmental authorities and potential trading participants capable of administering a trading program?	yes no
Specific:	
C Do governmental authorities have enforcement mechanisms to ensure trades are being implemented correctly?	yes no
C Are governmental authorities with expertise in different types of nonpoint sources available to help administer trading programs?	yes no
C Is a governmental agency capable of operating a bank or fund for purchasing BMPs, if a banking-style trading program is desired?	yes no
C Are responsibilities clearly defined for administering institutions and nonpoint sources taking part in trading?	yes no
C Is the scope of administrative infrastructure compatible with the amount and complexity of the trading that is expected?	yes no
C Is accountability for implementation and success of BMPs clearly established?	yes no
C Can the agency responsible for enforcing trading provisions give necessary feedback to parties responsible for water quality?	yes no

GLOSSARY

Acute: A stimulus severe enough to rapidly induce an effect; in aquatic toxicity tests, an effect observed in 96 hours or less typically is considered acute. When referring to aquatic toxicology or human health, an acute effect is not always measured in terms of lethality.

Advanced Wastewater Treatment: Any treatment of sewage that goes beyond the secondary or biological water treatment stage and includes the removal of nutrients such as phosphorus and nitrogen and a high percentage of suspended solids. (See: primary, secondary treatment.)

Agricultural Pollution: Farming wastes, including runoff and leaching of pesticides and fertilizers; erosion and dust from plowing; improper disposal of animal manure and carcasses; crop residues; and debris.

Anti-degradation: Policies that are part of each state*s water quality standards. These policies are designed to protect water quality and provide a method of assessing activities that may impact the integrity of the waterbody.

Assimilative Capacity: The capacity of a natural body of water to receive wastewaters or toxic materials without deleterious effects and without damage to aquatic life or humans who consume the water.

Benefits: A good, service, or attribute of a good or service that promotes or enhances the well-being of an individual, an organization, or a natural system.

Best Management Practices (BMPs): Schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the United States. BMPs also include but are not limited to treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or wastewater disposal, or drainage from raw material storage.

Bioaccumulation: The process by which a contaminant accumulates in the tissues of an individual organism. For example, certain chemicals on food eaten by a fish tend to accumulate in its liver and other tissues.

Bioavailable: The state of a toxicant such that there is increased physicochemical access to the toxicant by an organism. The less the bioavailability of a toxicant, the less its toxic effect on an organism.

Categorical Pretreatment Standard: A technology-based effluent limitation for an industrial facility discharging into a municipal sewer system. Analogous in stringency to Best Availability Technology (BAT) for direct discharges.

Chronic: A stimulus that lingers or continues for a relatively long period of time, often one-tenth of the life span or more. Chronic should be considered a relative term depending on the life span of an organism. The measurement of a chronic effect can be reduced growth, reduced reproduction, etc., in addition to lethality.

Clean Water Act (CWA): The Clean Water Act (formerly referred to as the Federal Water Pollution Control Act or Federal Water Pollution Control Act Amendments of 1972), Public Law 92-500, as amended by Public Law 96-483 and Public Law 97-117, 33 U.S.C. 1251 et seq.

Coastal Zone: Lands and waters adjacent to the coast that exert an influence on the uses of the sea and its ecology, or whose uses and ecology are affected by the sea.

Combined Sewer Overflow: Discharge of a mixture of stormwater and domestic waste when the flow capacity of a sewer system is exceeded during rainstorms.

Concentration-Based Limit: A limit based on the relative strength of a pollutant in a wastestream, usually expressed in milligrams per liter (mg/l).

Continuous Discharge: A discharge that occurs without interruption throughout the operation hours of the facility, except for infrequent shutdowns for maintenance, process changes, or other similar activities.

Control Authority: A POTW with an approved pretreatment program or the Approval Authority in the absence of a POTW pretreatment program.

Conventional Pollutants: Statutorily listed pollutants understood well by scientists. These may be in the form of organic waste, sediment, acid, bacteria, viruses, nutrients, oil and grease, or heat.

Created Wetland: A wetland intentionally created from a non-wetland site to produce or replace natural habitat (e.g., a compensatory mitigation project). These wetlands are normally considered waters of the United States or waters of the state. (See restoration, enhancement, constructed wetland.)

Designated Uses: Those water uses identified in state water quality standards that must be achieved and maintained as required under the Clean Water Act. Uses can include cold water fisheries, public water supply, irrigation, and others.

Direct Runoff: Water that flows over the ground surface or through the ground directly into streams, rivers, and lakes.

Discharge Monitoring Report (DMR): The EPA uniform national form, including any subsequent additions, revisions, or modifications, for the reporting of self-monitoring results by permittees. DMRs must be used by approved states as well as by EPA.

Discharge: Flow of surface water in a stream or canal or the outflow of groundwater from a flowing artesian well, ditch, or spring. Can also apply to discharge of liquid effluent from a facility or to chemical emissions into the air through designated venting mechanisms.

Ecosystem: A biological community together with the physical and chemical environment with which it interacts.

Effluent: Wastewater, treated or untreated, that flows out of a treatment plant, sewer, or industrial outfall.

Effluent Guidelines: Technical EPA documents that set effluent limitations for given industries and pollutants.

Effluent Limitation: Restrictions established by a state or EPA on quantities, rates, and concentrations in wastewater discharges.

Enhancement: In the context of restoration ecology, any improvement of a structural or functional attribute.

Feedlot: A confined area for the controlled feeding of animals. Tends to concentrate large amounts of animal waste that cannot be absorbed by the soil and, hence, may be carried to nearby streams or lakes by rainfall runoff.

Groundwater: The supply of fresh water found beneath the earth*s surface, usually in aquifers, which supply wells and springs. Because groundwater is a major source of drinking water, there is growing concern over contamination from leaching agricultural or industrial pollutants and leaking underground storage tanks.

Heavy Metals: Metallic elements, such as mercury, lead, nickel, zinc, and cadmium, that are of environmental concern because they do not degrade over time. Although many are necessary nutrients, they are sometimes magnified in the food chain and in high concentrations can be toxic to life.

Indirect Discharge: A nondomestic discharge introducing pollutants to a publicly owned treatment works.

Industrial User (IU): A source of indirect discharge that does not constitute "discharge of pollutants" under regulations issued pursuant to section 402 of the Clean Water Act.

Irrigation Return Flow: Surface and subsurface water that leaves a field following the application of irrigation water.

Irrigation: Applying water or wastewater to land areas to supply the water and nutrient needs of plants.

Land Application: Discharge of wastewater onto the ground for treatment or reuse. (See: irrigation)

Landfills: 1. Sanitary landfills are disposal sites for nonhazardous solid wastes spread in layers, compacted to the smallest practical volume, and covered by material applied at the end of each operation day. 2. Secure chemical landfills are disposal sites for hazardous waste, selected and designed to minimize the chance of release of hazardous substances into the environment.

Leachate: Water that collects contaminants as it trickles through wastes, pesticides, or fertilizers. Leaching can occur in farming areas, feedlots, and landfills and can result in hazardous substances entering surface water, groundwater, or soil.

Leachate Collection System: A system that gathers leachate and pumps it to the surface for treatment.

Load Allocation (LA): The portion of a receiving water*s loading capacity that is attributed either to one of its existing or future nonpoint sources of pollution or to natural background sources. Load allocations are best estimates of the loading, which can range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. Wherever possible, natural and nonpoint source loads should be distinguished. (40 CFR 130.2(g))

Loading Capacity (LC): The greatest amount of loading that a water can receive without violating water quality standards.

Margin of Safety (MOS): A required component of the TMDL that accounts for the uncertainty about the relationship between the pollutant loads and the quality of the receiving waterbody (CWA section 303(d)(1)(C)). The MOS is normally incorporated into the conservative assumptions used to develop TMDLs (generally within the calculations or models) and approved by EPA either individually or in state/EPA agreements. If the MOS needs to be larger than that which is allowed through the conservative assumptions, additional MOS can be added as a separate component of the TMDL (in this case, quantitatively, a TMDL = LC = WLA + LA + MOS)

Mass-Based Standard: A discharge limit that is measured in a mass unit such as pounds per day.

Mitigation: Actions taken to avoid, reduce, or compensate for the effects of environmental damage. Among the broad spectrum of possible actions are those which restore, enhance, create, or replace damaged ecosystems.

Monitoring: Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, plants, and animals.

National Pollutant Discharge Elimination System (NPDES): The national program for issuing, modifying, revoking and reissuing, terminating, monitoring, and enforcing permits, and imposing and enforcing pretreatment requirements, under Sections 307, 402, 318, and 405 of the Clean Water Act.

Nonpoint Source: Diffuse pollution sources (i.e., without a single point of origin or not introduced into a receiving stream from a specific outlet). The pollutants are generally carried off the land by stormwater. Common nonpoint sources are agriculture, forestry, urban, mining, construction, dams, channels, land disposal, saltwater intrusion, and city streets.

Permit: An authorization, license, or equivalent control document issued by EPA or an approved state agency to implement the requirements of an environmental regulation; e.g., a permit to operate a wastewater treatment plant or to operate a facility that may generate harmful emissions.

Point Source: Any discernible confined and discrete conveyance, including, but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel, or other floating craft from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural stormwater runoff.

Pollutant: A contaminant in a concentration or amount that adversely alters the physical, chemical, or biological properties of the environment. The term includes pathogens, toxic metals, carcinogens, oxygen-demanding materials, and all other harmful substances. With reference to nonpoint sources, the term is sometimes used to apply to contaminants released in low concentrations from many activities that collectively degrade water quality. As defined in the federal Clean Water Act, pollutant means dredged spoil; solid waste; incinerator residue; sewage; garbage; sewage sludge; munitions; chemical wastes; biological materials; radioactive materials; heat; wrecked or discarded equipment; rock; sand; cellar dirt; and industrial, municipal, and agricultural waste discharged into water.

Pollution: Generally, the presence of matter or energy whose nature, location, or quantity produces undesired environmental effects. Under the Clean Water Act, for example, the term is defined as the man-made or man-induced alteration of the physical, biological, chemical, and radiological integrity of water.

Pretreatment: The reduction of the amount of pollutants, the elimination of pollutants, or the alteration of the nature of pollutant properties in wastewater to a less harmful state prior to or in lieu of discharging or otherwise introducing such pollutants into a publicly owned treatment works.

Primary Treatment: A basic wastewater treatment method that uses settling, skimming, and (usually) chlorination to remove solids, floating materials, and pathogens from wastewater. Primary treatment typically removes about 35 percent of biochemical oxygen demand (BOD) and less than half of the metals and toxic organic substances.

Privately Owned Treatment Works: Any device or system that is (a) used to treat wastes from any facility whose operator is not the operator of the treatment works and (b) not a POTW.

Public Comment Period: The time allowed for the public to express its views and concerns regarding action by EPA (e.g., a *Federal Register* notice of a proposed rule-making, a public notice of a draft permit, or a Notice of Intent to Deny).

Publicly Owned Treatment Works (POTW): Any device or system used in the treatment (including recycling and reclamation) of municipal sewage or industrial wastes of a liquid nature that is owned by a state or municipality. This definition includes sewers, pipes, or other conveyances only if they convey wastewater to a POTW providing treatment.

Restoration: Return of an ecosystem to a close approximation of its condition prior to disturbance.

Riparian Areas: Areas bordering streams, lakes, rivers, and other watercourses. These areas have high water tables and support plants that require saturated soils during all or part of the year. Riparian areas include both wetland and upland zones.

Riparian Vegetation: Hydrophytic vegetation growing in the immediate vicinity of a lake or river close enough so that its annual evapotranspiration represents a factor in the lake or river regime.

Riparian Zone: The border or banks of a stream. Although this term is sometimes used interchangeably with floodplain, the riparian zone is generally regarded as relatively narrow compared to a floodplain. The duration of flooding is generally much shorter, and the timing less predictable, in a riparian zone than in a river floodplain.

Secondary Treatment: The second step in most publicly owned waste treatment systems, in which bacteria consume the organic parts of the waste. It is accomplished by bringing together waste, bacteria, and oxygen in trickling filters or in the activated sludge process. This treatment removes floating and settleable solids and about 90 percent of the oxygen-demanding substances and suspended solids. Disinfection is the final stage of secondary treatment. (See: primary, tertiary treatment.)

Septic System: An on-site system designed to treat and dispose of domestic sewage. A typical septic system consists of a tank that receives waste from a residence or business and a system of tile lines or a pit for disposal of the liquid effluent (sludge) that remains after decomposition of the solids by bacteria in the tank; must be pumped out periodically.

Sewer: A channel or conduit that carries wastewater and stormwater runoff from the source to a treatment plant or receiving stream. “Sanitary” sewers carry household, industrial, and commercial waste. “Storm” sewers carry runoff from rain or snow. “Combined” sewers handle both.

Stormwater: Stormwater runoff, snowmelt runoff, and surface runoff and drainage; rainfall that does not infiltrate the ground or evaporate because of impervious land surfaces but instead flows onto adjacent land or watercourses or is routed into drain/sewer systems.

Stream Restoration: Various techniques used to replicate the hydrological, morphological, and ecological features that have been lost in a stream due to urbanization, farming, or other disturbance.

Surface Runoff: Precipitation, snowmelt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of nonpoint source pollutants.

Surface Water: All water naturally open to the atmosphere (rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors directly influenced by surface water.

Technology-Based Limitations: Industry-specified effluent limitations applied to a discharge when it will not cause a violation of water quality standards at low stream flows. Usually applied to discharges into large rivers.

Technology-Based Standards: Effluent limitations applicable to direct and indirect sources that are developed on a category-by-category basis using statutory factors, not including water quality effects.

Tertiary Treatment: Advanced cleaning of wastewater that goes beyond the secondary or biological stage, removing nutrients such as phosphorus, nitrogen, and most biochemical oxygen demand (BOD) and suspended solids.

Total Maximum Daily Load (TMDL): The sum of the individual wasteload allocations (WLAs) for point sources and land allocations (LAs) for nonpoint sources and natural background. If a receiving water has only one point source discharger, the TMDL is the sum of that point source WLA plus the LAs for any nonpoint sources of pollution and natural background sources, tributaries, or adjacent segments. TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measure that relates to a state*s water quality standard. If best management practices (BMPs) or other nonpoint source pollution control actions make more stringent load allocations practicable, WLAs can be made less stringent. Thus, the TMDL process provides for nonpoint source control trade-offs. (40 CFR 130.2(I))

Total Maximum Daily Load (TMDL) Process: The approach normally used to develop a TMDL for a particular waterbody or watershed. This process consists of five activities, including selection of the pollutant to consider, estimation of the waterbody*s assimilative capacity, estimation of the pollution from all sources to the waterbody, predictive analysis of pollution in the waterbody and determination of total allowable pollution load, and allocation of the allowable pollution among the different pollution sources in a manner that ensures that water quality standards are achieved.

Toxic Pollutants: Materials that cause death, disease, or birth defects in organisms that ingest or absorb them. The quantities and exposures necessary to cause these effects can vary widely. Those pollutants listed by the Administrator under section 307(a) of the Clean Water Act.

Wasteload Allocation (WLA): The portion of a receiving water*s loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality-based effluent limitation (40 CFR 130.2(h)).

Water Quality Criteria: Levels of water quality expected to render a body of water suitable for its designated use. Composed of numeric and narrative criteria. Numeric criteria are scientifically derived ambient concentrations developed by EPA or states for various pollutants of concern to protect human health and aquatic life. Narrative criteria are statements that describe the desired water quality goal. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, fish production, or industrial processes.

Water Quality Standard: A law or regulation that consists of the beneficial designated use or uses of a waterbody or a segment of a waterbody and the water quality criteria that is necessary to protect the use or uses of that particular waterbody. Water quality standards also contain an anti-degradation policy. The water quality standard serves a twofold purpose: (a) it establishes the water quality goals for a specific waterbody and (b) it is the basis for establishing water quality-based treatment controls and strategies beyond the technology-based levels of treatment required by sections 301(b) and 306 of the Clean Water Act, as amended by the Water Quality Act of 1987.

Water Quality-Based Effluent Limitations: Effluent limitations applied to dischargers when mere technology-based limitations would cause violations of water quality standards. Usually WQBELs are applied to discharges into small streams.

Water Quality-Based Permit: A permit with an effluent limit more stringent than one based on technology performance. Such limits may be necessary to protect the designated use of receiving waters (e.g., recreation, irrigation, industry or water supply).

Water Quality-Limited Segments: Those water segments which do not or are not expected to meet applicable water quality standards even after the application of technology-based effluent limitations required by sections 301(b) and 306 of the Clean Water Act (40 CFR 130.29(j)). Technology-based controls include, but are not limited to, best practicable control technology currently available (BPT) and secondary treatment.

Waterbody Use: A waterbody or a segment of a waterbody can have many uses. Typical uses include public water supplies, propagation of fish and wildlife, recreational purposes, agricultural use, industrial use, navigation, and other such uses. EPA does not recognize waste transport as an acceptable use.

Watershed Protection Approach (WPA): The U.S. EPA*s comprehensive approach to managing water resource areas, such as river basins, watersheds, and aquifers. WPA has four major features—targeting priority problems, stakeholder involvement, integrated solutions, and measuring success.

Watershed-Scale Approach: A consideration of the entire watershed, including the land mass that drains into the aquatic ecosystem.

Watershed: A drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.

Wetlands: An area that is saturated by surface water or groundwater with vegetation adapted for life under those soil conditions, as in swamps, bogs, fens, marshes, and estuaries.

APPENDIX A—EFFLUENT TRADING IN WATERSHEDS POLICY STATEMENT

EFFLUENT TRADING IN WATERSHEDS
POLICY STATEMENT

Purpose

In response to President Clinton's *Reinventing Environmental Regulation* (March 1995), EPA strongly promotes the use of effluent trading to achieve water quality objectives and standards. This statement communicates EPA's policy on effluent trading in watersheds, discusses the benefits of trading, presents an explanation of several types of effluent trading, and outlines how EPA will be encouraging trading. This policy is Agency guidance only and does not establish or affect legal rights or obligations. It does not establish a binding norm and is not finally determinative of the issues addressed. Agency decisions in any particular case will be made by applying the law and regulations on the basis of specific facts when permits are issued.

Policy

EPA will actively support and promote effluent trading within watersheds to achieve water quality objectives, including water quality standards, to the extent authorized by the Clean Water Act and implementing regulations. EPA will work cooperatively with key stakeholders to find sensible, innovative ways to meet water quality standards quicker and at less overall cost than with traditional approaches alone. EPA will assure that effluent trades are implemented responsibly so that environmental progress is enhanced, not hindered.

Benefits

EPA's support of watershed-based trading is anchored to a strong commitment to achieve and maintain water quality standards. EPA believes that trading is an innovative way for community stakeholders (e.g., regulated sources, non-regulated sources, regulatory agencies and the public) to develop more "common sense" solutions to water quality problems in their watersheds. Effluent trading potentially offers a number of economic, environmental and social benefits:

Economic Benefits:

- Reduces costs for individual sources contributing to water quality problems.

- Allows dischargers to take advantage of economies of scale and treatment efficiencies that vary from source to source.

- Reduces overall cost of addressing water quality problems in the watershed.

Environmental Benefits:

- Achieves equal or greater reduction of pollution for the same or less cost.

- Creates an economic incentive for dischargers to go beyond minimum pollution reduction and also encourages pollution prevention and the use of innovative technologies.

- Can reduce cumulative pollutant loading, improve water quality, accommodate growth and prevent future environmental degradation.

- Can address the broader environmental goals within a trading area, e.g., ecosystem protection, ecological restoration, improved wildlife habitat, endangered species protection, etc.

Social Benefits:

- Encourages dialogue among stakeholders and fosters concerted and holistic solutions for watersheds with multiple sources of water quality impairment.

Explanation of Different Types of Effluent Trading

Trading supplements the current regulatory approach. It is a method to attain and/or maintain water quality standards, by allowing sources of pollution to achieve pollutant reductions through substituting a cost-effective and enforceable mix of controls on other sources of discharge. As the Agency improves its understanding of the opportunities afforded by watershed-based decision making, EPA will provide information for additional forms of trading.

To take advantage of trading, a point source must be in compliance, and remain in compliance, with applicable technology-based limits. Intra-plant trades must also have a technology-based floor, while the technology floor for pretreatment trading is determined by the categorical standards. EPA expects that most trades will be covered by Total Maximum Daily Loads (TMDL) or similar watershed-based analysis.[1]

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[1] A TMDL provides the water quality analysis and planning process for determining the specific pollution reductions that are necessary to attain or maintain water quality standards. Under section 303 (d) of the CWA, States establish TMDLs for impaired waters. The TMDL process includes legal requirements for public participation and implementation through NPDES permits.

The items to be traded are the pollutant reductions or water quality improvements sought. Under trading, a source that can more cost-effectively achieve greater pollutant reduction than is otherwise required would be able to sell or barter the credits for its excess reduction to another source unable to reduce its own pollutants as cheaply. To ensure that water quality standards are met throughout a watershed, an equivalent or better water pollutant reduction would need to result from a trade. Below are proposed definitions for several different types of effluent trading approaches. These definitions are preliminary and do not reflect the full range of feasible trades:

Intra-Plant Trading:	A point source is allocated pollutant discharges among its outfalls in a cost-effective manner, provided that the combined permitted discharge with trading is no greater than the combined permitted discharge without trading in the watershed.
Pretreatment Trading:	An indirect industrial point source(s) that discharges to a publicly owned treatment works arranges, through the local control authority, for additional control by other indirect point sources beyond the minimum requirements in lieu of upgrading its own treatment for an equivalent level of reduction.
Point/Point Source Trading:	A point source(s) arranges for other point source(s) in a watershed to undertake greater than required control in lieu of upgrading its own treatment beyond the minimum technology-based treatment requirements in order to more cost-effectively achieve water quality standards.
Point/Nonpoint Source Trading:	A point source(s) arranges for control of nonpoint source discharge(s) in a watershed in lieu of upgrading its own treatment beyond the minimum technology-based treatment requirements in order to more cost-effectively achieve water quality standards.
Nonpoint/Nonpoint Source Trading:	A nonpoint source(s) arranges for more cost-effective control of other nonpoint sources in

a watershed in lieu of installing or upgrading its own control.

How EPA Will Be Encouraging Trading

EPA is developing a framework for watershed-based effluent trading, as well as information exchange workshops, and limited technical assistance for trading projects in specific areas. Watershed-based trading will be implemented on a voluntary basis under existing Clean Water Act (CWA) authorities. There will be substantial public outreach effort to obtain stakeholders' recommendations and insights on draft portions of the framework prior to implementation.

Finally, while EPA believes that the potential of trading is largely untapped, the usefulness of trading will depend on the site-specific water quality conditions in any given situation. The framework will describe situations which EPA believes are most appropriate for watershed-based trading, and those that are generally inappropriate.

EPA plans to distribute a draft trading framework in February, 1996 and hold a series of stakeholder meetings. For more information call Mahesh Podar at (202)260-7818, fax (202)401-3372 or send an Email message to herzi.hawa@epamail.epa.gov or tuano.theresa@epamail.epa.gov.

Attachment

s/
Robert Perciasepe
Assistant Administrator for Water

Steven A. Herman
Assistant Administrator for Enforcement and Compliance Assurance

Jonathan Z. Cannon
General Counsel

Attachment

EXPERIENCE TO DATE

Trading is being explored, developed or implemented in a number of watersheds throughout the country. Some examples are below:

Project/Location	Focus	Type of Trading
Fox River, WI	BOD, nutrients	point/point
Dillon Reservoir, CO	phosphorus	point/nonpoint; nonpoint/nonpoint
Boulder Creek, CO	ammonia, nutrients	point/nonpoint
Tar-Pamlico, NC	nitrogen, phosphorus	point/nonpoint
Arkansas Nature Conservancy	wetlands	nonpoint/nonpoint
Maryland Nontidal Wetlands	wetlands	nonpoint/nonpoint
Iron and Steel	BOD, TSS, zinc, and lead	intra-plant
Rhode Island electroplaters	metals	pretreatment
Chehalis River Basin, WA	BOD	point/nonpoint
Boone Reservoir, TN	nutrients	point/nonpoint
Wicomico River, MD	phosphorus	point/nonpoint
Honey Creek Watershed, OH	phosphorus	point/nonpoint
South San Francisco Bay, CA	copper	point/point
Long Island Sound, NY	dissolved oxygen	Point/nonpoint
Cherry Creek, CO	phosphorus	point/nonpoint; point/point
Tampa Bay, FL	nitrogen, TSS	point/point; point/nonpoint; nonpoint/nonpoint
Chatfield Basin, CO	phosphorus	point/nonpoint

APPENDIX B—ISSUES FOR FUTURE CONSIDERATION

ISSUES FOR FUTURE CONSIDERATION

Intra-Plant Trading to Meet Technology-Based Requirements

This framework establishes the principle that sources must meet applicable technology-based requirements before they are eligible to participate in trades. Below is an example of the only instance where EPA has allowed trading to meet technology-based requirements. It is unclear whether future effluent guidelines will allow this form of intra-plant trading.

INTRA-PLANT TRADING IN THE IRON AND STEEL INDUSTRY

In establishing effluent limitation guidelines for the iron and steel industry, EPA employed the same procedures it uses in setting technology-based requirements for other industries. Unlike guidelines for other industries, effluent limitation guidelines for the iron and steel industry permit a facility to trade discharge allowances among multiple outfalls. Under these regulations, a facility that reduces pollutant discharges beyond technology-based requirements at one or more outfalls need not meet technology-based requirements at other outfalls, provided that total discharges of pollutant(s) involved in such trades are less than would be discharged under normal uniform technology-based requirements. This flexibility is designed to allow facilities to reduce their total pollution control costs, provided that they can simultaneously achieve better overall pollution control.

EPA regulations have placed the following specific conditions on intra-plant trading in the iron and steel industry:

1. Resultant discharges comply with applicable state water quality standards.
2. Each outfall is assigned specific, fixed effluent limitations for pollutants affected.
3. Process wastewaters associated with certain iron and steel industry operations are excluded from trades since trades involving these wastewaters could inadvertently result in a net increase in quantity of toxic pollutants discharged.
4. The net allowable discharge of traded pollutants is less than the discharge that would be allowed without the trade. The minimum necessary reduction is approximately 15 percent for total suspended solids and oil and grease, and 10 percent for all other pollutants.

A recent EPA study identified 10 iron and steel plants that took advantage of the intra-plant trading rule. These facilities applied trading to wastewater discharges from a range of steel plant processes, including trades of both conventional pollutants and metals. Estimates of the reduction in pollution control expenditures attributable to trading are available for only seven of these facilities. The present value of the cost savings realized at the seven facilities between 1983 and 1993 is approximately $123 million(1993 dollars). Estimated savings ranged from $3 million at an East Chicago plant to $69 million at a Gary, Indiana, facility. Moreover, the permits for each of these facilities established discharge limits more stringent than ordinary technology-based requirements. At the Gary plant, for example, the permitted daily average discharge of total suspended solids (TSS) under trading was 2,575 pounds per day lower than would have been allowed under a standard permit. Trades at other iron and steel facilities have established more stringent permit limits for lead, zinc, and oil and grease, as well as TSS. In each case, trades also resulted in significant cost savings.

Source*: The Use and Impact of Iron and Steel Industry Intra-Plant Trades* , prepared for the Office of Policy, Planning, and Evaluation, USEPA, March 1994.

Cross-Pollutant Trading

EPA does not currently envision a situation in which "cross-pollutant" trading could work under current regulatory conditions and technical limitations. Most (if not all) trades to date have involved the same pollutant, such as nitrogen for nitrogen or phosphorus for phosphorus. A few communities are investigating cross-pollutant trading involving different pollutants, such as nitrogen for phosphorus or nitrogen for zinc.

Sufficient data are often unavailable to enable assessment of the impacts of different pollutants, and therefore the relative value of pollutant load reductions. Without such assessment, though, water quality managers are unable to predict the effects of trading. In the future, when environmental benefits can be thoroughly demonstrated, EPA will consider the use of cross-pollutant trading.

CROSS POLLUTANT TRADES? CLEANING UP ORPHAN NONPOINT POLLUTION SOURCES FOR CREDIT

Stakeholders in Colorado*s Clear Creek Basin are examining point/nonpoint source trading opportunities that could include cross-pollutant trading. Under the proposed program, point sources could "adopt" (clean up) orphan nonpoint sources in exchange for pollutant loading reduction credits. Orphan sources fall outside current regulations or have no identifiable owner or operator. Abandoned mines and areas of habitat destruction are two examples of orphan sites that are prevalent in the watershed. Such trades could involve translating reductions of one pollutant or habitat benefits into reduction credits for another pollutant.

Because there are multiple constituents of concerns some stakeholders believe that cross-pollutant trading could achieve significant environmental improvements. Consider the example of an industrial facility that faces additional nutrient loading reductions. If cleaning up an orphan mine site, where loadings contain significant amounts of metal but few nutrients, could provide nitrogen or phosphorus credits, the point source would probably be more interested in the trade than if only metals credits were available. Cross-pollutant trading might require the development of an index or series of trading ratios that would convert one pollutant or water quality benefit into credits that are desirable to regulated point sources. Cross-pollutant trades are being considered across (and within) such categories as nutrients, metals, sediment, habitat, instream flow, and wetlands. The feasibility study is one of several initiatives sponsored by the National Forum on Nonpoint Source Pollution

APPENDIX C—EXAMPLES OF EXISTING AND POTENTIAL FUTURE TRADING PROGRAMS

Examples of Existing and Potential Future Trading Programs

Table 1. Existing Programs.

Program/Location What's Being Traded Trade Type(s)	How Is It Set Up?	Who's Involved?	Status
Arkansas Nature Conservancy, AK wetlands nonpoint/nonpoint	U.S. Army Corps of Engineers (USACE) permittees pay compensatory mitigation fees to The Nature Conservancy. The Conservancy applies these fees to wetland acquisition and enhancement projects. A mitigation ratio is based on types of wetlands.	USACE, Little Rock District (501-324-5296); Arkansas Nature Conservancy (501-663-6699).	At least 6 trades had occurred as of 3/93.
Boulder Creek, CO ammonia, nutrients point/nonpoint	The City of Boulder contributed to a riparian enhancement project (including riparian zone restoration and restoration of instream habitats) to alleviate an un-ionized ammonia problem and defer expensive modifications at its POTW. Studies had shown that POTW upgrades alone would be insufficient to reach water quality standards due to the degraded condition of the creek. See TMDL Case Study #8 (EPA-841-F-93-006; fax requests for document to NCEPI, 513-569-7186).	Denver Regional Council of Governments (303-455-1000); EPA Region 8 (Bruce Zander 303-312-6846). Also the City of Boulder and the Colorado Dept. of Health.	Short-term results look promising; monitoring is in place to assess long-term effects.
Cherry Creek, CO phosphorus point/nonpoint	Point sources can earn wasteload allocation credits by installing, operating, maintaining, and monitoring nonpoint source phosphorus controls. Before trading may begin, urban nonpoint source loadings must be reduced by half.	Denver Regional Council of Governments (303-455-1000); EPA Region 8 (Bruce Zander 303-312-6846). Also the Colorado Water Quality Control Commission.	Implementation of the program has been delayed because nonpoint source loadings are not yet halved and loadings are still below the maximum limit.
Dade County, FL wetlands nonpoint/nonpoint	Clean Water Act section 404 permittees impacting wetlands in specific areas have the option to pay a fee to satisfy mitigation requirements. Funds go into a Wetlands Mitigation Trust Fund that supports improvements in the East Everglades.	USACE, Jacksonville District (904-232-3943); Dade County (305-372-6789). Also the Florida Department of Environmental Resource Management, and Everglades National Park.	As of 3/93, the fund had received over $400,000.
Fox River, WI BOD, nutrients point/point	Point sources were allowed to trade effluent allocations, but only under limited circumstances: the facility buying reductions must be new, expanding, or not able to meet discharge limits even with use of required technology. Trades where cost-savings is the sole objective are prohibited. Trades are effective for a minimum of one year, and a maximum of the time left on the permit.	Wisconsin Department of Natural Resources (608-266-2621).	The program was first implemented in 1981, but only one trade has occurred since that time.

Examples of Existing and Potential Future Trading Programs

Program/Location What's Being Traded Trade Type(s)	How Is It Set Up?	Who's Involved?	Status
Laguna de Santa Rosa, CA nutrients point/nonpoint	The City of Santa Rosa ships treated wastewater to area dairies and farms for application to pasture and some food crops. The city initially paid dairies to take the water; no payments are currently made due to the desirability of the water for the farms. This allows the city to avoid discharging during summer months and is also beneficial to the dairies.	EPA Region 9 (Dave Smith 415-744-2012). Also the City of Santa Rosa, local dairies and farms, North Coast Regional Water Quality Control Board.	The city has upgraded to tertiary treatment, and a TMDL was completed for Laguna de Santa Rosa in 1994. Wastewater transfers continue and are recognized in the city*s NPDES permit, but these transactions are not recognized as “formal” trades.
Lake Dillon, CO phosphorus point/nonpoint, nonpoint/nonpoint	At Lake Dillon (previously known as Dillon Reservoir), Colorado, the four wastewater treatment plants discharging to the lake can receive credit for phosphorus load reductions by purchasing nonpoint source reductions. Currently, nonpoint/nonpoint trades are the main focus of the program	Northwest Colorado Council of Governments (970-468-0295); EPA Region 8 (Bruce Zander 303-312-6846). Also the Denver Water Board.	Program began operation in 1984. Improvements in plant treatment efficiencies and slower-than-anticipated growth resulted in few point/nonpoint source trades.
Maryland Nontidal Wetlands Compensation Fund, MD wetlands nonpoint/nonpoint	The Maryland Department of Natural Resources (MD DNR) accepts payment in lieu of mitigation under certain circumstances from Clean Water Act section 404 and state permittees. Fees are deposited into a trust fund that pays for larger restoration projects conducted by the Department and its contractors.	MD DNR (410-974-2985/3016)	As of 3/93, the state had completed 15 fee-funded projects and fee deposits reached approximately $200,000.
Ohio Wetlands Foundation, OH wetlands nonpoint/nonpoint	The Ohio Wetlands Foundation, a private nonprofit organization, provides a mechanism to aggregate Clean Water Act section 404 mitigation requirements and create larger wetlands habitats. Eligible permittees pay fees to the foundation in lieu of on-site or other off-site mitigation. The Foundation administers fees through a trust.	Ohio Wetlands Foundation (614-228-6647); U.S. Army Corps of Engineers, Huntington District (304-529-5487). Also the Ohio Homebuilders Association and Ohio Department of Natural Resources.	As of 3/93, the Foundation had not yet collected any fees but was constructing wetlands ahead of fee receipt.
Pine Flatwoods Wetlands Mitigation Trust, LA wetlands nonpoint/nonpoint	The Louisiana Nature Conservancy (LNC) accepts fees from Clean Water Act section 404 permittees as compensation for unavoidable wetland losses. LNC uses the fees to support off-site preservation and activities for long-term management of degraded pine flatwoods wetlands.	USACE, New Orleans District (504-862-2250); LNC (504-338-1040). Also the Louisiana Departments of Natural Resources and Wildlife and Fisheries, and the US Fish and Wildlife Service.	As of 3/93, LNC had collected over $100,000 under this program and was about to make its first purchase.

Examples of Existing and Potential Future Trading Programs

Program/Location What's Being Traded Trade Type(s)	How Is It Set Up?	Who's Involved?	Status
Providence, RI salt (deicing chemicals) point/nonpoint (drinking water)	The Providence, Rhode Island, Water Department is paying the city's Department of Transportation $60,000 a year to use alternative deicing chemicals in the supply source recharge area. The alternative chemicals are lower in sodium content than those typically used. As a result, the Water Department is able to meet sodium standards without resorting to additional in-plant treatment.	Providence Department of Transportation (401-421-7740); Providence Water Department (401-521-6300).	Ongoing.
Tar-Pamlico River Basin, NC nitrogen point/point, point/nonpoint	In North Carolina's Tar-Pamlico River Basin, a group of wastewater treatment plants can receive credit for nitrogen loading reductions by paying $56 per kilogram of desired reduction into an Agricultural Cost Share Fund that supports best management practices in the basin. In comparison, the dischargers estimated that technological upgrades would have provided nitrogen reductions at a cost of between $250 and $500 per kilogram. Notably, the point sources are treated as if they were a single point source (the “bubble” approach) for purposes of implementing the trading program. See TMDL Case Study #12 (fax requests for document to NCEPI, 513-569-7186).	Tar-Pamlico Basin Association (919-551-1500); NC Dept. of Environment, Health and Natural Resources (919-733-5083); and the Environmental Defense Fund (919-821-7793).	The program began operating in 1992 and has provided incentive for point sources to increase operations and maintenance efficiency. The ability of point sources to reduce loads below the limit through plant operational improvements resulted in few trades until recently.
Vicksburg District, U.S. Army Corps of Engineers, MS wetlands nonpoint/nonpoint	The Vicksburg District accepts fees from Clean Water Act section 404 permittees in lieu of compensation under certain circumstances. Funds support wetland restoration and enhancement projects. Past fee recipients include Ducks Unlimited, The Nature Conservancy, and other public agencies involved in environmental efforts in Louisiana and Arkansas.	USACE, Vicksburg District (601-631-5276)	As of 3/93, 7 permittees had participated and contributed over $150,000.

Examples of Existing and Potential Future Trading Programs

Table 2. Programs Under Development/Consideration.

Program/Location What's Being Traded Trade Type(s)	What's Being Considered?	Who's Involved?	Status
Chatfield Basin, CO phosphorus point/nonpoint	Modeling is under way to determine TMDL, potential responsibilities, and trading potential.	EPA Region 8 (Bruce Zander 303-312-6846).	Under development.
Chehalis River Basin, WA pollutant(s) to be determined point/nonpoint, nonpoint/nonpoint	The Chehalis River was identified as a candidate for trading in study done for the Washington Department of Ecology by Apogee Research, Inc. (1992). A subsequent scoping effort collected additional information (economic, regulatory, political, etc.) and confirmed potential for trading. A TMDL for the segment under consideration has recently been completed, and trading opportunities remain uncertain.	Washington Department of Ecology (360-407-3600). Other stakeholders include the Chehalis River Council and three county conservation districts.	Trading opportunities will depend on how wasteload and load allocations are developed.
Chesapeake Bay tributaries, MD nitrogen, phosphorus point/nonpoint, nonpoint/nonpoint	Under the state of Maryland*s nutrient reduction strategy developed for each major tributary to the Chesapeake Bay, some tributary plans include effluent trading as a potential option. A pilot project to examine trading opportunities among six POTWs discharging to the Lower Potomac River was begun but not completed.	Maryland Department of the Environment (410-631-3680); EPA Chesapeake Bay Program (410-267-5700).	Tributary-specific and site-specific issues are still being analyzed to determine trading opportunities.
Clear Creek, CO pollutant(s) to be determined point/nonpoint	Stakeholders are considering a program where point sources would “adopt” abandoned nonpoint sources (primarily mines) and clean up the sites, or otherwise reduce loadings in exchange for credits that could be applied to effluent discharge permits. Stakeholders are initially considering all types of trading, including cross-pollutant and banking scenarios.	Clear Creek Watershed Forum (303-692-3513); EPA Region 8 (Holly Fliniau 303-293-1603). Other stakeholders include the Colorado Dept. of Health and Coors.	Stakeholders recently completed a consensus-building process regarding the trading concept. Next steps will involve more detailed scientific and economic analysis.
Little Deep Fork DO, phosphorus source(s) to be determined	An intensive water quality study was conducted as part of a TMDL development project and some potential for trading was identified. The area is generally cattle country, with some cropland, and urban areas. Preliminary analysis indicates animal BMPs may potentially be implemented in lieu of, or to delay, POTW upgrades.	Indian Nations Council of Governments (Richard Smith 918-584-7526); Oklahoma Conservation Commission (Phillip Moershel 405-842-8744).	The TMDL is ongoing. Water quality managers are currently characterizing nonpoint source loading and developing and implementing BMPs. Trading is scheduled to be considered after results of these efforts are evaluated.

Examples of Existing and Potential Future Trading Programs

Program/Location What's Being Traded Trade Type(s)	What's Being Considered?	Who's Involved?	Status
Sacramento River, CA metals Source(s) to be determined	Stakeholders are discussing the potential for trading to address metals loading issues in the Sacramento River above the City of Sacramento. Interest is primarily due to high metals loadings from abandoned mines and agricultural chemicals relative to municipal and stormwater loadings.	EPA Region 9 (Dave Smith 415-744-2012). Also the City of Sacramento and the Central Valley Regional Water Quality Control Board.	The current focus is to set up a regional monitoring program to better assess metals loading sources and potential controls. Rough loading estimates exist. Trades are unlikely to occur before 1997.
San Joaquin River, CA selenium point/point, point/nonpoint	The Environmental Defense Fund (EDF), the state of California, EPA, and agricultural interests have investigated options for using tradable discharge permits to find least- cost solutions to selenium discharge control problems related to Central Valley irrigated agriculture operations. See EDF*s "Plowing New Ground" report for details.	EDF (Terry Young 510-658-8008). Also irrigation districts, Central Valley Water Resources Control Board, EPA, and the Natural Resources Defense Council.	Trading may be a year or two away. EDF has received another grant to help market trading. The proposal to reopen San Luis Drain, an agricultural tailwater drainage structure that discharges to San Joaquin River, will impact trading issues. The proposed program might be a vehicle for setting up load reductions and drainage districts.
South San Francisco Bay, CA copper point/point, point/nonpoint	Three POTWs and a stormwater management agency were directed by the Regional Water Board to negotiate how to obtain a 900 lb/yr copper loading reduction needed to attain a TMDL. The 900 lb goal is in addition to individual wasteload allocations already set for each POTW and the stormwater utility. The four parties were to report back to the Board regarding how the reduction target would be met and to identify specific responsibilities for actions.	EPA Region 9 (Dave Smith 415-744-2012). Also the Cities of San Jose, Palo Alto, and Sunnyvale; the Santa Clara Valley Nonpoint Source Pollution Control Program; and the San Francisco Regional Water Quality Control Board.	Parties have negotiated a Memorandum of Agreement and are now working on a stormwater source assessment to fill in information gaps on stormwater load reduction feasibility.

Examples of Existing and Potential Future Trading Programs

Program/Location What's Being Traded Trade Type(s)	What's Being Considered?	Who's Involved?	Status
Tampa Bay, FL nitrogen, total suspended solids point/point, point/nonpoint, nonpoint/nonpoint	Several trading initiatives are under consideration. In one, stakeholders may develop a trading program to supplement the allocation of nitrogen loads under a pollutant loading reduction goal. In another, the City of Tampa is considering a trading scheme under which some stormwater retrofit requirements placed on redevelopment projects in specific sections of the city would be waived. In exchange, either the city or the developer would contribute funds to a "stormwater bank" that would pay for larger projects elsewhere in the city. An offset program for specific tributaries also is being considered, in which new and expanding point sources would be required to partially or fully offset their N and/or TSS loads through trading with other point or nonpoint sources.	Tampa Bay National Estuary Program (813-893-2765). Other stakeholders include Tampa Bay Regional Planning Council; City of Tampa; and other industrial, municipal, and agricultural interests.	Trading is under consideration; implementation will depend on a variety of scientific, economic, and political issues.
Truckee River, NV nitrogen and flows point/nonpoint	A not-yet-signed agreement among the U.S. Department of the Interior (DOI), EPA, the state of Nevada, Reno-Sparks municipal government, and the Pyramid Lake Paiute Tribe will provide for DOI and Reno-Sparks to each pay $12 million per year to acquire water rights to be dedicated to instream flow down to Pyramid Lake. In exchange for city water purchases, Nevada would revise a TMDL and permits to allow increased nitrogen discharge to take advantage of increased assimilative capacity associated with flow augmentation. Reno-Sparks is seeking a State Revolving Fund (SRF) loan to finance water purchases. In a related effort, EPA provided a grant to the University of California-Berkeley to study the potential use of economic incentives for pollution control for the Truckee River.	EPA Region 9 (Dave Smith 415-744-2012, Cheryl McGovern 415-744-2013); University of California at Berkeley (510-643-5364). Also DOI, Nevada Division of Environmental Protection, Reno-Sparks, Indian tribes.	The details of this program are still being worked out. The tribe is concerned that the city wants to allocate all of the increased assimilative capacity to its wasteload allocation (despite paying only half the cost) and prefers to keep much of the loading capacity in reserve unallocated. Some concerns about model accuracy and whether the river is now complying with water quality standards also exist.
Yakima River Basin, WA pollutant(s) to be determined pource(s) to be determined	Battelle*s Pacific Northwest Laboratory is working with stakeholders in the basin to address pollutant and water quantity issues, and trading pollutants and/or water rights may be part of the solution. In an unrelated study commissioned by the Washington Department of Ecology, the Yakima River was identified as a candidate for point/nonpoint source trading (See Chehalis River above).	Battelle (509-372-4342). Other stakeholders include: the WA Department of Ecology, the Bureau of Reclamation the Yakama Indian Nation; and a watershed council.	Modeling capabilities are under development and preliminary analysis is under way.

Examples of Existing and Potential Future Trading Programs

Table 3. EPA Studies.

Program/Location What's Being Traded Trade Type(s)	What's Being Considered?	Who's Involved?	Status
Boone Reservoir, TN nutrients point/nonpoint	This study examined the cost-effectiveness of both point and nonpoint source controls (*Sobatka, 1989*). The study concluded that the most cost-effective means of controlling phosphorus, nitrogen, and BOD involved a combination of point and nonpoint source controls. Several agricultural BMPs were among the least expensive choices, followed by upgrades at selected POTWs. BMPs for unconfined animals, urban BMPs, and septic tank renovations were among the most expensive.	EPA Office of Policy, Planning, and Evaluation (202-260-5363) sponsored the study. Study conducted in conjunction with Tennessee Valley Authority.	No program developed.
Wicomico River, MD phosphorus point/nonpoint	This case study simulation estimated the potential cost savings from point/nonpoint source trading in the Wicomico Basin (*Industrial Economics, 1987*). The results demonstrated that trading offers potentially significant cost savings and water quality benefits.	EPA Office of Policy, Planning, and Evaluation (202-260-5363) sponsored the study.	No program developed.

APPENDIX D—REFERENCES

REFERENCES

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