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Office of Wastewater Management
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Water Quality Trading Toolkit for Permit Writers

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Foreword

EPA is pleased to issue the Water Quality Trading Toolkit, the first-ever how-to-trade manual with real-world examples. In January 2003, EPA released the National Water Quality Trading Policy which laid out a framework for trading under the Clean Water Act. In 2004 we published the Water Quality Trading Assessment Handbook to help users determine whether trading is environmentally viable and financially attractive in a watershed. This Toolkit builds upon the two earlier documents and provides more detail regarding actual design and implementation of trading programs. This document will not only help permit writers incorporate trading into National Pollutant Discharge Elimination System (NPDES) permits but is a guide for anyone interested in establishing a water quality trading program in their watershed. We look forward to hearing about the innovative trading programs generated by this useful resource.

Benjamin H. Grumbles
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Disclaimer

This guidance expresses the U.S. Environmental Protection Agency's (EPA) support for implementation of water quality trading through National Pollutant Discharge Elimination System (NPDES) permitting. Implementation of water quality trading will be governed by existing requirements of the Clean Water Act (CWA) and EPA's NPDES implementing regulations. Those CWA provisions and regulations contain legally binding requirements. This document does not substitute for those provisions or regulations. The recommendations in this guidance are not binding; the permitting authority may consider other approaches consistent with the CWA and EPA regulations. The use of non-mandatory words like "should," "could," "would," "may," "might," "recommend," "encourage," "expect," and "can" in this guidance mean solely that something is suggested or recommended, and not that it is legally required, or that the suggestion or recommendation imposes legally binding requirements, or that following the suggestion or recommendation necessarily creates an expectation of EPA approval. When EPA makes a permitting decision, it will make each decision on a case-by-case basis and will be guided by the applicable requirements of the CWA and implementing regulations, taking into account comments and information presented at that time by interested persons regarding the appropriateness of applying these recommendations to the particular situation. EPA may change this guidance in the future.

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Abbreviations and Acronyms

AFO	animal feeding operation
AML	average monthly limit
AWL	average weekly limit
BMP	best management practices
BPJ	best professional judgment
CBOD	carbonaceous biochemical oxygen demand
CSO	combined sewer overflow
CWA	Clean Water Act
DMR	discharge monitoring report
EPA	U.S. Environmental Protection Agency
gpd	gallons per day
ICIS	Integrated Compliance Information System
LA	load allocation
MEP	maximum extent practicable
mgd	million gallons per day
MS4	municipal separate storm sewer system
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
PBTs	persistent bioaccumulative toxics
PCS	Permit Compliance System
POTW	publicly owned treatment works
RNC	reportable noncompliance
SISL	Surface Irrigation Soil Loss
SNC	significant noncompliance
SWCD	Soil and Water Conservation District
TBEL	technology-based effluent limitations
TKN	total Kjeldahl nitrogen
TMDL	total maximum daily load
TN	total nitrogen
TP	total phosphorus
TRE	toxicity reduction evaluations
USDA	U.S. Department of Agriculture
USLE	Universal Soil Loss Equation
WLA	wasteload allocation
WQBEL	water quality-based effluent limitations

Water Quality Trading
Keys to Success

Every trading program should strive to be:

Transparent

Keep the public informed at every step of the process by:

- ★ Involving stakeholders in the design of the trading program
- ★ Communicating to the public information deemed necessary to maintain stakeholder confidence

Real

Show pollutant reductions and water quality improvement by:

- ★ Measuring reductions
- ★ Verifying BMP installation and maintenance, e.g., through a third party

Accountable

Manage the program effectively by:

- ★ Including trade tracking mechanisms in the program design
- ★ Periodically reviewing the program's process and results

Defensible

Base the program on sound science and protocol by:

- ★ Using dynamic water quality models
- ★ Requiring credit generators to certify credits
- ★ Developing scientifically based trading ratios

Enforceable

Establish responsibility for meeting or exceeding water quality standards by:

- ★ Incorporating clearly articulated trading provisions in NPDES permits

Introduction

For more than a decade, the U.S. Environmental Protection Agency (EPA) has promoted and supported the concept of water quality trading as an innovative approach for achieving water quality standards with flexibility and economic efficiency. A variety of pilot programs and projects have generated useful information on how to conduct water quality trading, yet the number of actual trades that have occurred is relatively small. EPA believes that as awareness of the potential benefits of water quality trading grows, National Pollution Discharge Elimination System (NPDES) permittees will be more interested in water quality trading and request permitting authorities to incorporate trading provisions into their permits. As a result, the process for crafting water quality trading programs and requirements should involve the permitting authority staff as early as possible. This will help ensure that trading programs are effective and workable and fully consistent with the implementation and compliance framework of the permitting authority's NPDES program.

This *Water Quality Trading Toolkit for Permit Writers* (Toolkit) is intended to facilitate trading by providing NPDES permitting authorities with the tools they need to facilitate trading and to authorize and incorporate trading in NPDES permits. Although the Toolkit primarily targets state, tribal and EPA NPDES permitting authorities, it might also be useful to other stakeholders interested in water quality trading and the NPDES permitting process. Users of the Toolkit should have an existing, fundamental understanding of both water quality trading concepts and the NPDES permitting process. To ensure consistency and minimize redundancy, the Toolkit refers users to existing EPA guidance on water quality trading and NPDES permit development and issuance whenever possible.

This guidance is based on EPA's *Water Quality Trading Policy* (Trading Policy) published in January 2003. The Trading Policy was written on the assumption that, if a total maximum daily load (TMDL) were in place, all trading partners would be covered by the TMDL. In this case, wasteload allocations (WLAs) and load allocations (LAs) under the TMDL form the baseline for trading. In all cases, permits must be designed to meet water quality standards as required under Clean Water Act (CWA) section 301(b)(1)(C). Inclusion of trading provisions in NPDES permits should facilitate meeting this requirement.

Water quality trading programs are necessarily tailored to meet the needs of the dischargers and stakeholders in the watersheds for which they are developed. Because each watershed is unique, water quality trading programs may exist in many different forms. It would be impracticable and cumbersome to attempt to cover in this document every possible type of program that might be developed to meet an individual watershed's needs. This Toolkit attempts to equip program developers and permit writers with an understanding of the issues involved in water quality trading and the types of program characteristics that are best suited to address them. The fact that a particular trading program design or element is not represented in the examples presented in the Toolkit does not necessarily mean that it is not appropriate or would not be supported by EPA.

Toolkit Organization and Instructions

With the permitting authority as the primary target user, the Toolkit first addresses broad water quality trading policy issues and then focuses on specific trading scenarios. Water quality trading scenarios fall into two major categories: (1) point source–point source trading and (2) point source–nonpoint source trading. Point source–point source trading includes single point source–single point source trading, multiple facility point source trading, and point source credit exchanges. Point source–nonpoint source trading includes single point source–nonpoint source trading and nonpoint source credit exchanges.

The first section of the Toolkit, *Fundamentals of Water Quality Trading*, addresses broad water quality trading policy issues; this section applies to all Toolkit users. Within the Fundamentals section, the *Overview of Water Quality Trading* section addresses the role of NPDES permitting authorities in water quality trading and the legal and policy framework for water quality trading. The *Essential Trading Information for Permit Writers* section discusses specific water quality trading issues relevant to NPDES permitting authorities. Issues addressed in this section include the type of pollutants to be traded, definition of a pollutant reduction credit, circumstances conducive to trading, baselines for water quality trading, trading ratios, timing and duration of credits, and the geographic scope of trades. All Toolkit users should have a thorough understanding of the policy and technical issues addressed in these sections before proceeding to the specific trading scenario sections. Understanding of the important policy and technical issues contained in the initial sections of the Toolkit is essential to prevent ineffective or inappropriate water quality trading conditions in NPDES permits. After reviewing the initial sections of the Toolkit, the user is prepared to proceed to the appropriate section of the Toolkit that focuses on a specific trading scenario. The intent is to allow the Toolkit user to review only the information that applies to the specific trading scenario of interest. The following diagram (Figure 1) is intended to help navigate the trading scenario sections of the Toolkit:

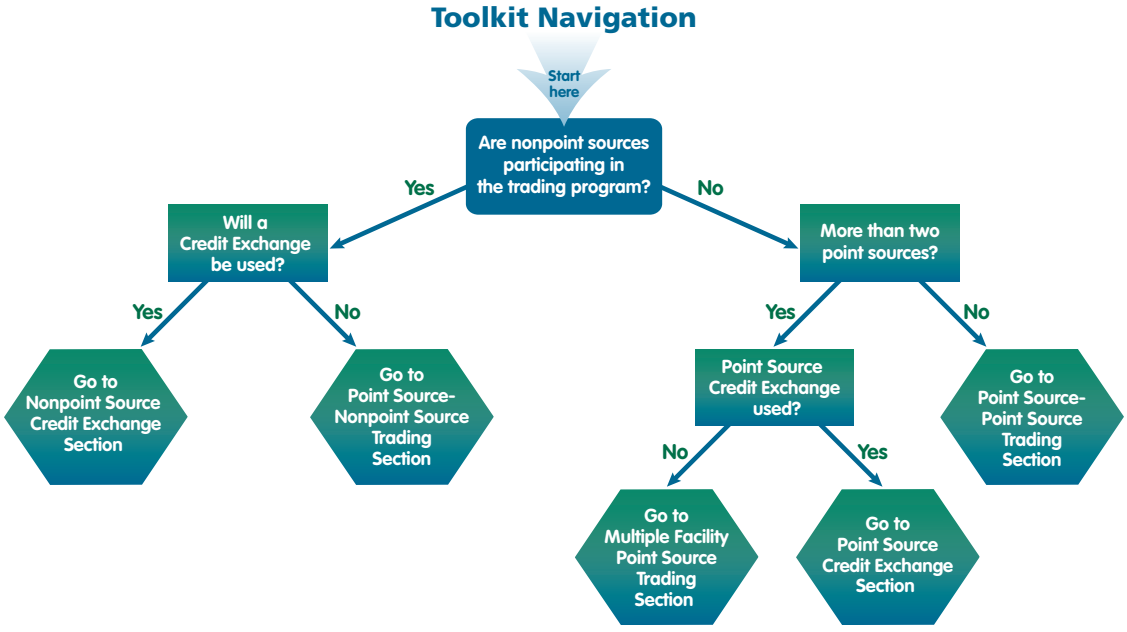

Figure 1. Toolkit navigation.

For example, a permitting authority developing conditions in a NPDES permit to authorize and facilitate trading between two single point sources would first review the Overview of Water Quality Trading and Essential Trading Information for Permit Writers sections for important policy and technical information and then carefully review the Single Point Source–Single Point Source Trading scenario for specifics pertaining to trading between two single point sources.

The Toolkit is intended to assist with developing and implementing NPDES permits that allow for water quality trading. Each trading scenario section walks NPDES permitting authorities through the normal process of developing the components of a NPDES permit and provides the tools they need to incorporate water quality trading into that process. Each section of the Toolkit contains two important components that supplement the narrative: (1) a hypothetical trading example and (2) real-world examples that apply the trading concepts discussed in the section. Each of these components of the Toolkit is presented in a unique format, as illustrated below, to ensure easy identification.

Hypothetical Examples

Hypothetical examples appear throughout each section highlighted in a blue-shaded text box.

Real-World Examples

Where applicable, each section includes either summaries of real-world examples or Web pages that provide more detailed information. These examples appear in a green-shaded text box. When actual permit provisions from these examples are available, see Appendix A for the exact permit language.

Overview of Water Quality Trading

Water quality trading is an innovative, market-based approach that if used in certain watersheds can achieve water quality standards more efficiently and at lower cost than traditional approaches. Costs to control discharges compared with runoff for a given pollutant often vary significantly in a watershed, creating the impetus for water quality trading. Through water quality trading, facilities that face higher pollutant control costs to meet their regulatory obligations can purchase pollutant reduction credits from other sources that can generate these reductions at lower cost, thus achieving the same or better overall water quality improvement. In most cases, trading takes place on a watershed level under a pollutant cap (the total pollutant load that can be assimilated by a waterbody without exceeding water quality standards) developed through the TMDL process or a similar type of water quality analysis that produces information on pollutant loadings and resulting water quality conditions (USEPA 2004).

For example, where a TMDL has been established, the baselines relative to which point sources and nonpoint sources can generate credits are their WLAs and LAs (for definitions, see glossary), respectively. To generate tradable credits, a source would need to reduce loadings below the allocation set by the TMDL. A source buying credits would be able to increase its discharge over what would otherwise be allowed, but only by the amount of the credits purchased from another source (or sources) and subject to other conditions specified in the permit and trading program. The result would be that, at a minimum, the post-trade loadings from the trading sources would be equal to or less than the loadings that would have been discharged by the sources in the absence of trading. Trading programs may also be designed to require a net reduction in loadings when trading occurs.

EPA's *2004 Water Quality Trading Assessment Handbook* notes that, in water quality trading markets, the marketable product is the *over control* of pollutant loadings. A pollutant reduction credit is the amount (mass) of pollutant reduced over a specified time period (day, month, year) that is in excess of the required reduction for a certain source. The excess pounds of pollutant reduced can be made available for a NPDES permittee to purchase as credits. It is important to note that, due to trade ratios, one pound of pollutant reduced at the seller's discharge location is not necessarily equal to one pound of pollutant reduced at the buyer's location. Therefore, for the purposes of this Toolkit, one credit will be equal to one unit of load reduction per time (lb/day) at the location of the buyer.[1] One credit may be greater or less than one unit of load reduction per time at the location of the seller.

[1] The definition of a credit may vary from program to program.

NPDES Permitting Authority Role in Water Quality Trading

EPA or an authorized state, territory, or tribe is the permitting authority for NPDES permits. When states are referenced in this document, it is meant to also include state, territorial, and tribal permitting authorities. Regardless of the entity issuing NPDES permits, the process for crafting water quality trading requirements should involve the permitting authority staff. This will help ensure that trading provisions are fully consistent with the implementation and compliance framework of the particular jurisdiction's NPDES program. The role of NPDES permitting authorities in water quality trading should include the following:

- Advising state or local entities, as they develop trading frameworks, on what is needed for NPDES programs to authorize trading
- Developing enforceable trading provisions, NPDES permit limitations and conditions that meet the requirements of the CWA and its implementing regulations, consistent with the following:
  - EPA's Trading Policy
  - State laws, regulations, and policy
  - Any applicable trading program
- Helping to develop and implement mechanisms to ensure accountability and compliance with trading requirements. Examples include the following:
  - Credit certification forms
  - Trade tracking mechanisms
  - Enforcement if permit requirements are not met
  - Review of monitoring data from credit buyers and sellers

In addition to the expertise used to develop permits and especially water quality-based effluent limits (WQBELs), the NPDES permitting authority will need an understanding of the following:

- The legal and policy framework for water quality trading
- The specific issues involved in incorporating water quality trading into NPDES permits
- The various trading scenarios and the types of sources, watersheds and pollutants for which they are appropriate

The remainder of this section briefly describes the federal legal and policy framework for water quality trading and provides examples of state regulations, policy, and guidance that establish a framework for trading or address specific aspects of trading.

Legal and Policy Framework for Water Quality Trading

Where trading is feasible, the terms of a trade will depend, in part, on the structure of a trading program or other trading requirements developed by the state or other permitting authority. These in turn must comply with federal and state rules that define the legal framework within which trading programs and requirements are developed.

Federal Law, Regulations, and Policy

The CWA, 33 United States Code (U.S.C.) section 1251, et seq. and its implementing regulations establish the legal framework within which a trading program involving regulated point sources would be developed. The NPDES regulations at Title 40 of the *Code of Federal Regulations* (CFR) 122.44(d) describe the requirements for WQBELs that are set at levels necessary to achieve water quality standards. EPA's Trading Policy provides states with guidance on how to facilitate trading consistent with the CWA and its implementing regulations. The Trading Policy is included in this document as Appendix B. Many of the concepts in the Trading Policy are explored in greater detail in the section on Essential Trading Information for Permit Writers. In addition, relevant portions of the Trading Policy are referenced throughout the Toolkit.

Under CWA section 301(b), NPDES permits must contain technology-based effluent limitations (TBELs) and more stringent effluent limitations when necessary to meet applicable water quality standards. Trading cannot be used to meet TBELs, except where specifically authorized by effluent guidelines (e.g., the *water bubble* provisions in the effluent guidelines for the Iron and Steel point source category). EPA has promulgated regulations at 40 CFR Part 122 specifying when WQBELs under CWA section 301(b)(1)(C) are necessary and how such limitations are to be derived. Among other things, EPA's regulations at 40 CFR 122.44(d)(1)(vii) require the permitting authority to ensure that: (a) the level of water quality to be achieved by limits on point sources is derived from, and complies with, all applicable water quality standards; and (b) effluent limitations developed to protect a narrative water quality criterion, a numeric water quality criterion, or both, are consistent with the assumptions and requirements of any applicable WLA for the discharge prepared by the state and approved by EPA pursuant to 40 CFR 130.7. To be lawful, a WQBEL must be consistent with the requirements of CWA section 301(b)(1)(C) and EPA's regulations at 40 CFR 122.44(d)(1).

WQBELs must also be calculated at levels that do not result in a shift in loadings that causes a localized impairment of designated uses. A localized impairment may occur wherever the applicable water quality criteria are exceeded. Where state or tribal water quality standards allow for mixing zones, the WQBELs must be consistent with the restrictions associated with those mixing zones.

The requirements of CWA section 301(b)(1)(C) and EPA's regulations at 40 CFR Part 122 apply to all WQBELs, including those based on a water quality trade.

State Regulations, Policy, and Guidance

EPA issued its Trading Policy to encourage state regulatory agencies to include trading as an option for a point source to meet water quality standards. Some states have chosen to develop regulations, policy, or guidance to do any of the following:

- Establish a statewide or watershed trading framework
- Support local trading frameworks
- Address specific aspects of a trading program

State trading rules should be consistent with the CWA, NPDES permit requirements, and state water quality standards. The following sections describe various state approaches for facilitating water quality trading.

Establishing a Statewide or Watershed Trading Framework

States may choose to develop state rules or regulations to facilitate the consistent and efficient implementation of a statewide or watershed-wide trading program and provide a regulatory framework for local rulemaking. Where a statewide or watershed trading program is in place, permittees or other stakeholders interested in pursuing trading know what is expected, what rules apply, and with whom they need to coordinate. NPDES authorities should participate in the development of state rules to ensure trading programs are consistent with NPDES permitting requirements and will address the needs of permit writers.

Connecticut has adopted trading legislation. Public Act No. 01-180 establishes the trading framework for a Long Island Sound Nitrogen Credit Exchange Program to be directed by a Nitrogen Credit Advisory Board appointed by the General Assembly and the governor. The Nitrogen Credit Exchange Program establishes a well-defined trading structure supported and regulated by limits mandated in state law. The state legislation specifies trading ratios (e.g., delivery and location ratios) and accounting methodologies to formalize all calculations used in trading.

States do not necessarily have to develop trading rules and regulations to provide a trading framework. Some states have developed guidance documents and other tools to assist dischargers interested in trading. Pollutant trading is recognized in Idaho's Water Quality Standards regulations, and the Idaho Department of Environmental Quality (DEQ) has produced the *Pollutant Trading Guidance* that establishes the procedures to be followed for pollutant trading. The draft document specifies the conditions under which pollutant trading may take place, establishes record-keeping and reporting procedures, and prescribes how best management practices (BMPs) are to be developed for each watershed in which pollutant trading occurs. Idaho DEQ and EPA Region 10 will rely on this document to convey information to stakeholders about the state's *ground rules* for authorizing and verifying trades and to ensure a level of regulatory consistency between the Lower Boise project and other emerging projects across the state. The nonprofit organization established to record trades for the Lower Boise and other watersheds with trading programs will also refer to the guidance for the transaction information it needs to record and make available to trading participants, EPA and DEQ, and the general public.

Trade Facilitation

The Virginia General Assembly passed legislation authorizing the creation of a Chesapeake Bay Nutrient Credit Exchange Program in 2005. This program includes the issuance of a watershed-based nutrient general permit that incorporates trading, as well as the formation of the Virginia Nutrient Credit Exchange Association, which coordinates and facilitates trading among its members. The Virginia Department of Environmental Quality (VA DEQ) is charged with developing the watershed-based permit and overseeing the credit exchange. The VA DEQ must certify the credits purchased by facilities and publish a record of all credits

available as well as the trades that have taken place. In addition, the legislation established that the VA DEQ may conduct audits of the Virginia Nutrient Credit Exchange Association to ensure completeness and accuracy of reports.

Supporting Local Trading Frameworks

Some states allow trading without having state trading rules, policy, or guidance specifically addressing pollutant trading. For example, the North Carolina Department of Environment and Natural Resources (DENR) works with any watershed group interested in trading to develop a trading framework for that watershed and cover dischargers under an overlay permit. This trading framework originated in the Neuse River watershed. The state classified the river as a Nutrient Sensitive Water (NSW). Major fish kills in 1995 prompted legislation requiring nutrient controls and led the North Carolina Environmental Management Commission (EMC) to revise its 1988 Nutrient Management Strategy for the Neuse River Basin. The 1997 strategy established a goal that sources would reduce total nitrogen (TN) loads to the estuary by 30 percent by the year 2003. Subsequently, the North Carolina EMC adopted a rules package in 1998 to support the strategy. The rules were aimed at reducing TN impacts in the watershed by promoting nutrient management activities for agriculture, stormwater, point sources, and riparian areas. One of the rules under the strategy, the Wastewater Discharge Requirements rule, allowed dischargers to form an association to meet their allocated TN load collectively. Though not expressly stated in the rule, trading is allowed under this option among the members of the association. Members are allowed to purchase, sell, trade, or lease their individual portions of the estuary TN allocation (which are included in their permits as mass-based effluent limits) among co-permittees covered under an overlay permit so as long as they do not exceed the association's overall estuary TN allocation (2.8 million pounds per year). Individual trades conducted under the overlay permits are typically not reviewed by the state.

Market Drivers

In most states, meeting water quality standards, WLAs under TMDLs, or other kinds of pollutant caps are the leading drivers for water quality trading markets; however, some states have developed state regulations to allow trading in other circumstances, such as on Wisconsin's Red Cedar River. The primary regulatory driver for point sources involved in trading on the Red Cedar River is Chapter NR 217 of the Wisconsin Administrative Code. This chapter of the code mandates 1 mg/L total phosphorus (TP) discharge limits for municipal treatment plants with a monthly discharge exceeding 150 pounds of TP and for industrial sources with a monthly discharge exceeding 60 pounds of TP. This cap is used to control phosphorous loadings and provides an incentive for water quality trading in the Red Cedar River watershed, as well as a baseline against which trading can be conducted.

There may be other specific aspects of a trading program that a state chooses to address through regulation, policy or guidance, such as selection of approved BMPs for generating tradable credits from nonpoint sources or general eligibility requirements (e.g., compliance history) for point sources wishing to engage in a trading program. Permitting authorities

should be familiar with all applicable federal and state policies, regulations, and guidance before beginning to develop a permit that incorporates trading.

As is apparent from this discussion of the legal and policy framework for water quality trading, the decision to incorporate trading into a NPDES permit requires careful consideration. The permitting authority should, first, be aware of the broader state/local/watershed context for trading and consider how this context will affect the incorporation of trading provisions into NPDES permits. Specific permit conditions should be guided by state regulations and policies, including any established trading framework. The following section, Essential Trading Information for Permit Writers, provides an overview of issues that permitting authorities should consider, within the context of established regulation and policy, before developing permits that incorporate water quality trading.

Essential Trading Information for Permit Writers

Permitting authorities are key players in any water quality trading program. Trades involving point sources, whether they are buyers or sellers, should be reflected in their NPDES permits. Listed below are some fundamental issues regulatory authorities should address when establishing a trading program or evaluating potential trading opportunities.[2] It is essential that the permitting authority have a clear understanding of these fundamental issues and how they will affect development of the NPDES permit that implements water quality trading.

- Pollutants most suitable for trading
- Geographic scope of trading
- Types of trading scenarios
- Appropriate circumstances for trading
- Definition of a pollutant reduction credit
- Definition of a baseline for generating credits
- Trading ratios
- Types of effluent limitations that may be met through trading
- Credit reconciliation based on timing and duration of credits
- Role of stakeholders
- Potential for and avoidance of localized exceedances of water quality standards

Appendix E provides the permit writer with a list of fundamental questions that should be answered when implementing water quality trading in a NPDES permit.

What Pollutant Trading Does EPA Support?

Not all pollutants are necessarily suitable for trading. Regulatory authorities should determine which pollutants may be traded within a specific watershed or as part of a particular trading program and may determine that certain pollutants may not be traded at all. EPA's Trading Policy supports trading for TN, TP, and sediment and indicates that other pollutants may be considered for trading on a case-by-case basis. EPA does not support trading of persistent bioaccumulative toxics (PBTs). For a list of pollutants that EPA considers PBTs see www.epa.gov/pbt/index.htm. In general, pollutants that cause adverse water quality effects

[2] This guidance is based on EPA's Trading Policy. The Trading Policy was written on the assumption that all trading partners would be covered by the same TMDL analysis. Thus, there are some suggestions within this document that may not apply to trades in which the trading partners are not under the same TMDL. In all cases where trading provisions are included in a permit, it remains the responsibility of the permitting authority to issue permits designed to meet water quality standards as required under CWA section 301(b)(1)(C).

primarily as a result of cumulative loadings that are high relative to the contributions of any individual source are more suitable for trading than those that exert acute effects over small areas and in relatively low concentrations. Chapter 2 of EPA's *Water Quality Trading Assessment Handbook* provides more information regarding trading suitability analyses for specific pollutants.

Nonconventional Pollutants

EPA's Trading Policy explicitly supports trading to reduce nutrients. A number of established trading programs and pilot projects have shown that nitrogen and phosphorus can be successfully traded within a watershed to make progress toward meeting a TMDL and water quality standards. Appendices A and B of EPA's *Water Quality Trading Assessment Handbook* provide detailed information on evaluating trading suitability for phosphorus and nitrogen.

Nutrient trading programs:

Long Island Sound, Connecticut

Lower Boise River, Idaho

Truckee River, Nevada

Neuse River Basin, North Carolina

Red Cedar River, Wisconsin

Southern Minnesota Beet Sugar Cooperative, Minnesota

Trading of other types of nonconventional pollutants may be supported on a case-by-case basis provided the trading programs are properly designed and prior approval is provided through a NPDES permit, a TMDL, or in a state-, tribe-, or EPA-supported watershed plan or pilot trading project.

Conventional Pollutants

The Trading Policy explicitly supports trading to reduce sediment loads. Another conventional pollutant that may be suitable for trading is temperature, or thermal load. Appendices C and D of EPA's *Water Quality Trading Assessment Handbook* provide detailed information on evaluating trading suitability for temperature and sediments. Trading of other types of conventional pollutants may be supported on a case-by-case basis, as long as the trading program is properly designed to ensure that trades are consistent with water quality standards.

Conventional pollutant trading programs:

Truckee River, Nevada: Total Dissolved Solids

Clean Water Services, Oregon: Temperature

Does EPA Support Cross-Pollutant Trading?

EPA's *Trading Policy* supports cross-pollutant trading programs (i.e., trading between two different pollutant parameters) when mass loads that are approximately equal with respect to their impacts on the aquatic environment can be calculated. The Trading Policy explicitly supports cross-pollutant trading for oxygen-related pollutants where there is adequate information to establish and correlate impacts on water quality.

Rahr Malting Company, Minnesota

The Rahr Malting facility offsets 5-day carbonaceous biochemical oxygen demand ($CBOD_5$) discharges from its facility by funding upstream nonpoint source phosphorus reductions. This trade was implemented to reduce downstream oxygen demand (Breetz et al. 2004). Phosphorus loads affect oxygen demand and thus could be traded for $CBOD_5$ once correlations between the impacts of the upstream phosphorus discharges and the downstream $CBOD_5$ discharges were determined.

What Is the Appropriate Geographic Scope for Water Quality Trading?

EPA's Trading Policy states that all water quality trading should occur either within a watershed or within a defined area for which a TMDL has been approved. But what, exactly, does "trading within a watershed" mean? For example, how large can the watershed be? Is it appropriate to trade between dischargers to different streams within the same watershed? Does it matter where the trading partners' discharges are located relative to one another? The answers to these questions will vary on the basis of a number of factors. In general, the geographic scope of a trade should be no larger than necessary to encompass the universe of sources that contribute to a specific water quality problem that is to be addressed through trading. Beyond this, regulatory authorities should carefully consider the following factors when determining the appropriate geographic scope of a water quality trade. Many of the decisions regarding geographic scope are synonymous with decisions that define TMDLs. For this reason, EPA encourages the inclusion of specific trading provisions in the TMDL itself.

First, trading should occur only within a hydrologic unit that is appropriately defined to ensure that trades will maintain water quality standards within that unit, as well as within downstream and contiguous waters. Second, it is important to remember that the purpose of trading is to improve water quality. This can occur only if the parties to the trade discharge, either directly or indirectly, to the same waterbody where water quality improvement is necessary. This may involve trading across a wide geographic area if the waterbody to be addressed drains a large area (e.g., the Chesapeake Bay), or across a small area if the impaired waterbody is itself small (e.g., an individual stream segment). Inappropriate trading across geographic or hydrologic units (i.e., where the dischargers are not both contributing to the same water quality problem) will not improve, and could worsen, water quality downstream of the credit purchaser. Water quality trading is intended to provide opportunities for efficiently achieving and maintaining water quality standards within watersheds, as opposed to cleaning up one watershed at the expense of another.

As noted above, trades can also occur on a very small scale. The Trading Policy supports several types of trading that, by definition, would occur below the watershed scale. Specifically, pretreatment trading, intraplant trading, and intramunicipal trading are limited to the geographic scale that encompasses the collection system, facility, or municipality involved in trading.

The appropriate size of the area within which trading may occur depends on the specific characteristics of the site and the trade. Regulatory authorities should consider hydrogeologic conditions, fate and transport of pollutants, ecological parameters, the location and types of point sources, the parameters to be traded, and the regulations and management structure affecting the trading program in evaluating appropriate trading boundaries (USEPA 1996a). These factors, obviously, will vary from watershed to watershed and even within watersheds depending on the pollutants and trading partners. Some example considerations are provided below.

Regulatory authorities should take into account the following factors in determining appropriate boundaries for a trading program and the geographic coverage of a permit that incorporates water quality trading:

- Where are the dischargers located relative to the waterbody for which reductions are needed?
- What is the distance between the potential trading partners' discharges, either along a shared receiving stream, or to the point where the receiving streams converge?[3]
- Is the potential credit purchaser upstream or downstream of the potential credit generator?
- If the credit generator is a nonpoint source, where is its loading released?
- Are there diversions, tributaries, impoundments, drinking water intakes, or other water withdrawals between the potential trading partners' discharges?
- What political boundaries exist between trading partners or within a watershed of interest that may impact the requirements or regulations affecting trades? Are potential partners regulated by the same permitting authority?
- What are the water quality impacts and fate and transport (e.g., decay) characteristics of the pollutant(s) to be traded?[4]
- Can appropriate trade ratios be established to account for the distance between trading partners' discharges?
- Are other water quality trades being conducted in the waterbody, and how might they affect the water quality impacts of the trade being considered?

Interstate trading may be a viable option in some parts of the country. For instance, in the Chesapeake Bay, CWA section 117(g) says that the administrator, in coordination with other members of the Chesapeake Bay Executive Council, "shall ensure that management plans are developed and implementation is begun by signatories to the Chesapeake Bay Agreement to achieve and maintain - (A) the nutrient goals of the Chesapeake Bay Program for the quantity of nitrogen and phosphorus entering the Chesapeake Bay and its watershed…". EPA interprets this language as supporting the Chesapeake Bay states in establishing multijurisdictional water quality trading programs as part of the *management* planning and *implementation* necessary to achieve the Bay's nutrient goals.

Also, trading could be an option under already established interstate compacts (e.g., Ohio River Valley Water Sanitation Commission (ORSANCO)). CWA section 103(b) expresses

[3] The difference between these two measuring points relates to the location of the trading partners and the waterbody of concern. If the waterbody of concern is downstream from the trading partners, the permitting authority should compare the distance between the buyer and the waterbody of concern and the seller and the waterbody of concern to determine the appropriate location ratio. If the buyer is on the waterbody of concern, the permitting authority should determine the distance between the buyer and the seller to calculate the appropriate delivery ratio. More information on trade ratios is available later in this document.

[4] Fate and transport modeling will often be needed and should be the same as or consistent with any model used to develop the TMDL.

Congress' *consent* that states "negotiate and enter into agreements or compacts… for (1) cooperative effort and mutual assistance for the prevention and control of pollution and the enforcement of their respective laws relating thereto, and (2) the establishment of such agencies, joint or otherwise, as they may deem desirable for making effective such agreements and compacts." To be binding, the CWA says such agreements or compacts must be approved by Congress.

For interstate trading outside of congressionally approved compacts, section 103(a) of the CWA directs EPA to "encourage cooperative activities by the states for the prevention, reduction, and elimination of pollution, [and] encourage the enactment of improved and, so far as practicable, uniform state laws relating to the prevention, reduction, and elimination of pollution." EPA believes that encouraging states to engage in cooperative, interstate activities like establishing multijurisdictional water quality trading programs designed to prevent, reduce, and eliminate pollution is consistent with the directives in section 103(a).

In many cases, the trading boundaries will be established under a trading program or agreement, independent of the NPDES permit that implements the trade. As such programs and agreements are developed, NPDES permitting authorities should provide input on the appropriate trading boundaries on the basis of their experience permitting the facilities potentially involved. In any case, the permitting authority should write permit conditions in such way as to ensure that trades occur only within appropriate boundaries.

Types of Trading Scenarios

NPDES permitting authorities are likely to encounter a variety of trading scenarios. In general, however, all trades included in permits will involve either trading between point sources or trading between point sources and nonpoint sources. Trading between multiple point sources or between point sources and nonpoint sources can occur with or without an intermediary or broker to facilitate the trades. A third-party broker—a person, organization, or Web site—can help trading partners identify one another in a watershed. For example, NutrientNet acts as a Web-based broker.

NutrientNet©

The World Resources Institute has created a trading Web site (NutrientNet - www.nutrientnet.org), which acts as a trading broker, facilitating a way for buyers and sellers to connect, "by making it relatively easy for both point sources and nonpoint sources to estimate their remediation costs using standard, consistent methods, and by making the record of trade readily accessible. Specifically, NutrientNet is designed to serve the following functions:

- Provide potential market participants and other stakeholders with background information on nutrient trading;
- Provide farmers, municipal treatment works, and industrial plants with tools for estimating releases of nutrients to surface waters from their operations, exploring reduction options, estimating the costs of achieving reductions;

NutrientNet© *(continued)*

- Help market participants identify potential trading partners;
- Track the volume and type of trades within a watershed;
- Share lessons learned about trading across the watersheds where it is being tried or considered; and
- Provide information on water quality problems and trading as a possible means to address them." (World Resources Institute 2004)

Point Source–Point Source Trading

Trading between point sources is the most basic form of water quality trading. Point source–point source trading is relatively straightforward, easily measurable, and directly enforceable. Trading between point sources is generally the easiest type of trading to implement, to measure reductions from, and to ensure compliance and enforcement with because all sources have a permit, the effectiveness of removal technologies is relatively well known, and monitoring protocols are in place. For example, in a particular watershed a publicly owned treatment works (POTW) that installs advanced technology to meet new nutrient limits could create credits by achieving greater reductions than necessary to meet its WQBELs. Other POTWs in the same watershed may find that, instead of installing expensive new technology, it is more economical for them to buy pollutant reduction credits to meet their own WQBELs.

Trading Between Two Point Sources

Single point source–single point source trades generally involve a trade agreement[5] between two point sources (see Figure 2). In this type of trade, one point source is the credit generator and the other is the credit purchaser. For point source–point source trades, a single permit can be issued that incorporates or references the trade agreement and includes both point sources as co-permittees. Alternatively, each discharger can be issued an individual permit with trading provisions placed in each permit.

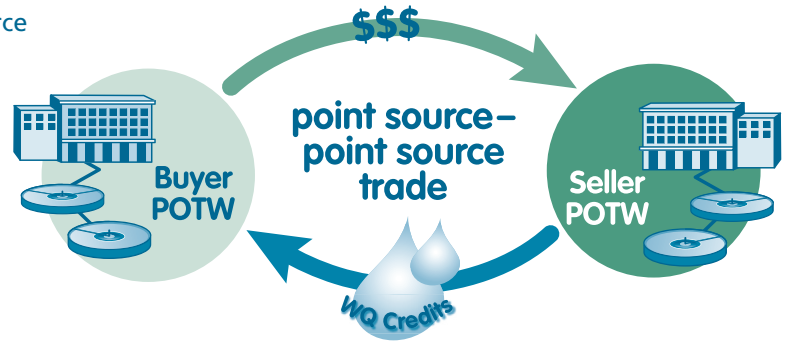

Figure 2. Point source–point source trade.

[5] A trade agreement is a document that specifies the overall trading policies that a buyer and a seller must follow to participate in trading. The NPDES permitting authority could approve the trade agreement and either reference the terms of the trade agreement in the NPDES permit or include the trade agreement as part of the permit for each point source participating in a trade.

Multiple Facility Point Source Trading/No Exchange

Multiple facility point source trades involve a group of point sources operating under a single trade agreement (see Figure 3). The agreement can establish *ground rules* for trading to allow point sources to trade among themselves as needed. The trade agreement can specifically identify the point sources that may participate in water quality trading, or it can identify a geographic boundary (typically a watershed) or a type of discharger, or both, and allow qualifying point sources to participate in trading as desired or appropriate. An overall limit or cap set by the permit regulates all trades. Point sources trading under a multiple facility trade agreement are sometimes organized under a group that facilitates and oversees trading among the members.

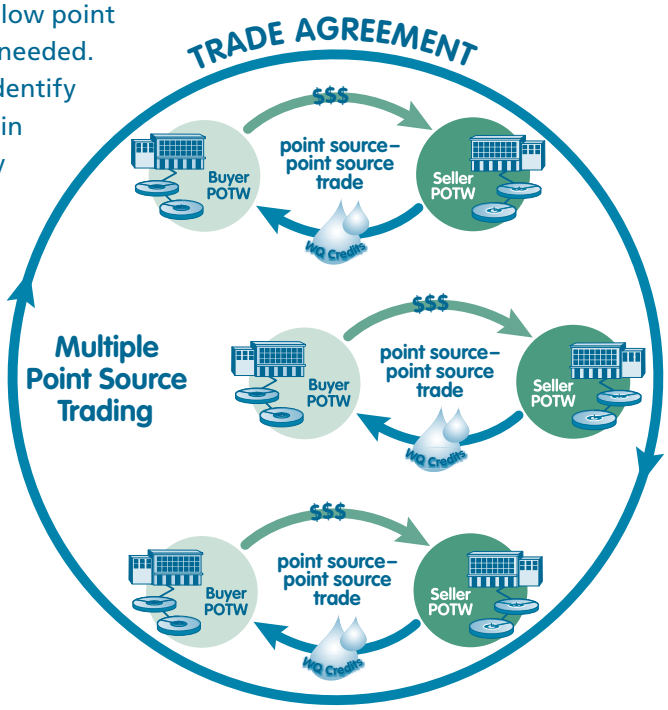

Figure 3. Multiple point source trading.

Neuse River Basin, North Carolina

Point sources participate in the Neuse River Compliance Association and have coverage under a group compliance permit that includes individual and group allocations of TN. Members of the association can trade with each other as long as they remain under the cap. If the cap is exceeded, members will be subject to their individual limits. The North Carolina Division of Water Quality may take enforcement action against the compliance association and any individual discharger. When trades occur that involve nonmembers or new or expanding dischargers within the Neuse River Basin, the group cap is modified. If credits are not available from existing dischargers, a new or expanding discharger can also obtain an allocation by paying into the Wetlands Restoration Fund; however, it must pay at double the rate of a compliance association member, and the purchase must be sufficient to fund 30 years of nitrogen reduction.

Point Source Credit Exchanges

Another type of multiple facility point source trade involves a group of point sources that may purchase credits from a central exchange as needed to comply with individual effluent limitations (see Figure 4). The credit exchange is maintained by a separate entity, which may be a state agency, a conservation district, or other organization established to administer the

credit exchange. Credits in the exchange are generated by point sources that over control their discharges. The trade agreement can specify how credits may be generated and purchased, how trade ratios are calculated, and individual and group responsibilities for meeting effluent limitations and overall pollutant loading caps. Credit exchanges do not hold credits for longer than the reconciliation period, which typically corresponds to the type of effluent limitation. For example, the reconciliation period for trades to meet monthly average effluent limitations for phosphorus would be one month. For each reconciliation period, new credits are generated for purchase. The credit exchange would likely have to be either operated by or approved and overseen by a state regulatory agency.

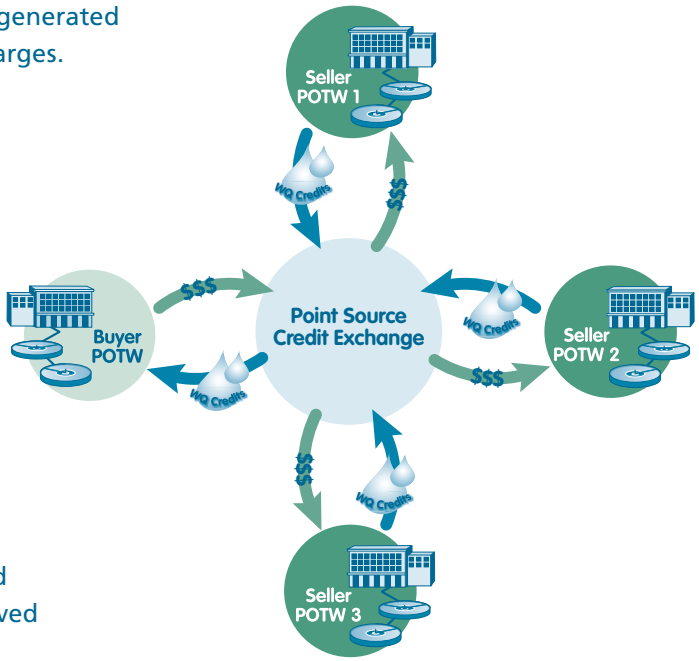

Figure 4. Point source credit exchange.

Long Island Sound, Connecticut

POTWs in the Connecticut portion of the Long Island Sound watershed may participate in the Nitrogen General Permit and Nitrogen Credit Exchange Program. Participating POTWs must individually meet the annual average discharge limits in the permit or purchase the necessary credits to achieve their individual limits through the program, which is administered by an advisory board and Connecticut Department of Environmental Protection. POTWs performing better than required by their permit limits generate credits to sell through the program. The reconciliation period for this program is one year.

Point Source–Nonpoint Source Trades

Trading between point source buyers and nonpoint source sellers provides another opportunity to meet water quality standards. In successful point source–nonpoint source trading programs, point sources benefit by purchasing credits for required reductions at lower cost than technology upgrades; nonpoint sources benefit by gaining income from better resource management; and water quality improves. One major advantage of trading is that it may reduce the cost to achieve water quality goals. For example, as shown in Figure 5, it is often less expensive to remove nutrients through the use of improved agricultural practices, such as conservation tillage, grass buffers, and enhanced animal waste management than through upgraded municipal waste treatment.[6] In developing point source–nonpoint source trading programs and associated NPDES permits, extra care should be taken to ensure that nonpoint source load reduction uncertainty is addressed. EPA's Trading Policy recommends that states

[6] Data for this table was taken from information gathered to support the Chesapeake Bay Commission's 2004 *Cost-Effective Strategies for the Bay*. There are other areas in the country where municipal waste treatment costs for TN have been shown to be lower, depending on the level of TN removal.

Nutrient Reduction Costs

BMP	Phosphorous ($/lb)	Nitrogen ($/lb)
Municipal waste treatment	$4.78-$105.67	$5.73-$10.78
Conservation tillage	$7.39	$1.59
Agricultural grass bufffers	$20.69	$1.03
Animal waste management/ runoff control	$30.55	$3.93

Figure 5. Nutrient reduction costs for Chesapeake Bay.

and tribes establish methods to account for uncertainties inherent in trading with nonpoint sources. These methods include monitoring to verify load reductions, the use of greater than 1:1 trading ratios between nonpoint and point sources (see the discussion of trading ratios later in this document), using demonstrated performance values or conservative assumptions in estimating the effectiveness of nonpoint source management practices, and retiring credits. Permitting authorities should be aware of such methods and incorporate them into permit requirements for point source–nonpoint source trades as appropriate. The nonpoint source trading scenario sections of this document include detailed discussions on using trading ratios to account for uncertainties in nonpoint source modeling, BMP effectiveness, and nonpoint source compliance.

There are a number of ways trading between point and nonpoint sources may occur. These include single point source–nonpoint source trades, multiple facility point source–nonpoint source trades, and multiple facility trades where credits are exchanged through a third party.

Single Point Source–Nonpoint Source Trades

Single point source–nonpoint source trades involve a trade agreement between a single point source and one or more nonpoint sources (see Figure 6). Under this type of trade, the nonpoint source(s) reduce(s) pollutant loads below the established baseline to generate credits, and these credits are purchased by the point source. Single point source–nonpoint source trades should be reflected in an individual permit for the point source that either references or incorporates the terms of the trade agreement.

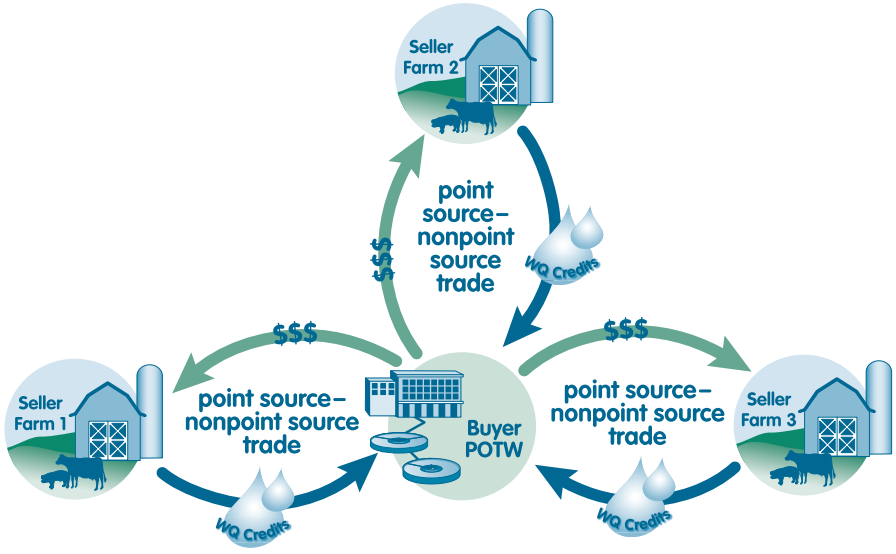

Figure 6. Point source–nonpoint source trade.

Southern Minnesota Beet Sugar Cooperative, Minnesota

The Southern Minnesota Beet Sugar Cooperative (SMBSC) wanted to build its own wastewater treatment plant; however, because of a WLA on the Lower Minnesota River, SMBSC had to completely offset its phosphorus discharge. To do so, SMBSC negotiated contracts with 256 of its member farmers to install BMPs (e.g., cover crops) to reduce their phosphorus loads.

Nonpoint Source Credit Exchange

In this scenario, a credit exchange program is established to buy credits from multiple nonpoint sources to sell to point sources (see Figure 7). A credit exchange could be managed by the state, a conservation district, a private entity, or another third party. A broker can be used to identify trading partners and facilitate trades. There are two general types of exchanges: (1) a broker-facilitated exchange where the broker brings parties together to trade directly with each other and (2) a central exchange where the point sources are not required to deal directly with nonpoint sources. For this second type of exchange, the credit sellers (nonpoint sources) generate pollutant load reductions using a variety of approved BMPs and sell the credits to the credit exchange. Point sources may then purchase credits from the credit exchange rather than directly from the nonpoint sources. This can save transaction costs for the point source purchasers and minimizes administrative burden for credit sellers. In addition, the credit exchange can perform various other functions such as establishing standards for trading, incorporating monitoring, determining the maximum feasible nonpoint source load reductions available to generate credits in the watershed, setting credit prices, determining eligibility of credits, ensuring that the buyer has a steady supply of credits by creating a reserve pool of credits, verifying the operation and maintenance of BMPs, and tracking important trade information for all participants. The credit exchange would likely have to be either operated by or approved and overseen by a state regulatory agency.

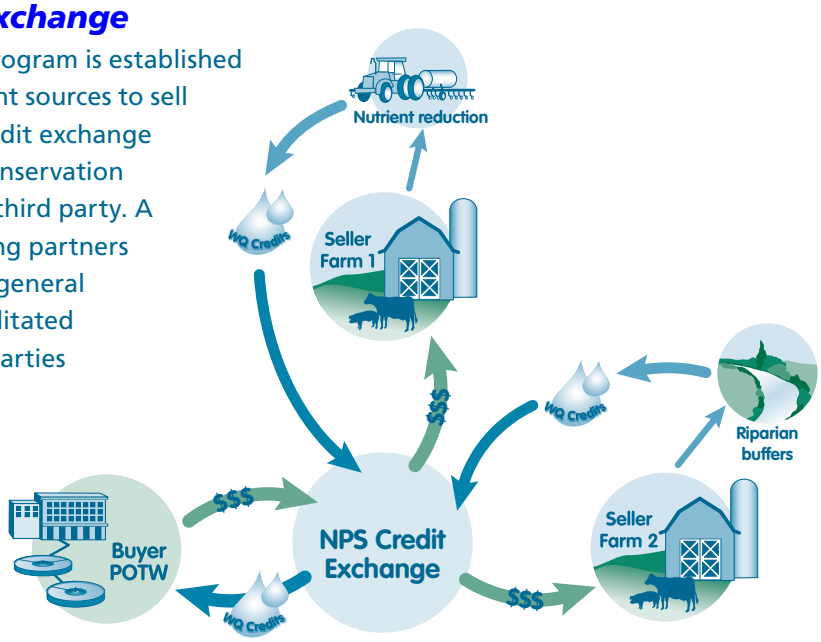

Figure 7. Nonpoint source credit exchange.

Red Cedar River, Wisconsin

The city of Cumberland participated in the Red Cedar River Nutrient Trading Pilot Program, which involves paying farmers in the Red Cedar watershed to install BMPs that reduce phosphorus loads. The Barren County Land Conservation Department facilitates the trades by negotiating with farmers and establishing contracts between the farmers and the city of Cumberland.

Under What Circumstances Does EPA Support Trading?

Trading is driven by regulation, motivated by economics, and governed by project-specific trading rules. The drivers for trading are typically new, more stringent WQBELs in NPDES permits derived from new or existing water quality criteria, a TMDL or the establishment of a pollutant cap. For trading to be economically viable, there must be other sources that can achieve excess reductions at lower cost than the permitted point source. Other factors, such as a stakeholder agreement to implement a trading program, may also play an important role.

Trading to Address Impaired Waters Under a Pollutant Loading Cap or TMDL

> *Trades and trading programs in impaired waters for which a TMDL has been approved or established by EPA should be consistent with the assumptions and requirements upon which the TMDL is established. EPA encourages the inclusion of specific trading provisions in the TMDL itself, in NPDES permits, in watershed plans and the continuing planning process (USEPA 2003).*

TMDL development or the establishment of a pollutant cap often serves as the driver for point sources to get involved in trading. Therefore, water quality trading provisions included in NPDES permits often will address impaired waters where a TMDL or similar pollutant loading cap has been established. In these cases, the baseline water quality requirement for a particular point source is specified by a WLA in the TMDL and expressed in the point source's NPDES permit as a WQBEL that is consistent with the WLA. A point source's required pollutant reduction is the difference between the discharger's current pollutant load and the load required to meet the WQBEL.

The facility could potentially have three options for complying with its WQBEL. One option is to implement pollution prevention, reuse, or recycling measures adequate to meet the WQBEL at the point of discharge. The second option is to install treatment technology. The third option is trading. Trading allows the facility to purchase the needed reductions from point or nonpoint source credit sellers in the watershed. The facility also could choose to implement some treatment or pollution reduction measure to partially reduce its discharge of the pollutant and purchase the remaining reductions through trading.

If a discharger installs a control technology that results in pollutant reductions greater than those required by the WQBEL, the discharger may potentially generate credits. The number of credits generated would be the difference between the discharger's WQBEL in its permit implementing the WLA and the pollutant load actually discharged after installing treatment processes or other pollutant reduction measures.

Trading to Address Impaired Waters Pre-TMDL

EPA's Trading Policy specifically states that "EPA supports pre-TMDL trading in impaired waters to achieve progress toward or the attainment of water quality standards. EPA believes this may be accomplished by individual trades that achieve a net reduction of the pollutant

traded or by watershed-scale trading programs that reduce loadings to a specified cap supported by baseline information on pollutant sources and loadings."

Trading is an option in impaired waters to reduce pollutant loads where a TMDL has not yet been established. A pre-TMDL trade must not cause or contribute to further impairments of the waterbody. CWA 301(b)(1)(C); 40 CFR 122.44(d)(1)(vii)(A). The Trading Policy presents two approaches for pre-TMDL trading depending on the scale of the trade. One approach is individual trades, which could be individual point source–point source trades or individual point source–nonpoint source trades. These sources may choose to trade to eliminate the need for a TMDL or to ameliorate conditions for a pending TMDL. An example of this type of trading is the Great Miami River Watershed Trading Pilot Program. Trades should result in a net reduction of the pollutant traded to ensure that further impairment to the waterbody is avoided. (For details of this program, see Appendix A.)

The other approach is where a pollutant loadings cap has been set for a waterbody at a watershed-scale through watershed-based permitting (e.g., Neuse River[7]) or a voluntary cap has been set on a downstream waterbody and a strategy has been developed to allocate reductions within the watershed (e.g., Chesapeake 2000 Bay Agreement and Tributary Strategies). A cap on total loadings can be derived from baseline information on pollutant sources and loadings that is consistent with water quality standards. Trades can occur to make progress toward or meet that cap.

To establish a target or loading cap below current conditions that represents progress in the attainment of water quality standards, it is necessary to quantify the current conditions. Current conditions would be the pollutant loads represented by current permit and regulatory requirements for point sources (i.e., the applicable effluent limitations or other quantified performance requirements) and the current level of pollutant loads from all nonpoint sources and background conditions. Once the total current pollutant load is quantified, EPA would support trading to achieve a target or cap representing a reduction in the overall pollutant load.

For discharges to impaired waters pre-TMDL, trading need not trigger the anti-backsliding provision of CWA section 402(o) or the limitations under CWA section 303(d)(4) even where the effect of the permit authorizing trading is to allow a greater actual discharge from the facility itself (because of the purchase of credits) than the previous permit issued to the trading point source. Allowing a facility to meet an established WQBEL through trading does not necessarily constitute a *less stringent* effluent limitation as specified in section 402(o) if the facility is still responsible for the same level of pollutant reduction. In that case, trading merely offers the discharger an additional means of achieving that limitation and must not result in a net increase in the pollutant discharged to the waterbody or in a localized impairment. Similarly, allowing a facility to meet a WQBEL through trading does not necessarily constitute a *revised* effluent limit under section 303(d)(4)(A) if a facility is still responsible for the same level of pollution reduction. All WQBELs, including those that are subject to CWA section 402(o), must meet the requirements of CWA section 301(b)(1)(C). Section 301(b)(1)(C)

[7] In 1999 a TMDL was completed for the Neuse River. The Neuse River Compliance Association was formed before this TMDL, and the cap that was incorporated into the TMDL was set by the state as part of its 1997 nutrient strategy for the Neuse River.

requires that the limitations be set at levels necessary to achieve water quality standards, which also includes avoiding localized impairments.

In the absence of a watershed-wide trading program to meet a specific target or pollutant loading cap, EPA supports individual pre-TMDL trades that achieve a net reduction in loadings of the pollutant traded and, thus, progress toward attainment of water quality standards.

Trading in Unimpaired Waters

Federal regulations (40 CFR 131.12) establish requirements for states and tribes to develop and adopt statewide antidegradation policies that, at a minimum, maintain and protect the level of water quality necessary to support existing uses and to protect high-quality waters including outstanding national resource waters. Where the level of water quality exceeds the level necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, federal regulations allow a state or tribe to authorize new or increased pollutant discharges to that water under two circumstances: (1) when the jurisdiction determines that the new or increased discharge would not lower water quality; or (2) when lower water quality will occur, but the jurisdiction finds that such lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located. In allowing lower water quality, a state or tribe must assure water quality adequate to fully protect existing uses and also assure achievement of the most stringent statutory and regulatory requirements for all new and existing point sources and all cost-effective and reasonable BMPs for nonpoint source control (40 CFR 131.12(a)(2)).

When drafting or interpreting their antidegradation policies, jurisdictions have the flexibility under current law to determine when a new or increased discharge lowers water quality. A jurisdiction can explicitly provide in its antidegradation policy that no lowering of water quality occurs within the meaning of 40 CFR131.12(a)(2) in the case of new or increased discharges when, as a result of a water quality trade, there is no net increase of the pollutant being discharged into the waterbody and the trade will not result in any localized impairments. EPA encourages jurisdictions to use trading in high-quality waters for the purpose of mitigating the effects of new or increased discharges that, without the trade, might lower water quality.

It is important to note that this guidance does not preclude a jurisdiction from requiring an antidegradation review under 40 CFR 131.12(a)(2) or from finding that a lowering of water quality would occur as a result of a proposed new or increased discharge. Nor is this guidance intended to mean that there necessarily would be a lowering of water quality if there is a net increase of pollutants. Rather, it simply identifies a trade-related situation where a jurisdiction could authorize a new or increased discharge without a review because the increased load would be compensated for through trading.

Intraplant and Intramunicipal Trading

One straightforward form of trading is intraplant trading, or trading between different outfalls within a plant. Intraplant trading can be accomplished within the context of a single NPDES permit and, thus, does not require the establishment of a formal trading program.

> *EPA supports intraplant trading that involves the generation and use of credits between multiple outfalls that discharge to the same receiving water from a single facility that has been issued an NPDES permit (USEPA 2003).*

A facility with multiple outfalls may receive a mass WLA of a particular pollutant through a TMDL, another watershed-level analysis, or calculation of individual effluent limitations. Typically a permitting authority would assign fixed, mass-based, effluent limitations to each outfall contributing the pollutant by apportioning the loading on the basis of the outfall's historical or design flow. By incorporating intraplant trading into the permit, the permitting authority could assign the overall mass loading limitation to the facility but allow the permit holder to manage the facility as a system, apportioning the loading among outfalls in a way that makes the most sense both technically and economically. The NPDES permit should still ensure that the overall mass loading requirement for the facility is reflected in the effluent limitations and that there is no potential for creating a localized exceedance of water quality standards.

Another form of trading that would not require establishing a formal trading program is intramunicipal trading. Similar to intraplant trading, intramunicipal trading allows a municipality to manage its multiple discharges as a system. The difference is that intramunicipal trading involves trading among multiple facilities or point sources owned by a single municipality that, traditionally, would be covered under separate individual NPDES permits. A permitting authority could assign a mass loading of a particular pollutant to the municipality as a whole (if appropriate) or to its individual discharges on the basis of a TMDL or other watershed-level analysis. An overall mass loading assigned to the municipality would be appropriate only where localized impacts would not be expected from each of the municipality's individual discharges. The municipality could apportion the overall allocation among its facilities to meet the overall mass limitation. Where its discharges received individual allocations, it still could trade among sources to allow them to meet those individual allocations. This type of trading may be more complex than intraplant trading because trade ratios for the different discharges may have to be established to address differences in their locations. Also, the intramunicipal trading would have to be incorporated into NPDES permits by either developing individual permits with coordinated requirements or developing an integrated municipal permit. Where facilities are assigned individual allocations, a facility would have to perform better than its WQBEL to generate credits. Any facility accepting credits would have to first meet any applicable TBELs and ensure that its discharge would not create a localized exceedance of water quality standards. This requirement could be implemented through a limit on the number of credits the facility may accept.

New sources and new dischargers, including those involved in intramunicipal trading must meet the requirements of 40 CFR 122.4(i), which states that

> *No permit may be issued to a new source or a new discharger, if the discharge from its construction or operation will cause or contribute to the violation of water quality standards. The owner or operator of a new source or new discharger proposing to discharge into a water segment which does not meet applicable water quality standards or is not expected to meet those standards even after the application of the effluent limitations required by sections 301(b)(1)(A) and*

> *301(b)(1)(B) of CWA, and for which the State or interstate agency has performed a pollutants load allocation for the pollutant to be discharged must demonstrate, before the close of the public comment period, that:*
>
> > *(1) There are sufficient remaining pollutant load allocations to allow for the discharge; and*
> >
> > *(2) The existing dischargers into that segment are subject to compliance schedules designed to bring the segment into compliance with applicable water quality standards. The Director may waive the submission of information by the new source or new discharger required by paragraph (i) of this section if the Director determines that the Director already has adequate information to evaluate the request.*

EPA interprets 40 CFR 122.4(i) to allow for a new source or new discharger to compensate for its entire increased load through trading. In the case of intramunicipal trading, new sources or dischargers operated by a municipality may discharge to an impaired water if their discharge does not cause the municipality to exceed its overall cap for the pollutant(s) of concern.

Clean Water Services, Oregon

Trading of oxygen-demanding parameters is permitted between two wastewater treatment plants operated by Clean Water Services, a public utility in the Tualatin River Basin responsible for wastewater and stormwater management. These facilities are covered under a general permit that specifically authorizes the Durham and Rock Creek Advanced Wastewater Treatment Facilities to trade $CBOD_5$ and ammonia.

Trading Involving Wet Weather Point Sources

Several classes of wet weather point sources, including combined sewer overflows (CSOs), discharges from municipal separate storm sewer systems (MS4), and stormwater discharges from industrial activities, are regulated under the NPDES program and could provide opportunities for trading. The general framework for trading involving point sources[8] is applicable to wet weather point sources, with some additional considerations to account for the nature of the wet weather point sources and their permits. First, wet weather point sources cannot trade to meet their TBELs. EPA has not established effluent limitations guidelines for CSOs, MS4s or most types of stormwater discharges associated with industrial activities; however, the CWA provides technology-based standards for the different classes of wet weather point sources. For CSOs and stormwater discharges from industrial activities, the technology-based standard is Best Available Technology Economically Achievable/Best Conventional Pollutant Control Technology. For MS4s, the technology-based standard is Maximum Extent Practicable (MEP). Therefore, in the absence of effluent limitations guidelines, a permit writer must use the CWA's technology-based standard to establish TBELs on a permit-by-permit basis using the permit writers' best professional judgment (BPJ).

[8] For more information about the general framework for trading involving point sources, see the discussion *What Discharge Limits Apply in Water Quality Trading?* in this document.

EPA supports trading involving wet weather point sources where it can be shown to have a water quality benefit. However, to ensure water quality improvement, the following conditions are generally necessary for trading involving wet weather point sources to occur:

A Wet Weather Point Source as a Seller:

- The seller meets its most stringent effluent limitation (baseline), which is either its TBEL or WQBEL. Reductions in excess of the most stringent effluent limitation are eligible to be sold as credits.
- The seller's permit or fact sheet includes numeric effluent limitations or allowable loads. The fact sheet for the seller's permit clearly describes the value of the trade in terms of a numeric pollutant load and clearly demonstrates that water quality objectives will be achieved after all trades have been made.
- The permit requires discharge monitoring to verify that all discharges involved in the trade are performing consistent with expectations of the trade.
- No credit can be generated without an actual reduction in pollutants. An existing discharge that is either uncontrolled or has existing controls with concentrations/loads that do not *meet water quality standards* would not be able to generate credits without achieving additional reductions.

A Wet Weather Source as a Buyer:

- The buyer's permit or fact sheet identifies numeric effluent limitations or allowable loads to be achieved to meet the technology-based standard (minimum control level).
- The permit or fact sheet identifies the actual controls that the buyer must implement to meet its minimum control level.
- Credits are purchased to meet the buyer's baseline (WQBEL).
- Discharge monitoring data is available in advance of the trade to verify that the control measures for the wet weather sources are capable of meeting minimum control levels. After the trade, discharge monitoring data is able to ensure the goals of the trade are being met.

Credits are generated only by actual reductions of pollutants in discharges. Credits should not be for nondirect or indirect water quality-based measures such as educational programs, public outreach, and so on, unless these practices are translated into quantified load reductions.

Lake Lewisville, Texas

The city of Denton, Texas, draws its drinking water from and discharges its wastewater to Lake Lewisville. Lake Lewisville is also used for recreation. It is in the interest of the city of Denton to improve and maintain the quality of water in Lake Lewisville. Thus, Denton has implemented an aggressive water quality improvement program. More than 70 monitoring sites have been installed in the three watersheds that encompass the city. The city has monitored a variety of parameters monthly. This data plus extensive modeling has provided Denton with excellent data to assess the condition of its water as well as make future projections on the basis of expected growth. Denton is a stormwater phase II city and has gone well beyond the six minimum measures required by the stormwater phase II regulations. The city is investigating water quality trading as an option for developers as the city requires any sediment or nutrient loadings coming from development to be compensated for through other reductions. Because the city has extensive monitoring and modeling of the water quality in the three watersheds, it will have the data to set the baseline for trading at pre-development conditions.

Using Flow as the Trading Parameter

State and local regulations that regulate stormwater flow may create a market for wet weather trading outside of the NPDES program. For example, state or local ordinances could require offsets for wet weather flow and thus create a market for trading flow across all wet weather sources to meet these requirements.

Portland, Oregon

The city of Portland, Oregon, is evaluating the viability of a stormwater trading program. An approach under evaluation would allow redevelopers to buy credits for flow reductions required for their site from other parties, for example from the city, which would install *green streets*. This trade may be viable where the permitting authority determined that the installation of green streets represented technology over and above what was determined to meet the MEP standard of the NPDES program. The first phase of the study will determine if the approach is economically beneficial and if the program can provide acceptable environmental results. If the trading approach is determined to be feasible, later phases of the study will outline the model approach, determine the geographic trading area, select appropriate BMPs, and develop economic models for program valuation. In later phases, the city also plans to demonstrate the operation of the trading system by implementing a pilot program.

Vermont

The state of Vermont is also developing an approach under which a form of trading could be used to meet flow restrictions. This approach would identify site-specific stormwater/hydrologic indicators for use as surrogate TMDL targets. The approach provides a tailored estimation of target stormwater runoff volumes and stream characteristics using reference watersheds that represent the stream channel conditions and pollutant loadings necessary to support aquatic life. In addition to providing a tailored target for TMDLs, this site-specific approach will also generate information to support the development of stormwater permit limits on a watershed-basis. These limits could then serve as a baseline for trading.

For the interim period before TMDL adoption, Vermont's 2005 rules for stormwater discharges to impaired waters (Vermont Environmental Protection Rules, Chapter 22) specify that new development in impaired waters must cause no net increase in sediment loading or hydrologic impact (VTDEC 2005). To achieve this standard, the rules allow for one of the following: (1) the development of projects that offset the new discharges within the same watershed; (2) payment of a stormwater impact fee to the state to obtain the necessary *offset charge capacity*[9] (the fee is based on amount of impervious cover created and is used to purchase the comparable amount of impervious cover removed—or the discharge equivalent) from a stand-alone *offset project* within the watershed; or (3) a combination of options 1 and 2. To determine the size of the offset project or the amount of offset charge capacity needed, the applicant must calculate the increase in impervious cover and sediment loading or hydrologic impact expected to result from the project following stormwater BMP implementation. The no-net-increase provision of the Vermont rules is consistent with 40 CFR 122.4(i) for new discharges to impaired waters.

[9] *Offset Charge Capacity* is defined in Vermont's 2005 Stormwater Rules as "the amount of reduction in sediment load or hydrologic impact that an offset project generates" (VTDEC, 2005).

Pretreatment Trading

> *EPA supports a municipality or regional sewerage authority developing and implementing trading programs among industrial users that are consistent with the pretreatment regulatory requirements at 40 CFR Part 403 and the municipality's or authority's NPDES permit (USEPA 2003).*

Pretreatment trading gives a municipality the flexibility to allow trading among industrial users to meet its maximum allowable load as an alternative to allocating the load among users directly. Under this trading scenario, the effluent limitations for the permitted wastewater treatment facility would not change. The trading program itself can be established and administered by the POTW that has responsibility for administering the pretreatment program. The permitting authority need not incorporate the details of individual trades into the wastewater treatment facility's permit; however, the permit should acknowledge that the permittee has or will establish a pretreatment trading program to facilitate and supervise trading among industrial users to meet the effluent limitations established in the permit. In addition, before including pretreatment trading in a NPDES permit, the permitting authority should confirm that pretreatment trading is permissible under municipal sewer use ordinances establishing local limits and other local requirements. In addition, indirect industrial users cannot trade to meet categorical effluent discharge limits based on federal pretreatment standards because these are technology-based standards or other national pretreatment standards (e.g., general and specific prohibitions at 40 CFR 403.5). There are no categorical pretreatment standards that specifically allow for trading. For more on pretreatment trading, see *Sharing the Load: Effluent Trading for Indirect Dischargers*.

Passaic Valley Sewerage Commissioners, New Jersey

Indirect dischargers to the POTW may participate in trading to meet uniform local pretreatment limits.

Some Trading Scenarios Are Not Supported

EPA's Trading Policy does not support trading to meet TBELs. The intent of a TBEL is to require a minimum performance level for point sources based on currently available treatment technologies. EPA expects all dischargers within a particular industrial category to achieve the defined basic level of pollutant control and does not support the use of water quality trading to meet technology standards. The only time trading is supported by EPA to meet TBELs is when federal regulations expressly authorize trading. For example, existing technology-based effluent guidelines for the iron and steel industry allow intraplant trading of conventional, nonconventional, and toxic pollutants between outfalls under certain circumstances. The Trading Policy does state that the Agency will consider including provisions for trading in the development of new and revised TBEL guidelines and other similar regulations. Unless such effluent guidelines have been promulgated, permitting authorities should not include trading provisions into a permit designed to achieve compliance with TBELs.

> *EPA does not support any use of credits or trading activity that would cause an impairment of existing or designated uses, adversely affect water quality at an intake for drinking water supply or that would exceed a cap established under a TMDL (USEPA 2003).*

NPDES permits must not incorporate trades that would cause impairment of a designated use (CWA 301(b)(1)(C); 40 CFR 122.44(d)(1)(vii)(A)). This restriction includes localized exceedances of water quality standards caused by increased pollutant loads from a credit purchaser.

Also, NPDES permits should not incorporate trades that would adversely affect drinking water systems by creating the need to increase the level of drinking water treatment over what was needed before the trade or by causing a water supplier to exceed regulatory standards established under the Safe Drinking Water Act.

What Are Some Factors Involved in Determining a Reduction Credit?

As stated earlier, EPA's *Water Quality Trading Assessment Handbook* notes that, in water quality trading markets, the marketable product is the over control of pollutant loadings. A pollutant reduction credit is a measured or estimated unit of pollutant reduction per unit of time at the discharge location of the buyer or user of the credit.[10] A seller generates excess load reductions by controlling its discharge beyond what is needed to meet its baseline. A buyer compensates a seller for creating the excess load reductions, which are then converted into credits by using trade ratios. Where appropriate, the buyer can use the credits to meet a regulatory obligation. To determine when a pollutant reduction credit has been generated, a regulatory authority will need to develop procedures for determining baselines for credit generation, trading ratios, timing of credit generation, and the duration of credits. These issues are summarized in the checklist in Appendix E and are explained in the following sections.

What Discharge Limits Apply in Water Quality Trading?

Trading participants should have an understanding of three types of discharge limits: baselines, minimum control levels, and trading limits (see Figure 8). Baselines apply to both a buyer and a seller. Minimum control levels are relevant only to the buyer and trading limits are relevant only to the seller. Each limit should be contained in the trade agreement.

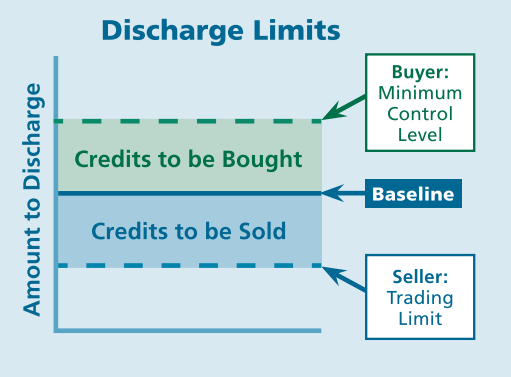

Figure 8. Point source discharge limits.

Baselines

The baselines for water quality trading are the NPDES permit limits (for point sources) or BMPs (for nonpoint sources) that would apply in the absence of trading. These baselines will vary depending on the sources involved and the specific circumstances under which trading will occur.

[10] It is important to note that, because of trade ratios, one pound of pollutant reduced at the seller's discharge location is not necessarily equal to one pound of pollutant reduced at the buyer's location. Therefore, for the purposes of this Toolkit, one credit will be equal to one unit of load reduction per time (lb/day) at the location of the buyer. One credit may be greater or less than one unit of load reduction per time at the location of the seller. Different programs may define credit differently.

Point Source Seller

The baseline for a point source seller is its most stringent effluent limitation. A point source seller generates credits when it reduces its discharge below its baseline.

Point Source Buyer

Because a buyer cannot buy credits to meet its TBEL, a point source would buy credits only if its WQBEL is more stringent than its TBEL. Therefore, the baseline for a point source buyer would be its WQBEL. WQBELs are developed to meet state water quality standards.

Nonpoint Source Seller

For a nonpoint source seller in a watershed under a TMDL, the source's baseline would be derived from the nonpoint source's LA. In the absence of a TMDL, EPA's Trading Policy states that state and local requirements and/or existing practices should determine a nonpoint source's baseline (see Figure 9). The trading program provisions could also specify some additional minimum level of control that nonpoint sources would have to achieve before they could generate credits. The baseline level of control should never be less than existing practice.

A more in-depth discussion of establishing a baseline for nonpoint sources is provided in the nonpoint source trading scenario sections of the Toolkit.

Nonpoint Source Seller Baseline for Trading

NPS Seller With TMDL	NPS Seller Without TMDL
Load allocation	State and local requirements and/or existing practice

Figure 9. Nonpoint source seller baseline for trading.

Minimum Control Levels

A discharger that chooses trading to meet its baseline can buy credits; however, the discharger would still be expected to meet a minimum control level at the point of discharge (see Figure 8). The minimum control levels are either the TBELs specified in a permit or the current discharge levels, depending on which are more stringent. TBELs are derived from secondary treatment standards for POTWs and effluent guidelines or BPJ for industries (see Figure 10). After a discharger meets its minimum control level through treatment, it can buy credits to meet its baseline.

A permitting authority can choose to impose a more stringent minimum control level than the TBEL or current discharge to prevent localized exceedances of water quality standards near the point of discharge but not one that is less stringent the TBEL. For a more detailed discussion of how these minimum control levels are incorporated into a permit, see the discussion in the trading scenario sections.

Point Source Buyer Minimum Control Level

POTW Buyer	Industrial Buyer
Secondary Treatment *	TBEL *

* Must be stringent enough to avoid localized exceedences of water quality standards

Figure 10. Point source buyer minimum control level.

Trading Limits

To become a seller, a discharger would control its pollutant discharge beyond its baseline. The seller can choose to what level it will control its pollutant discharge (based on the technology or BMPs it will implement) and this level becomes its trading limit (see Figure 8). If the seller does not meet its trading limit, it could violate its trade agreement, and the buyer could be out of compliance with its permit. The number of credits generated could be calculated by taking the difference between the seller's baseline and its trading limit and multiplying that difference by the applicable trading ratio.

Developing Trade Ratios

In many cases, pollutant credits are not generated on a "one pollutant pound-to-one pollutant credit" basis. Rather, some type of a trading ratio is used to either discount or normalize the value of pollutant credits. For example, a trading program with a trading ratio of 4:1 would require a buyer to purchase 4 pounds of nitrogen reduction to achieve a credit worth one pound of nitrogen reduction from its facility. There is no set limit for how high a trading ratio can be.

Trading ratios depend on the specific circumstances in the watershed. Factors that drive the use of trading ratios might relate to environmental conditions, pollutants, or programmatic goals. Although existing trading programs use various types of trading ratios and different terms to describe them, *the basic categories of trading ratios are delivery, location, equivalency, retirement, and uncertainty.*[11]

Delivery or location ratios are calculated as part of the overall trading ratio for a particular pair of sources to account for pollutant attenuation because of the fate and transport characteristics of a pollutant, the unique characteristics of the watershed (e.g., hydrology, vegetation), distance, and time. This type of ratio accounts for the fact that a pound of a pollutant discharged upstream will not arrive as a pound of a pollutant at a given point downstream.

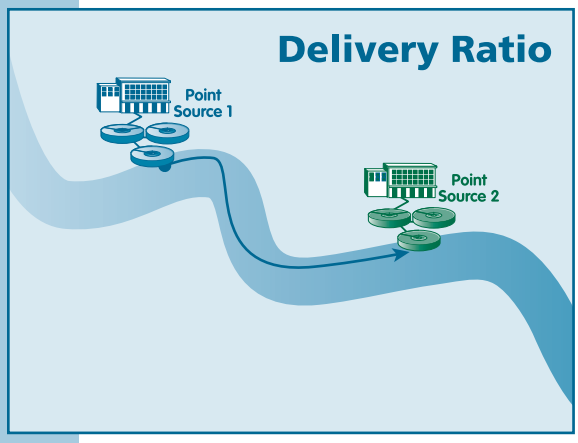

Figure 11. Delivery ratio.

- **Delivery ratios** are used when sources are directly discharging to the waterbody of concern. These ratios account for the distance and unique watershed features (e.g., hydrologic conditions) that will affect pollutant fate and transport between trading partners (see Figure 11). For example, an upstream point source is interested in trading with another point source that is several miles downstream. Because of the distance between the two dischargers, modeling shows that a 5:1 delivery ratio should be applied to trades between the two sources. This means that the downstream point source would need to purchase 5 pounds of pollutant credits to achieve the equivalent of one pound of pollutant reduction at its own discharge point. Sources that are closer in proximity with less intervening hydrological features are likely to have a lower delivery ratio.

[11] It is important to note that trading programs are likely to use a variety of names for trading ratios and the categories described are generalized for simplicity.

- **Location ratios** are used when sources are upstream of the waterbody of concern. These ratios account for the distance and unique watershed features between a pollutant source and the downstream waterbody (e.g., bay, estuary, lake, reservoir) that the trading program is trying to address (e.g., a hypoxic zone in a waterbody). The location ratio allows credits to be traded between unique sources by converting their loadings or reductions into credits needed or available at the waterbody of concern. Each source has a unique location ratio that reflects a source's relative impact of pollutant loading or reduction on the waterbody of concern. There will likely be differences in the water quality impacts of a discharge of a pound of a pollutant near the area or waterbody of concern versus a pound of pollutant discharged farther upstream. Using Figure 12 to illustrate, sources in closer proximity to the downstream waterbody of concern will have lower location ratios than sources farther upstream. The lower location ratio indicates that the mass of a pollutant load (e.g., one pound of nitrogen) from a source nearer the waterbody of concern has a greater impact on the waterbody. If the two sources in Figure 12 wanted to trade, the location ratios of both sources would have to be figured into the trading ratio between the sources. For example, suppose the location ratio of the point source were 2:1 and the location ratio of the nonpoint source were 3:1. Then the trading ratio for the two sources would include a location component of 3:2. Note that while in this example consideration of location ratios leads to a > 1:1 trading ratio, this is not necessarily always the case. If the seller were closer to the waterbody of concern than the buyer, this could lead to a trading ratio of < 1:1.

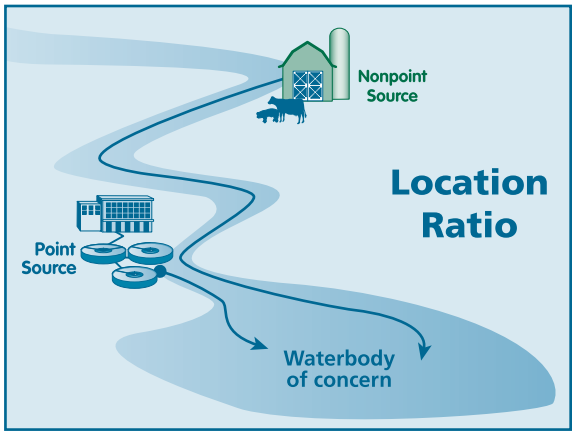

Figure 12. Location ratio.

Equivalency ratios adjust for trading different forms of the same pollutant. One pollutant can exist in different forms. While two sources may discharge the same pollutant, the composition of their discharges may differ with respect to the forms of the pollutant. Pollutants from different sources can be traded if they have the same effect on the waterbody of concern or if their effects can be related by some factor. This factor is known as an equivalency ratio. To calculate this ratio, the water quality impacts from each pollutant source need to be estimated. For nutrients, the effect on water quality is related to the percent of the nutrient that is biologically available in the source's discharge. Biologically available nutrients are readily available for uptake by the biota. Nutrients can be present in forms that are immediately biologically available and in forms that are less accessible to the biota. Excess biologically available nutrients contribute to eutrophication and degradation of water quality. Those forms of nutrients that are not immediately biologically available can become accessible to the biota (biologically available) through different biological and chemical cycling mechanisms. Hence, nutrients can be present as readily biologically available or bound to sediment, and depending on environmental factors, such as climate, apparent

geology, residence time, and so on, have different effects on the waterbody of concern. The relative biological availability of nutrients in the trading sources' discharges should be incorporated into the equivalency ratio. For example, consider a point and nonpoint source trading phosphorous. Generally, a point source's discharge will have a higher proportion of biologically available phosphorous than a nonpoint source's discharge. While some of the nonpoint source's bound phosphorous will convert into biologically available phosphorous, it will generally still have a lower percentage of biologically available phosphorous than the point source during the time frame the point source must account for the reductions. It is important that the buyer offset its load with reductions that will have similar impacts on the waterbody at the time the offset is needed. The number of pounds of the nonpoint source's reduction that the point source will have to buy to have a similar impact on the biota in the waterbody is the equivalency ratio.

An equivalency ratio can also be used in cross-pollutant trading. While the general idea that the water quality effects of the two pollutants should be equivalent or related by a factor still holds, determination of the ratio may involve a more detailed study for cross-pollutant trading than for single-pollutant trading. As with consideration of location ratios, consideration of equivalency ratios may lead to either a greater or less than 1:1 trading ratio.

Uncertainty ratios account for multiple types of uncertainty that normally occur in point source–nonpoint source trades. Most point source–point source trades should not require an uncertainty ratio because measurement is relatively straightforward and both sources are required to perform discharge monitoring in accordance with the terms of their permits. However, challenges exist in accurately measuring nonpoint source credit generation because of complexities and cost associated with assessing and monitoring of pollutant load reductions from BMPs (see Figure 13). Measurement uncertainty addresses the level of confidence in the field testing of a nonpoint source BMP. Implementation uncertainty is also accounted for in this type of ratio, addressing the level of confidence that a nonpoint source BMP is properly designed, installed, maintained, and operated (Moffett 2005). Together, these factors contribute to performance uncertainty (the risk of a BMP failing to produce the expected results). All trading programs involving nonpoint sources should address nonpoint source BMP performance uncertainty through ratios, use of conservative assumptions in calculating credits, or some other approach. Where uncertainty ratios are used, they will generally be greater than 1:1, because there is greater uncertainty associated with nonpoint sources (sellers) than with point sources (buyers). The method of reducing the uncertainty ratio is typically to improve the certainty of nonpoint source load reductions though monitoring, modeling, and estimating effectiveness.

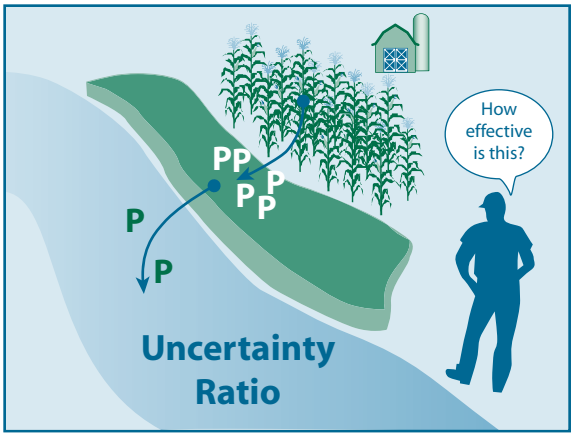

Figure 13. Uncertainty ratio.

Retirement ratios can be applied if a goal of the trading program is to accelerate achievement of water quality standards. These ratios *retire* a percentage of all credits generated, and these credits cannot be sold. Therefore, the overall loading to the waterbody is reduced with each trade that yields net water quality improvement. This form of ratio can be particularly useful in impaired waterbodies for which a TMDL has not yet been developed because the exact reductions required of individual sources to achieve water quality standards might not yet be known. For waterbodies where a TMDL has already been established, if each source meets its LA or WLA, either through adopting control technologies or through credit purchases, this should be sufficient to attain water quality standards. Where retirement ratios are used, they should always be greater than 1:1 because their purpose is to accelerate water quality improvements.

The trading ratio established for a particular trade might include one or more of these ratios depending on the scenario. Some of these ratios might be uniform for an entire trading program, while others might be specific to particular pairs of trading sources. EPA recommends that trading programs be as specific as possible about which underlying ratios are to be used and exactly how they are to be calculated when developing a trading ratio for a group of sources. The trading program design may also allow for adjustments to the trading ratios should uncertainties be greater or less than expected, means of control more or less effective, or if changes in watershed conditions occur. Being clear about how trading ratios are calculated will also foster transparency and public acceptance of the program.

Long Island Sound, Connecticut

The Connecticut Department of Environmental Protection (CTDEP) gained information on nitrogen attenuation factors in Long Island Sound and during riverine transport by using the LIS 3.0 Model and U.S. Geological Survey monitoring data for major tributaries. Attenuation factors were developed into location ratios, which are important for quantifying relationships between discharge points and actual delivery of nitrogen to Long Island Sound. These ratios combine to account for relative nitrogen impact on dissolved oxygen depletion in Long Island Sound from geographically distributed sources. They are used as trading ratios to put the 79 POTWs involved in trading on an equal basis, which is a critical component of the Nitrogen Credit Exchange. To calculate the overall trade ratios, CTDEP multiplied the river location ratios for a tier within a particular management zone by the Long Island Sound transport efficiency from Connecticut's six management zones once the nitrogen reached the edge of the sound. Figure 14 illustrates the combined trading ratios for the management zones. CTDEP expresses the ratios as the decimal fraction of the nitrogen load delivered. CTDEP made the assumption that the tiers closest to the Long Island Sound have no nitrogen attenuation (i.e., they deliver 100 percent of the nitrogen load) and assigned the value of 1 as the ratio.

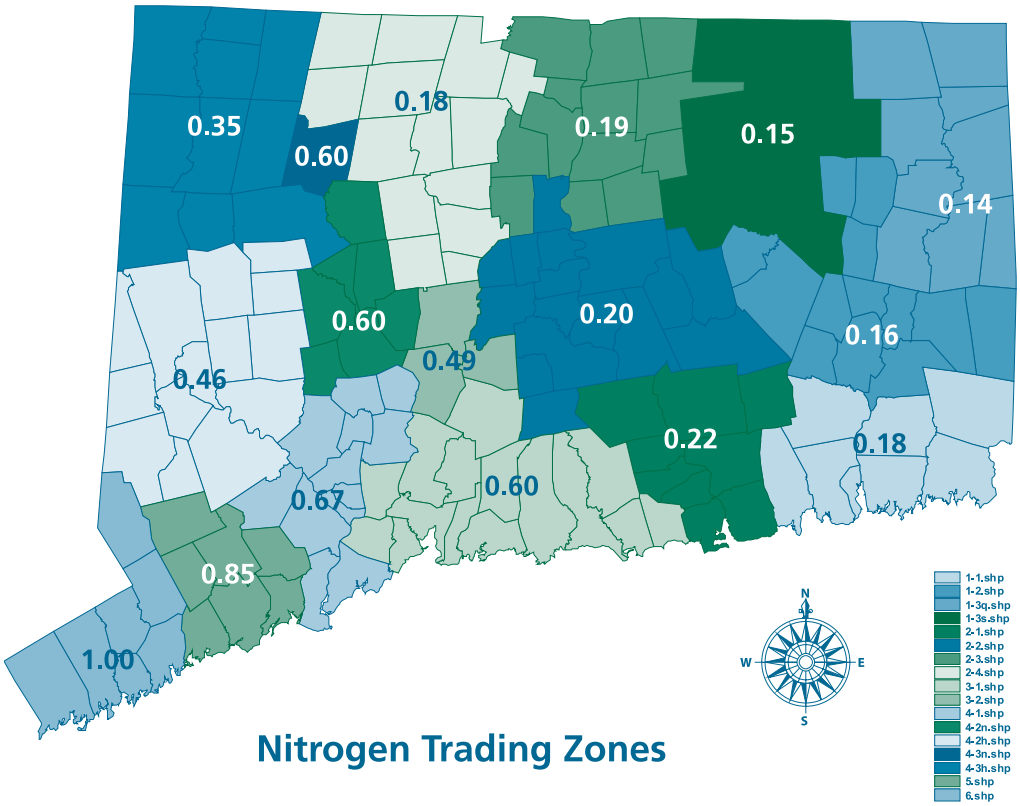

Figure 14. Long Island Sound, Connecticut, nitrogen planning zones.

Timing of Credit Generation and the Duration of Credits

The timing of credit generation and the duration of credits is tied to the credit reconciliation period. A credit reconciliation period is the period of time during which a seller generates water quality credits and a buyer may use those credits to offset a pollutant load that it discharges during that same period of time. Permitting authorities should be aware of how the trading program defines a reconciliation period through both the timing of credit generation and the duration of credits.

Timing of Credit Generation

The timing of trades is critical. A basic premise of water quality trading is that credits should not be used before the time frame in which they are generated. In general, a permitting authority should not allow for a pollutant reduction credit in a NPDES permit on the basis of the *proposed* treatment by another point source or an *unverified* commitment to install a BMP by a nonpoint source and their anticipated pollutant reduction.

Even after a practice is in place to achieve a reduction, the regulatory authority would need to decide at what point a credit is actually available to be used in a trade. For example, if point source requirements are based on a total annual load, the permitting authority might determine that credits from a point source that is *over controlling* its discharge would not be

available until the discharger has installed controls and has one year of monitoring data to demonstrate total annual loadings and reductions. This could be appropriate if there were uncertainty regarding the total amount of credits that would be generated, although this could also be addressed through an uncertainty ratio, which might be relaxed after the first year's worth of monitoring data were available. Credits that are based on shorter time periods may also require a period of time to demonstrate reductions or provide an understanding of how loadings and reductions may vary over time. Also, credits generated by nonpoint sources through installation of BMPs may not be available immediately because of a time lag between installation of the BMP and its effectiveness in reducing loadings or otherwise improving water quality. In some cases, the credit generation could be prorated on the basis of the pollutant reduction the BMP is achieving during the current reconciliation period, even where the BMP has not reached its maximum expected pollutant reduction efficiency. This could be reflected in the trading ratio. The decisions as to when credits are available for use may have already been made in the program design. The permitting authority should be aware of these decisions.

Also, as noted previously, EPA's *Water Quality Trading Assessment Handbook* indicates that trades should be consistent with the time periods that are used to determine compliance with effluent limitations. For example, a point source that has effluent limitations with monthly averaging periods should trade with sources that can generate credits on a monthly basis, and credits should be created in the same month they are expected to be used (e.g., a credit created in August 2006 should be used to compensate only for a discharge in August 2006). The permitting authority may have discretion to determine the appropriate averaging period for WQBELs, depending on the pollutants of concern and other watershed specific factors (see below).

Expiration of Credits

The permitting authority should decide whether and when a credit expires. Point sources generating credits should be able to continue to do so as long as they properly operate and maintain the appropriate controls and are able to demonstrate reductions below WQBELs. Credits generated by nonpoint sources, on the other hand, may decrease or expire if the BMP installed to generate the credit gradually becomes less effective over time and is not maintained or replaced.

Also, because of temperature differentials, there may be seasonal fluctuation in the amount of credits generated by either a point source or a nonpoint source and the amount of credits needed by a point source, particularly for pollutants such as nutrients. In many parts of the country, for point sources, nitrogen removal is much more effective in the summer than in the winter because of increased biological activity. Therefore, a point source might need more credits (or only need credits) to compensate for discharges in the wintertime. For nonpoint sources, the effectiveness of some land management BMPs fluctuates seasonally as well. Because it might be difficult to coordinate the timing of nutrient discharges, some permitting authorities have considered using annual mass-based discharge limits for nutrients, which facilitates trading these pollutants. Annual limits are appropriate only in certain circumstances (see discussion below, *Effluent Limits with Longer-Term (e.g., Annual) Compliance Periods*).

Often, point sources interested in purchasing credits express a desire to enter into contracts that include long-term commitments from sources generating credits to ensure the future availability of credits needed to compensate for their pollutant loads. Where possible, trading programs should attempt to identify credit generators that are willing and able to reliably generate credits over an extended period of time (e.g., 5 to 10 years) to reduce the risk and uncertainty of trading for permitted point sources.

In all cases, permitting authorities should ensure that NPDES permits incorporating water quality trading provide for periodic evaluation of pollutant reduction credits to ensure that the credits are still available and consistent with established trading program rules.

Determining Maximum Feasible Nonpoint Source Load Reductions

It is not feasible for a nonpoint source to control 100 percent of its pollutant runoff to a waterbody. Therefore, it is important that some analysis be done to estimate the maximum amount of pollutant runoff that can be controlled from the nonpoint sources in a watershed. The difference between this estimate and the nonpoint source's baseline equals the maximum nonpoint source load reductions available for trading.[12] This is a way to ensure that credits being purchased result in actual reductions. This increases the surety that the trading program can meet its goal of achieving water quality standards.

The trading program might want to include a mechanism for ensuring that this maximum tradable nonpoint source load reductions is not exceeded. This could be done, for example, by specifying the maximum tradable nonpoint source load reductions in the program documentation and then tracking credit sales, and therefore load reductions, by nonpoint sources to ensure that this maximum is not exceeded.

A more in-depth discussion of determining the maximum feasible nonpoint source load reductions is provided in the nonpoint source scenario sections of the Toolkit.

What Types of Effluent Limitations Could Be Met Through Trading?

In general, WQBELs for nutrients, sediments and other parameters that do not have localized toxic effects are amenable to control via a trading system. WQBELs are most commonly expressed as maximum daily limits and average monthly limits (AMLs). EPA's *Water Quality Trading Assessment Handbook* notes that trades should be consistent with the time periods that are used to determine compliance with effluent limitations. Trading to meet monthly average limits is more manageable for phosphorous and sediments than for nitrogen. Facilities trading phosphorous or sediments would potentially conduct only 12 trades during the

[12] The maximum tradable nonpoint source load reduction is not equal to the maximum number of credits available for trading in a watershed because of the impact of trading ratios. Because trading ratios can vary depending on many factors (as described in the *Developing Trade Ratios* section), determining the maximum number of credits is not as useful as determining the maximum tradable nonpoint source load reduction for the purpose of ensuring that every trade results in a reduction of total load to the waterbody.

course of the year. At the end of each month, each buyer and each seller would account for credits bought and sold through credit tracking and certification. For facilities trading nitrogen, the permitting authority might want to consider setting annual limits due to the seasonal fluctuation in treatment effectiveness.

Effluent Limits With Longer-Term (e.g., Annual) Compliance Periods

The NPDES regulations at 40 CFR 122.45(d) require that all effluent limits be expressed, *unless impracticable*, as both AMLs and maximum daily limits (MDLs) for all dischargers other than POTWs, and as average weekly limits (AWLs) and AMLs for POTWs. EPA has identified some circumstances where limits expressed with these averaging periods are impracticable.

For nutrients, the concern generally is whether it is appropriate to establish effluent limitations with longer, rather than shorter, averaging periods. This issue is particularly important when considering trading, because nutrients are a frequent subject of trading programs. Permitting authorities have some discretion on the use of nutrient effluent limitations with longer averaging periods. EPA indicated its support for using annual limits, rather than MDLs, AWLs, and AMLs, to meet criteria for nutrients in the Chesapeake Bay and its tidal tributaries in a memorandum from James Hanlon, Director of the EPA Office of Wastewater Management to EPA Region 3 and the Chesapeake Bay Program Office, dated March 3, 2004 (*Annual Permit Limits for Nitrogen and Phosphorus for Permits Designed to Protect Chesapeake Bay and its tidal tributaries from Excess Nutrient Loading under the National Pollutant Discharge Elimination System*). In this memorandum, EPA affirmed that it is impracticable to express permit effluent limits for nitrogen and phosphorus discharges in the Bay watershed on the basis of nutrient criteria for the Chesapeake Bay and its tidal tributaries in terms of monthly average, weekly average, or maximum daily limitations because of a number of factors, such as (1) the long residence time for nutrient loadings to the Chesapeake Bay and its tidal tributaries, (2) the focus on the far-field effects of such nutrients (rather than in the immediate vicinity of the discharge), and (3) the need to reduce average pollutant loads globally rather than maximum loads from any one source.[13]

The circumstances in the Chesapeake Bay that make annual limits appropriate are not necessarily unique. For other areas of the country, the memorandum states that "The establishment of an annual limit with a similar finding of 'impracticability' pursuant to 40 CFR 122.45(d) may be appropriate for the implementation of nutrient criteria in other watersheds when: attainment of the criteria is dependent on long-term average loadings rather than short-term maximum loadings; the circumstances match those [in the Chesapeake Bay and its tidal tributaries]; annual limits are technically supportable with robust data and modeling… and appropriate safeguards to protect applicable water quality standards are employed." Annual effluent limitations should be used only in these limited circumstances. Other than

[13] The applicable water quality criteria for the Chesapeake Bay are expressed as an annual average, so the underlying analysis of the memo is also applicable to implementation of other nutrient criteria where attainment of the criteria is dependent on long-term average loadings rather than short-term maximum loadings. Examples of such criteria include EPA's recommended CWA section 304(a) ecoregional nutrient criteria, which are expressed as an annual average.

nutrients, most pollutants would not have annual limits. In addition, when considering annual limits or other longer-term limits, the permitting authority should be certain that its state regulations do not prohibit setting such limits.

Even for nutrients, the behavior of the pollutant and the type of criteria will affect whether longer-term limits are appropriate or necessary. For example, in free-flowing streams where there are no impoundments, annual limits for phosphorus might not be needed. Phosphorus removal is not temperature dependent and AMLs may be most appropriate to protect water quality. Furthermore, in cases where nutrient water quality criteria and WLAs to protect those criteria are expressed on a shorter-term basis (generally to protect against local nutrient impacts in rivers or streams), effluent limitations derived from those criteria or allocations also should be expressed on a shorter-term basis, such as AMLs.[14]

What Are the Roles of Stakeholders?

Permitting authorities should consider the roles of permittees, other trading partners, and key stakeholders when incorporating water quality trading in NPDES permits.

Permittees

The permittee can be either a buyer or a seller of pollutant credits. The permittee's primary responsibility is compliance with the provisions of the NPDES permit. Beyond basic compliance, however, permitting authorities should consider the additional roles of the permittee(s). For example, the permittee is likely to play a primary role in developing the specific trade agreement to be included or referenced in the NPDES permit. The permittee may be a good resource for information useful to developing trade agreement provisions and appropriate permit conditions. The permitting authority should consider the permittee's responsibilities under any trading provisions and should establish conditional requirements in the permit that apply if the permittee does not meet these trading responsibilities.

In some circumstances, the permittee may be the manager of a trading program (i.e., pretreatment trading), or the sole trading participant (i.e., intraplant trading).

Unregulated Trading Partners

Often a permit will not place requirements on all of the partners involved in a trade, such as nonpoint sources or pollutant credit brokers. In those circumstances, the permitting authority should consider how default by the unregulated partners could affect the permittee(s)' compliance with the effluent limitations and conditions in the permit. To the extent possible, the permitting authority should incorporate appropriate, enforceable actions into the NPDES permit to address nonperformance by an unpermitted trading partner. For example, the trade agreement could provide that unregulated credit generators notify regulated credit

[14] EPA Memorandum dated November 15, 2006, *Establishing TMDL 'Daily' Loads in Light of the Decision by the U.S. Court of Appeals for the D.C. Circuit in* Friends of The Earth, Inc. v. EPA, et al., *No 05-5015, (April 25, 2006) and Implications for NPDES Permits* states, "EPA does not believe that the *Friends of the Earth* decision requires any changes to EPA's existing policy and guidance describing how a TMDL's wasteload allocations are implemented in NPDES permits."

purchasers of any anticipated circumstance when the credits would not be available. In this instance, the permit could require the regulated credit purchaser to provide notice to the permitting authority, seek other credit sources, and implement alternate controls to reduce pollutant loads in the permitted discharge.

Federal and State Agencies

Permitting authorities should not overlook the role of federal agencies such as the Natural Resources Conservation Service; Forest Service; Agricultural Research Service; and the Cooperative State, Research, Education, and Extension Service, as well as similar state agencies, when developing permits incorporating trades with forestry and agriculture nonpoint sources. While NPDES permits cannot require nonpoint sources to implement pollutant reduction BMPs or management practices, research conducted by these agencies can help develop and evaluate trading ratios and monitoring requirements. These agencies may also have independent statutory and regulatory authorities that could be used to facilitate adoption or implementation of trading provisions. The role of state agencies that serve as the NPDES permitting authority is discussed in the Overview of the Toolkit.

Local Governments

Local governments can also play a major role in the administration of trading programs. In addition to being a stakeholder that may provide comments on TMDLs or permits or being a point source discharger within a watershed, local governments can manage and facilitate trading.

Red Cedar River, Wisconsin

The Barron County Land Conservation Department served as a third-party facilitator for the Red Cedar River Nutrient Trading Pilot Program, negotiating with farmers and establishing contracts between participating nonpoint sources and the city of Cumberland.

Citizens

Permitting authorities should take advantage of the potential contributions of interested citizens to water quality trading efforts under the NPDES program. Permitting authorities should develop permits and fact sheets that clearly describe the calculations and assumptions used to determine baselines and trade ratios. Particularly where nonpoint sources are involved in the trade, the permit should clearly articulate the uncertainties associated with BMPs, their implementation, maintenance and operation, and how these uncertainties will be addressed, to allow interested citizens the opportunity to provide information relative to the trade that otherwise might not be accessible to the permitting authority (e.g., citizen monitoring). Additionally, the permitting authority should require reporting of sufficient information to evaluate compliance with trade agreements and permit conditions and should make that information easily accessible to the public. Finally, EPA's Trading Policy encourages states and tribes to make electronically available to the public information on the trading partners, the

quantity of credits generated and used, market prices where available, and delineations of watershed or trading boundaries. Permitting authorities can consider including reporting requirements associated with this information to allow interested citizens the opportunity to identify potential trades and to help establish public credibility for NPDES permits that include water quality trades. Interested citizens also have opportunities to participate in the development of a trading program. The public can comment on any applicable TMDL as well as the proposed permit before the permit takes effect. If the state establishes a statewide trading program, the state should issue a draft for public comment before finalizing the program.

How to Know if the Trading Program is Working

In this document, so far, we have covered five of the seven common elements of credible trading programs outlined in the Trading Policy. We have discussed (1) legal authority, (2) units of trade, (3) creation and duration of credits, (4) quantifying credits and addressing uncertainty, and (5) public participation and access to information. Compliance and enforcement mechanisms are covered in each of the scenarios under monitoring and reporting requirements and not covered here. This section focuses on the seventh element—program evaluation.

> ***"However beautiful the strategy, you should occasionally look at the results."***
>
> —Winston Churchill, 1874-1965

EPA's Trading Policy suggests that trading programs conduct periodic assessments of environmental and economic effectiveness and make revisions as needed. "Environmental evaluations should include ambient monitoring to ensure impairments of designated uses (including existing uses) do not occur and to document water quality conditions. Studies should be performed to quantify nonpoint source load reductions, validate nonpoint source pollutant removal efficiencies and determine whether the anticipated water quality objectives have been achieved."

To ensure that the trading program is meeting its goals, it is important that program evaluations be included in both the design and implementation of the trading program. This allows for adaptive management. Data and information collected can be used to assess whether the water quality goals of the program are being met and can be used to make program modifications where necessary. The results of these program evaluations and any changes that result should be made available for public comment.

Developing NPDES Permits for Specific Trading Scenarios

Once a NPDES permit writer has a clear understanding of the fundamentals of water quality trading in general and how the specific characteristics of the trading program involving regulated point sources will affect development of the NPDES permit, he or she should then begin to develop a NPDES permit that incorporates trading. To do this, the permit writer should determine the appropriate type of permit for the trading scenario and decide how the trading scenario can be incorporated into a NPDES permit.

What Type of Permit Best Suits the Trading Scenario?

The rest of this toolkit is arranged by type of trading scenario. There are some trading scenarios that are more conducive to watershed or general permits and some scenarios where individual permits are the best mechanism. For more on permitting, see EPA's series of guides on watershed-based permitting including the *Watershed-based National Pollutant Discharge Elimination System (NPDES) Permitting Implementation Guidance* (USEPA 2003b). Before a permitting authority can begin including water quality trading requirements in a NPDES permit, it should first determine the type of permit that is most appropriate for the parties involved in the trade or trades and the manner in which trading is conducted. There are two basic types of permits—a permit that covers a single point source and a permit that covers a group of point sources. A single point source permit is a permit specifically tailored to an individual facility and is commonly referred to as an individual NPDES permit. The permittee applies for a permit, and the permitting authority develops a permit for that particular facility on the basis of information contained in the permit application and other data submitted by the permittee or assembled from other sources. A permit also may be issued to a group of point sources. Some permitting authorities have issued permits that cover multiple sources but address only the particular pollutant or pollutants for which credits may be traded. This type of permit is issued in addition to the existing permits for the facilities involved and, hence, often is referred to as an *overlay* permit.

How Can the Trading Scenario Be Incorporated Into a NPDES Permit?

Trading may be incorporated into NPDES permits in a number of ways depending on the specifics of the trade. In some situations, the trade provisions may be reflected in the permit limits or other permit conditions imposed on the trading partners through the permit. Regardless of how water quality trades are included in NPDES permits, it is imperative that NPDES permitting authorities ensure the trades meet specific criteria such as enforceability, accountability, transparency, and consistency with water quality standards.

The permit should clarify what constitutes compliance with permit conditions, explain the measurement and timing of compliance, address compliance issues related to meeting permit limits using water quality trading, and address compliance schedules. Most state water

quality standards or implementing regulations authorize using compliance schedules. If that authority is available, the permit writer may place a compliance schedule in the permit special conditions.

Where Can I Get More Information?

This concludes the key sections of the Toolkit that apply to all users. The remaining sections of the Toolkit focus on specific trading scenarios. To determine which trading scenario is appropriate to read next, use the Toolkit Navigation decision tree below (see Figure 15.) Note that EPA developed the Toolkit with the expectation that users would read only the sections applicable to their unique circumstances and interests; therefore, the trading scenario sections do repeat essential information to ensure that users get comprehensive information in the trading scenario that best applies.

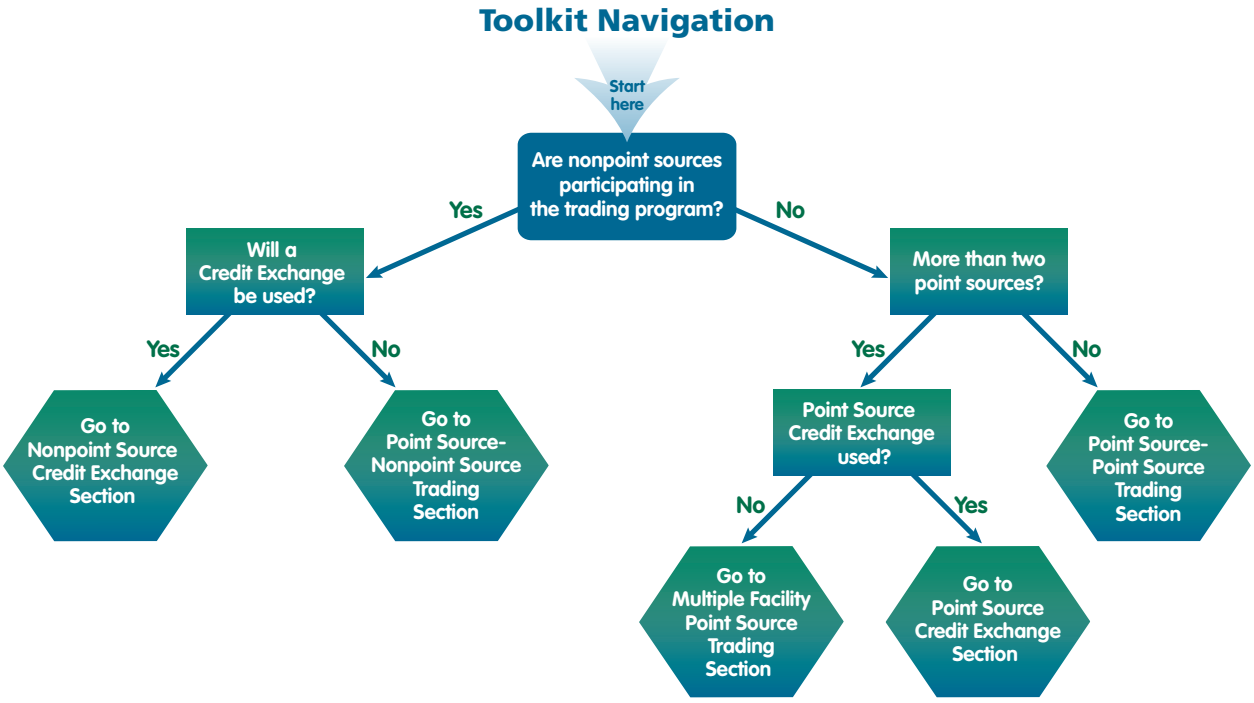

Figure 15. Toolkit navigation.