In It Together:

A How-To Reference for Building Point-Nonpoint Water Quality Trading Programs

Designing and Operating a Trading Program (Part 2 of 3)

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Willamette Partnership

About Us

Willamette Partnership is a 501c3 nonprofit working with a diverse coalition of leaders to shift the way people value, manage and regulate the environment. We continue to seek innovative ways to expand beyond the Willamette Valley in collaboration with other regional organizations with similar missions to direct investments in restoration to the places that matter most and at a scale that makes a difference.

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In it Together was produced by the Willamette Partnership, Pinchot Institute for Conservation, and World Resources Institute. The World Resources Institute developed the North Carolina case studies and updated information on the 24 point-nonpoint water quality trading programs, and the Pinchot Institute developed the Chesapeake and Willamette case studies.

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i. Preface

Watersheds across the United States have used different forms of water quality trading over the last decades as a flexible tool for meeting water quality goals. The successes, failures, and valuable lessons learned gathered by pioneering groups can be instrumental in helping new trading programs lay the groundwork for success. These lessons, paired with existing resources from U. S. Department of Agriculture (USDA), the U.S. Environmental Protection Agency (U.S.EPA), and others[1], have been incorporated into this how-to reference (Trading Reference) as part of USDA's ongoing efforts to advance market-based solutions as important tools for landowners implementing conservation practices.

Emerging water quality trading programs need not start from scratch—most programs require the same supporting infrastructure (standardized processes and technology tools), which is now available from model programs across the country. A framework has evolved that identifies what steps can be taken in order to build a water quality trading program for a local watershed. These steps include: 1) evaluating the feasibility of a program, 2) convening the right group of stakeholders, 3) designing the program itself, 4) securing some of form of program approval from regulatory agencies, 5) implementing the program, and 6) setting up an adaptive management approach that will allow for improvements and fine tuning along the way.

The Trading Reference is divided into several parts so readers can quickly access the information they need.

This **Part 2** is a design reference for building and operating water quality trading programs. It is essentially a manual for new or emerging programs that outlines how to move through each of the phases of trading program development and provides milestones within each phase that will help trading program designers identify and plan for the work required to walk through the process.

Part 1 of this Trading Reference presents an overview and current status of point-nonpoint water quality trading programs around the country. This part is a useful primer for those interested in water quality trading in general or as important background summarizing existing water quality trading programs and the lessons they provide for new programs. Lessons from trading programs across the U.S. provide illustrations about what works in building and implementing point-nonpoint trading programs.

Part 3 presents case study write-ups for water quality trading programs in North Carolina, the Pacific Northwest, and the Chesapeake Bay. These case studies are meant to add to existing write-ups of other programs (e.g. Midwestern programs).

Each Part is designed to stand on its own, however, users not familiar with the basic terminology and elements of water quality trading should begin by reading Part 1. Taken together, this Trading Reference should be helpful for local groups as they build programs to reduce program start-up time, increase efficiency, and build the base of trust necessary to sustain water quality improvements over time.

Audience for this Reference

The audience for this Trading Reference includes the watershed stakeholders building programs for water quality trades between permitted entities under the Clean Water Act known as point sources (e.g. wastewater or urban stormwater) acting as typical *buyers*, with unregulated, nonpoint sources (e.g. agriculture) acting as typical *sellers*. Trades occur when nonpoint sources can reduce their pollution beyond their Clean Water Act obligations more cheaply than a point source can with technology improvements on its own (Selman *et. al.*, 2009).

[1]This Trading Reference specifically builds from NRCS guidelines on markets, U.S.EPA policy on water quality trading, World Resources Institute's overview of water quality trading, and Willamette Partnership lessons learned on building ecosystem market programs. They also incorporate the lessons learned from programs and research funded by the NRCS Conservation Innovations Grants, USDA Agricultural Research Service, National Institute for Food and Agriculture, and the USDA Economic Research Service.

I. Introduction and Objectives

Part 1 introduced the history, concepts, and current status of water quality trading in the United States. This Part 2 of the Trading Reference provides detailed information to groups considering development of new water quality trading programs as they move from assessing program feasibility, into program design, and on into the adaptive management of program operations.

Much of building a trading program involves navigating through inconsistencies in existing policy, uncertainty in science, and the different perspectives of multiple stakeholders. Doing that successfully can also inform how other community-based approaches to conservation might work (e.g. targeted Farm Bill incentives or coordinated land use practices).

More than a decade of experience in developing water quality trading programs has given rise to the program elements and process steps necessary to build a successful program. While there are many overarching lessons, the place-based nature of water quality trading programs requires significant customization to suit the politics, economics, and environmental conditions. The challenge for groups is moving through those steps efficiently, managing diverse stakeholder needs and goals, understanding sophisticated scientific concepts, and assessing the economics needed to make trading transactions work. Part 2 of this Trading Reference is designed to help new water quality trading programs gain the understanding and tools needed to move forward, from feasibility study through to program implementation.

Whether designing a complex trading program for multiple buyers or sellers, or putting together a deal between one buyer and one seller, the same basic steps are generally repeated across programs, throughout the country. Each of the following steps requires attention depending on the specific needs and characteristics of a watershed:

Feasibility: Does the watershed in question have the right geographic, economic, social, and other elements in place to make a trading program viable? Are water quality goals clear enough for stakeholders to know whether trading is an appropriate tool to achieve those goals? Conducting a feasibility assessment answers these and other questions to determine if trading is a viable tool.

Convening: Some of the most important work in building a trading program comes in convening and preparing the right group of stakeholders necessary for creating and operating the trading program.

Design: The design phase turns a feasible program opportunity into a reality. Important aspects of this phase include building the science to connect water quality improvements to point source discharges, and creating the policy to shape who can trade and how.

Agreement: Each program needs some level of stakeholder agreement to move from the design phase to becoming a fully active program, overseeing actual trades and transactions. That agreement can be more formal or less formal, but in order to ensure solid legal and policy footing, a program needs some form of regulatory agency approval.

Operations: Often, most energy is focused on program design, but operating a successful program over time requires flexibility, careful planning, a range of skill sets, and potentially different groups of stakeholders. The Operations phase requires rolling out a pilot version of the program's quantification methods and protocol documents, identifying a Program Administrator to see projects through the credit issuance process, and maintaining and improving the program over time.

Adaptation: No program is perfect and every program will need adjustments, particularly in the first few years of operation. Successful programs include in their design structured ways to gather lessons learned, catalogue needed improvements, and make regular adjustments to the program on a predictable schedule.

Throughout Part 2, call-out boxes present key milestones and program considerations that local groups should aim and plan for when developing water quality trading programs. These considerations include trading approaches that have been successful in one or many current programs. This Trading Reference focuses on groups designing point-nonpoint trading programs, filling an existing gap in guidance on the process of moving through the substantive phases of program design and operation.

Each phase includes considerations that will help groups budget the time and resources needed to complete each step. Groups building trading programs often underestimate 1) the time and the resources required to assess feasibility and convene the right stakeholders; and 2) the resources required for ongoing operations and adaptation.

Table 1.0. User Shortcuts

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Building a trading program can take several paths

II. Feasibility

Several key factors contribute to the feasibility of a water quality trading program. First, a regulatory driver such as *National Pollutant Discharge Elimination System* (NPDES) permits under a *Total Maximum Daily Load* (TMDL) need to be in place, or there needs to be a good prospect of one being established in order for a trading program to work. Second, a feasibility study should determine whether there will be enough demand for water quality credits over a time period that justifies the effort and cost of building the program. If a feasibility study reveals that demand is less than the determined threshold, programs should consider a one-off transaction operationalized through existing permit mechanisms and not spend the time and resources to develop a large water quality trading program.

Third, a feasibility study should determine if there is an appropriate organization with the capacity and legitimacy to convene stakeholders, facilitate program design, and administer the program. The same organization does not need to do all three tasks, but a lead needs to be committed to all three for a program to be feasible. Fourth, buyers need to be confident that regulatory agencies will support their ability to purchase credits via the trading program in order to meet their Clean Water Act obligations. Fifth, the feasibility study should determine whether there is an intermediary entity or group of landowners with the sophistication and willingness to take the risk of providing water quality credits to buyers. Finally, buy-in and support from key stakeholders (e.g. farmers, environmental groups, Department of Agriculture) is a crucial component for any program. With these five variables in place, a trading program is more likely to be successful.

Conducting a feasibility study can be more or less resource intensive, depending on what stakeholders need in order to move forward, how big the program will be, availability of data to assess likely credit demand, as well as other factors.

Feasibility Studies can Range in how Deep they Dive

Feasibility in the Wabash River (IN, IL)[2]

In 2011, the Conservation Information Technology Center released a feasibility study in the Wabash River watershed to determine if the necessary conditions existed to support water quality trading. It is an example of an extensive study of the scientific and economic feasibility of trading. The 290-page feasibility analysis had two major components: 1) a pollutant suitability analysis and 2) an economic suitability analysis. The study reviewed existing and emerging regulatory drivers, defined a suitable trading area for the program, estimated BMP cost schedules for different land types and landowners, and estimated potential credit demand. It identified key stakeholders, outlined some of their concerns, and presented strategies for addressing those concerns through program design.

Feasibility in the Great Miami River (OH)[3]

In 2004 the Miami Conservancy District commissioned a feasibility study for a nutrient trading program in the Great Miami River. The study focused on the economics of demand and supply, quantifying likely costs of treatment technology, and the ability of farms to supply BMPs cost-effectively.

Feasibility in the Rogue River (OR)

The Rogue River program in Oregon determined feasibility quickly through a more informal analysis. The two local wastewater facilities were committed to exploring compliance alternatives to meet their temperature needs, which would generate several million dollars in demand over the next 3-5 years. Oregon's Department of Environmental Quality was sending clear signals that using temperature trading rather than wastewater chillers was the preferred way to achieve water quality goals in the state. The Willamette Partnership provided tools and protocols to support transactions while The Freshwater Trust acted as an aggregator, bringing completed restoration projects to the wastewater facilities. All of these factors moved the Rogue River program quickly and relatively cheaply from feasibility into implementation.

[2] http://www.ctic.org/media/pdf/TWG/Wabash%20WQT%20Feasibility%20Study_091411_final%20report.pdf

[3] http://envtn.org/uploads/Great-Miami_Trading_Analysis.pdf

2.1. Is There Enough *Demand* to Justify a Trading Program?

Adequate demand for water quality credits is critical. A majority of water quality trading efforts enter into program design without having a clear understanding of either the potential quantity or timing of demand. Knowing how much demand there is likely to be and when this demand can be expected will help determine whether a full-blown water quality trading program is needed. This information is also useful for establishing timetables for the key decisions and actions required to generate an adequate supply of credits for when point sources need them. There are two types of demand—Potential and Actual. Potential demand can be estimated by:

1) Identifying water bodies with new TMDLs, NPDES permits with new and/or lower effluent limits, new water quality standards, or other activity likely to create pollutant reduction needs;
2) Within those water bodies, cataloguing all point sources with an NPDES permit and other potential buyers, and comparing buyers' current discharges with new wasteload allocations, concentration limits, planned facility expansions, or other indicators of likely need to reduce pollutant loads. Reviewing the land-use cover maps in relation to possible point source buyer locations can quickly show where sellers (farm land use) and buyers (urban land uses) are in relation to each other within the watershed.
3) Determining whether there are state and local limits on pollution (e.g. no new pollutant loads, no net increase in impervious areas, etc.), which can also create demand; and
4) Using population growth estimates as a proxy for potential future demand.

Program designers should characterize potential demand in terms of pollutant reduction needed from each source by mass (e.g. 14,000 lbs. of phosphorous/year), timing (e.g. in the next 5 years), and dollars (e.g. cost differential between trading and the next cheapest technology, or using an average price per credit). Potential demand is very different than actual demand. Potential demand is the reduction for which a wastewater facility, power plant, or other point source might theoretically be willing to purchase credits, but actual demand is the dollar amount they will actually spend on credits.

Determining actual demand involves conversations with point sources about their operations. Usually, as facilities are determining compliance alternatives, they will hire a consulting engineer to help with an update to their facilities plan or a more specific compliance plan. Those consulting engineers may not have the experience with water quality trading to offer that alternative to their clients. This phase presents a critical window of opportunity for inserting trading as a potential compliance alternative. Because facilities compare alternatives "apples to apples": the costs, risks, and effectiveness of each compliance alternative, the trading alternative must be communicated in units that can be compared directly to treatment technology (e.g. lbs. of phosphorous/year or annual cost in dollars).

This helps ensure the trading option is given serious consideration as an alternative. In order to ensure that trading is always included as a potential compliance alternative, some choose to build consideration of trading into their larger process of alternatives analysis, such as PENNVEST, a Pennsylvania agency that funds wastewater infrastructure, requires consideration of trading in a facility's alternatives analysis. All factors considered actual demand for trading in dollar volume may be much lower than potential demand when looking at the next cheapest compliance alternative.

Table 2.1. Information to Determine Actual Demand for Water Quality Credits

Information program designers need	Information buyers need
Existing limits on growth (new and reduced loads from point sources or new facilities)	Initial cost estimate of price/credit
Risk preferences and concerns about trading from buyers	Understanding of potential risks from nonpoint source BMP project failures
Timing of key decisions for buyers	Initial indication of support from regulatory agencies
Availability and cost of compliance alternatives	

Clean Water Services' Actual vs. Potential Demand

Clean Water Services, a wastewater utility in Oregon's Tualatin River Basin, would have spent $150 million on mechanical cooling of its two wastewater discharges to comply with new effluent limits in its NPDES permit, but instead spent $4.6 million restoring 35 miles of stream and putting an additional 30 cubic feet/second of flow back into streams (Cochran and Logue, 2011). Both options would have cooled the river, but would Clean Water Services have paid, say $100 million for the trading alternative? Probably not.

Even if it might have been cheaper, the uncertainties and risks associated with nonpoint source trading for a point source were very real. Using a mechanical chiller meant an engineer could have been hired on a predictable budget and timeline, and in two years, a switch would have been flipped, and Clean Water Services would be in compliance. In the trading scenario, Clean Water Services needed to work with the Tualatin Soil and Water Conservation District, more than 30 farmers, 13 cities, and the Tualatin Valley Irrigation District. Planting trees to shade streams made ecological sense, but had never been done before in a regulatory context. For a point source, removing regulatory uncertainty was worth a lot of money, and that uncertainty is what continues to hamper many trading programs via reduced demand for credits.

Milestone – Demand Assessment: *Estimate of potential demand and determination of actual demand for water quality credits in your local area expressed as dollar volume of trades.*

2.2. Is There Enough *Supply* to Meet Demand in the Right Place at the Right Time?

Supply in point-nonpoint water quality trading programs is usually generated by farmers, forest landowners[4], and ranchers taking actions to reduce their pollutant loads. In other types of trading reducing point source pollution connected with septic tanks, as well as other actions, can generate credits. With some estimates of demand in place, program designers must assess whether there is enough supply to meet that demand in the right place and at the right time. In general, there may be 1-3 years of lag time from when demand levels are definite to when supply is ready. For example, it may take the equivalent of a planting season to recruit a farmer to commit to generating credits, who in turn needs time to install buffer strips or purchase new tillage equipment. A feasibility assessment should look closely at the timing of when supply can be ready compared with key benchmarks for when buyers need to have that supply in hand.

To assess supply, trading groups need an initial understanding of the types of *best management practices* (BMPs) eligible to generate credits and the *trading areas* in which those credits can be sold. For water quality trading, a trading area is often the watershed upstream of the water body of concern as defined by a TMDL (U.S.EPA, 2003). This could be upstream of a point source discharge, but in modified systems like the Lower Boise River, trading might also occur downstream. The number of potential sellers and buyers in a trading area is also an important factor in choosing program structures later in the design phase.

The other aspect of assessing supply is a landowner's cost and ability to get credits to market. This includes potential BMPs needed to meet *baseline* requirements before landowners are eligible to generate credits. For non-point sources, a baseline requirement sets a threshold beyond which reductions are considered additional, and eligible to generate credits. Baseline requirements set too high may disqualify some landowners from participating or make the costs of credits higher than a point source's cost of installing technology. Ideally, the equity issued tied to baselines needs to be discussed early as part of the pollution load allocation process (e.g. in a TMDL) even before details of a trading program are discussed.

Analyzing supply also includes the availability of third parties (e.g. business, local government, or conservation districts) to provide technical assistance and/or aggregate credits to deliver to a buyer as a package. The availability of these third parties is critical. Soil and water conservation districts have played central roles in most of the active point-nonpoint trading programs (Selman *et. al.*, 2009). For example, they have helped farmers prepare price estimates and bids in Ohio's Great Miami River program, and they have implemented projects for landowners in Oregon's Tualatin River program. *Aggregators* also play an important role in helping reduce risk for buyers. In Oregon's Rogue River program, The Freshwater Trust, a regional nonprofit, acts as an aggregator, bringing landowners and watershed groups together to package credits for buyers. The Freshwater Trust assumes contract liability for the performance of restoration projects, protecting point source buyers who still retain the permit liability for those projects. More on managing liability is included in Section 4.3.5.

In many programs, accessing supply can be impeded early by mistrust and concerns from landowners surrounding the concept of trading. Some concerns include connecting farms to permit obligations, the perception that landowners are helping a point source "get off the hook" for polluting, and worries about long-term contract obligations that could restrict their operations. Early outreach to landowners and regular communication from program designers can help reduce some of these concerns.

***Milestone – Supply Assessment**: Assessment of supply, including timing of supply related to demand, landowners' ability to get credits to market, and availability of third parties to provide technical assistance or aggregate credits to deliver to a point source as a package.*

[4] Throughout this reference, landowners include both the true landowner and lessees who control use of land.

2.3. Are Supportive *Policies* in Place for Trading?

Water quality trading will not work without support from regulators such as state/tribal water quality agencies and both the national and regional offices of U.S.EPA. During the feasibility stage, groups need to secure some indication from these agencies that they support the concept of trading, and that they are willing to participate in program design. This includes confirmation that the required legal authorities for trading are in place where they exist. It can be helpful if program designers work with agency staff to explore existing authorities to see what is "allowed," what needs "exploration," and what is "not allowed." Without agency support, credit buyers and sellers will be hesitant to invest.

At the state level, agencies may have *statutes*, *regulations*, *policy*, or *guidance* governing trading. These policies provide a legal foundation to issue NPDES permits with trading provisions. The clearer those rules and guidance are, the more predictable trading can be. In the District of Columbia, Idaho, Massachusetts, New Hampshire, and New Mexico, state water quality agencies do not have delegated authority from U.S.EPA to issue NPDES permits (along with most tribes), so U.S.EPA regional staff will also play an important role. The challenge for agencies is in balancing the flexibility needed to work with local watersheds with the consistency needed to speed up permit writing and issuance. As many water quality agencies face budget cuts, their ability to work through new rules, guidance, or even keep up with re-issuing NPDES permits is increasingly constrained.

Currently, U.S.EPA explicitly supports trading for nitrogen, phosphorus, sediment, and temperature (U.S.EPA, 2003; U.S.EPA, 2007). It also supports trading for other conventional pollutants on a case-by-case basis. There is currently no support for trading in bio-accumulative toxics. State and local trading policies may have additional restrictions. Part of feasibility, therefore, is matching potential needs from point sources with the supported pollutants eligible for trading.

Groups building trading programs should work with water quality agencies to ensure consistent incorporation of trading policies in actions such as establishing and approving TMDLs and issuing NPDES permits to give as much policy support for trades as possible.

2.4. Is the *Science* Available to Quantify Nonpoint Source Water Quality Improvements?

Science informs the development of a trading program in several ways. First and foremost, it helps shape the overall environmental goals and objectives of a trading program through water quality standards, TMDLs, or other documents. Science is also used to quantify potential pollutant reductions from land management activities in terms that allow potential buyers to compare trading to other compliance alternatives.

From a trust and transparency perspective, there is great value in having consistent methods for quantifying water quality improvements. These quantification methods include models, *BMP efficiency rates*, or other tools. Program design costs are greatly reduced if these quantification methods are already available and require minimal change to be of relevance to a local watershed. Developing new quantification methods can consume a large percentage of the budget and time available for program design.

A developing program can make a list of potential quantification methods that: 1) quantify water quality improvements at the edge-of-field/site level, and 2) quantify the pollutant delivery or *attenuation* from the edge-of-field downstream to a point of concern for a buyer. That list of potential methods should specify any validation, calibration, or other adjustments needed to make existing methods relevant to the local watershed. Regulatory agencies may have already selected methods

Milestone - Policies: *Secured support from regulators clarifying that they are in favor of the concept of trading and are willing to participate in program design. Clarification of existing authorities with regulators as to what is allowed in terms of water quality trading in your particular area.*

that they will require. There is a strong tendency with local groups to want to build methods from scratch for their local situation. The feasibility assessment should push hard to question whether that customization is necessary. Building from existing work can reduce costs and increase consistency across programs.

2.5. Are There Local *Leaders* with the Capacity, Skill, and Willingness to Lead a Trading Program?

The sooner trading groups can match local stakeholder organizations with the roles that they will play during convening, program design, and operations, the better. Vaguely defined roles create uncertainty, which slows program design and implementation. It is important to establish early on who will act as the local convenor, who will lead program design, and who might be responsible for administering the trading program later on. Each of those roles requires different skills sets:

- **Convenors** need to have process skills and legitimacy in the eyes of multiple stakeholders, with the ability to bring stakeholders together.
- **Program designers** need to have a technical understanding of water quality dynamics and the Clean Water Act, as well as process skills that will help local stakeholders articulate a vision for the program, prepare stakeholders for required decisions, and complete the design process in a timely manner.
- **Program administrators** need the administrative skills and legitimacy to sustain operations of a market program, which includes understanding of existing policies and regulations, risks and liabilities associated with administering trades, and the ability to sustain trust from stakeholders.

One or more organizations may fill these leadership roles, but having "champions" to help trading programs move through hurdles is critical (Selman *et. al.*, 2009). A state water quality agency could be a good leader, as long as agricultural, point source, and environmental groups trust agency staff. In many instances, a non-profit organization or a coalition of organizations have filled the leadership role. Finding those leaders might involve figuring out who has regulatory authorities, which groups have the most diverse boards, which organization has staff with experience bringing stakeholders together, and which organizations other key stakeholders point to as leaders. To help define appropriate roles for stakeholders, each trading group member should think about whether they want to be involved on the financial side of transactions (e.g. buyers, sellers, and their agents), or if they want to operate the trading program (e.g. regulatory agencies, verifiers, program administrators). Separating these roles helps avoid potential conflicts of interest.

Milestone – Science-based Quantification Methods: *Analysis of available water quality quantification methods and considerations for adoption or adaptation where possible*

Milestone - Leadership: *Identification of who will act as the local convenor, who will lead program design, and who might be responsible for administering the trading program.*

Final Milestone - Feasibility: *Identification of possible quantification methods; identification of program leaders; assessment of demand and supply; and assessment of agency interest and support. With this information, the group is prepared for the convening work ahead.*

III. Convening

Convening water quality stakeholders together for the first time sets the tone for future conversations. The reality of trading is that every program and every permit can be challenged at any time. That is how much community support is needed.

Face time spent with each stakeholder before and during convening can help refine process design, flag issues for conversation, and build each stakeholder's ownership of the process and resulting decisions (Emerson *et. al.*, 2003). The questions in the box below need to be answered in the convening phase of the process. A convening report that captures this information will provide a good reference point for program designers down the road, and documentation of the effort should be transparent and inclusive. The end product of the convening phase should be a workplan that articulates who will be involved, what their respective roles and responsibilities will be, and what the trading program needs from each stakeholder. This workplan should include planning for at least the first year of trading program operations.

Before meetings begin, each stakeholder should have an understanding of the goals of the trading program, how the process can benefit them, as well as other stakeholders' interests and motivations for participating. White papers can be used to brief stakeholders on these details prior to the first group meeting. Because the state water quality agency will need to approve the trading program, they will need to be involved throughout this process. Including any agencies that regulate water quality will help ensure consistency with existing interpretations of policy or suggest the necessary changes.

Ultimately, the collaborative process should 1) build direct relationships between buyers and sellers of water quality credits, 2) enable business and environmental interests to have candid conversations about, for example, overall goals for their watershed, 3) safeguard the interests of the broader community and people not directly involved in the process, and 4) ease organizational adoption of agreements made by the stakeholder group. Some excellent guidance exists on the principles and practice of collaborative decision-making (Fisher and Ury, 1983; O'Leary and Bingham, 2003; Suskind and Cruikshank, 1987; Dukes and Firehock, 2001; Wondolleck and Yaffee, 2000; Carpenter and Kennedy, 2001; Gray, 1989; Kenney, 2000; Ozawa, 1991; Yankelovich, 1999).

Questions to Answer as Part of a Convening Report

1. What should a water quality trading program do? What should it not do?
2. In two years, how will it be determined successful or not?
3. Who should be part of the discussion and when?
4. What do stakeholders need to participate effectively and reach agreement?
5. What is the right process for accomplishing those goals?

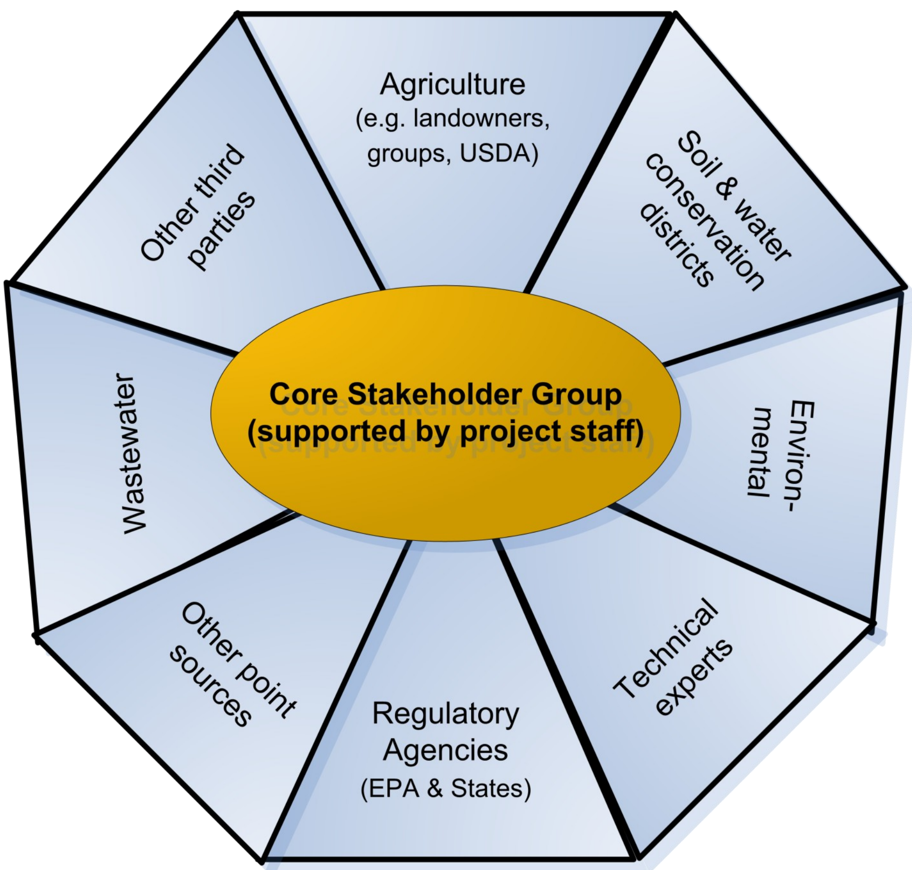
3.1. Who Has to Be Involved?

A successful process largely depends on the right stakeholders fulfilling the right roles and on cultivating trading champions during the process itself (Selman *et. al.*, 2009). Essential groups include representatives from state/tribal water quality agencies, point source buyers, nonpoint source sellers, environmental groups, and technical experts on water quality dynamics, farm practices, etc. Criteria to consider when drafting a list of individuals within those organizations include:

- Which agency issues permits and TMDLs, and who else has to say 'yes' to a trading program design (e.g. who will be signing agreements)?
- What resources/skills does the organization/ individual bring, and where are those best used?
- Is the individual in the organization positioned as a liaison to check details with technical staff, but also able to present policy decisions to directors?
- Does the organization/individual have the availability and financial resources to participate effectively in collaborative settings (Innes, 2004; Dukes and Firehock, 2001; Cohen, 1997)?
- Is the organization or individual trusted by others?

Not everyone needs to be involved in all parts of program design. A good process design will provide multiple opportunities for participation, but will ask appropriate questions of the right groups of people. For example, it may not make sense for a group of policy leaders to review the methods to quantify water quality improvements, or for hydrologists to develop the mechanisms to determine credit prices.

Figure 3.1. One Way to Structure Stakeholder Discussions



Some Ideas on Stakeholder Groups to Guide Program Design:

Program Design Team (Project Designers): A lead team that oversees all project elements and day-to-day activities. A team will be most effective when they have relevant policy knowledge, good working relationships with each stakeholder, excellent process and project management skills, and nearly full time dedication to the project.

This role is best filled by staff of a neutral and respected third party (e.g. a nonprofit or local or regional government body) because it must be free to build trust, hold stakeholder concerns in confidence, remain stable in changing political climates, and nimbly adapt to stakeholder needs. A consultant hired with public funds may also fill this role.

Stakeholder Working Group: The key group that forms and approves the details of the trading program. This group is broadly representative, but not too large to manage (e.g. about 10-30 members). Working Group members must be in a position to act as a liaison to the organizations they represent—ideally, in a middle position close enough to check details with their technical staff, but also able to present policy decisions to organizational directors.

Most importantly, Working Group members should be their organization's representative with the best working relationships with other members of the Working Group and Project Designers. With larger stakeholder groups, it will likely be important to create a small executive committee, or Coordinating Team, of the few (e.g. 4-8) most engaged Working Group members that reviews work between meetings, guides Project Designers, and helps move decisions along.

Coordinating Team members should have availability to meet regularly and spend significant time working as a group and reaching out to other stakeholders. This group can identify and articulate potential directions and decision points for the larger Working Group. Work includes drafting briefing papers and organizing project tasks and Working Group meeting agendas.

Technical Groups: Small groups that make detailed recommendations to the whole Working Group (e.g. credit quantification methods; setting trading ratios; or software tools). Technical Group members are both Working Group members and outside stakeholders with the best working knowledge of the technical task at hand.

Policy Group: If necessary, organizational policy leaders can be convened to adopt decisions or provide direction to the Working Group.

3.2. What Do You Need from Stakeholders?

Before stakeholders begin actively meeting, everyone should have a clear idea of what is expected from them, and ideally, what their role might be in a water quality trading program. This includes being clear on the number of meetings and time commitments requested. If the trading program agreement will be requesting formal approval and signatures from stakeholders, people should know this early on.

Meetings need a clear agenda and purpose. Meetings will be most effective when project designers can clearly communicate exactly what is being asked of the group as a whole and have a schedule looking ahead to future decisions/requests, ensuring that group members have time to communicate with their technical staff and directors as necessary. Some examples of what a trading program might want from some stakeholders:

Water quality agencies: Regulatory clarity and formal approval and use of trading program design if appropriate;

Buyers and Sellers: Assurance the program meets their needs and commitment to purchase or supply credits using the trading program design if appropriate; and

Technical experts: Assurance that the program provides real, verifiable trades that do not compromise environmental quality.

3.3. Dealing with Adversity

With the diversity of stakeholders involved in trading, some level of conflict can be expected during development of a water quality trading program, either from within the stakeholder working group or from outside the stakeholder group. These internal and external challenges can be handled much more easily if they are anticipated and planned for early on in the process. Below are some common challenges experienced by trading programs and some ideas on how to prevent and deal with them.

3.3.1. Internal Process Challenges

It is common for stakeholders from different agencies, with different mandates and different expectations, to have misperceptions about how trading programs work and about the roles of various stakeholders. The convening group can help reduce these misconceptions by having individual conversations with various stakeholders outside of group settings.

Engaging in the design of a trading program requires significant time commitments from stakeholders. Issues often arise when groups are getting down to the final stages of reaching agreement, where implications of engaging in water quality trading and associated responsibilities start to become real. If individuals have been minimally engaged and have not engaged in the decisions that have been made by the group, the last meeting is likely where they will raise objections or road blocks. To avoid this scenario, it is essential to clearly outline the level of commitment required to be involved in the process, get clear commitments upfront from stakeholders, and hold them to their commitment.

Sometimes People Get Angry

Individuals in collaborative settings can get angry. It happens for a variety of reasons. Sometimes anger comes from threatened interests, or it comes from not being heard. Either way, people need to have the time and space to vent and feel like their concerns have been acknowledged before the group tries to move forward. Conflicts need to be assessed for their intensity and importance early on so they do not derail a process (Wilmot and Hocker, 2001). There may be times, however, when conflicts cannot be resolved and convenors will need to decide how to move forward.

***Milestone – Stakeholder Involvement**: A clear articulation of what the trading program will require from stakeholders, including roles, responsibilities, time commitments, and outcomes from the process.*

3.3.2. External Process Challenges

Challenges that come from a source external to the process are more difficult to manage. A stakeholder who was left out of the working group can end up being a vocal critic of either the process or the outcomes. It is important to ensure that there is a venue or mechanism to acknowledge the ideas or issues being raised by people who are not part of the initial stakeholder group. This can be a planned series of presentations, question and answer sessions, or thinking ahead about how to add people to the stakeholder group mid-process, if necessary. Public access to the project (e.g. a project website) increases transparency and can help mediate critics.

Another challenge comes from changes in key agency or other stakeholder staff. This will require that 1) a new person be brought up to speed on the technical details and decisions already made, and 2) that the convenor/organizing group ensures a smooth transition as a new person enters a group process already underway.

As a group goes about designing their program, they should always have their ear to the ground for signs of changing economic, political, or legal conditions that may be relevant to their work (e.g. an election, lawsuit, or bankruptcy of a key buyer). This means building relationships with individuals in regulatory agencies and with local and state government officials that can provide some advance indication as well as guidance for what the changing conditions mean.

Milestone - Challenges*: A list of possible internal and external challenges that may arise throughout the process and strategies to address them.*

Final Milestone - Convening: *Understanding by all participants of the scope and scale of the project and the commitments needed to secure approval and move the trading program design into operation. With this information, the group is prepared for the substantive design work ahead.*

IV. Design

All the work completed to assess feasibility and convene the right stakeholders sets the stage for successful program design. The substantive work of design includes defining water quality goals, developing methods to quantify water quality improvements, creating a package of policy assurances and trading rules, implementing pilots to test the program design, adapting to new data and needs, and finally, transitioning to programmatic implementation.

4.1. Clearly Articulate the Goal(s) of a Trading Program

The first task of design is to formally agree on the overarching goals for the trading program. In many cases this might be either defined in regulation or be obvious (e.g. provide flexibility for reducing nitrogen load reductions to the river). Beyond improving water quality, related goals such as improving habitat, slowing conversion of farmland to urban uses, or increasing the amount of water in streams may also be important for consideration. Shared goals provide both a foundation and touchstone that make design decisions easier.

4.2. Select Methods to Quantify Water Quality Improvements

One necessary part of any design process is defining the units of trade (e.g. delivered pounds of nitrogen per year) and methods for estimating water quality improvements in terms that buyers can purchase and regulatory agencies can accept (e.g. standardizing the way in which nitrogen reduction benefits from riparian buffers are estimated). Often, a TMDL will define units of pollution that will be translated into NPDES permits. Trading programs will need to quantify the outcomes of land management actions in units that match the TMDL, NPDES permit, or other state or local water quality limits.

***Milestone - Goals**: Clearly articulated water quality and other ecological goals.*

The state water quality agency, or U.S.EPA regional office in non-delegated states, will need to formally accept the quantification methods via rule, guidance, agreement, or by placing the quantification method into an NPDES permit. Assuring the public that needed water quality improvements have been achieved requires that quantification methods articulate the outcomes not simply in terms of conservation actions.

General agreement on what needs to be counted begs the technical question: How exactly do we measure water quality improvements or impairments? During feasibility and convening phases, stakeholders should identify the pollutant, form of pollutant, and BMPs to be measured. With this information, developing quantification methods can be relatively standardized. Program design leads may establish a technical group of interested stakeholder group members and outside technical experts to evaluate and guide the details of a specific quantification method.

Program Consideration:

Trading is not new. The design conditions in this Reference are built from the decades of experience gathered from programs across the country. Try to pull designs from others.

4.2.1. Types of Quantification Methods

Generating water quality credits requires methods that can quantify water quality improvements at both the edge of a field/site or at the reach/watershed scale. The field scale measures water quality improvements where runoff leaves a farm field, and the reach scale measures the delivery of that water quality improvement from the field to some point downstream. Quantification methods can be grouped into three general types:

1. Modeling: Many programs are moving toward dynamic modeling of water quality improvements. The approach termed *Custom Calculation* uses average data for all agricultural operations in the land area under a program (e.g. using an average rainfall or average soil type for a watershed). It simplifies administration and is sufficient for environmental protection as long as the averages are conservative.

The *Site-Specific* approach considers farm-specific variables like soil type, historic rainfall, slope, prior cropping patterns, and crop management data to produce estimates of baseline and post-action nitrogen, phosphorous, sediment, crop yield, and flow at the edge of a field. The approach is complex because it requires all of the combinations and permutations of those variables. NutrientNet[5] and USDA's Nutrient Tracking Tool[6] are examples.

Several watershed-based models are also available to quantify the delivery of water quality improvements from one field to other points in the watershed. The Electric Power Research Institute (EPRI) completed a thorough review of both their Watershed Analysis Risk Management Framework (WARMF model) for measuring attenuation of pollutants and Nutrient Tracking Tool for measuring field-level water quality improvements (EPRI, 2011).

Models require some level of calibration because factors like erosion rates, hydrology, and farming practices differ across parts of the United States. If the data or resources are not available to calibrate an existing model, program designers may need to start off with a different approach (e.g. using pre-determined BMP efficiencies discussed below). Models can be more sensitive to site-specific conditions than standard BMP effectiveness rates, but not necessarily more accurate when those BMP effectiveness rates have been well-researched (e.g. in the Chesapeake program). Calibration of models requires reliable data on BMP effectiveness to generate accurate water quality estimates.

2. Pre-determined BMP efficiencies: Most of the early water quality trading programs used BMP effectiveness rates to quantify water quality improvements. An *effectiveness rate* is based on the best available science that connects a specific BMP to the percent or mass reduction in a pollutant following installation of that BMP (e.g. cover crops generate 5 pounds of nitrogen credit per acre per year). Some of these effectiveness rates are grounded in extensive research and modeling, while others are adopted from the most relevant literature. BMP effectiveness rates provide a high level of repeatability and predictability in a trading program, but they may not be as sensitive to site-specific conditions as modeling approaches. They may also have high start-up costs in the absence of relevant studies or modeled values, though they may be cheaper to maintain over time once established. Ideally, BMP efficiencies are not used in isolation, but are used as inputs and companions to other modeling approaches to quantify credits.

3. Direct monitoring: Direct monitoring is not typically used in trading programs for quantifying water quality credits largely because it is the most costly measurement system to implement. In-stream changes are difficult to directly measure from one BMP, one field, or even in one season. Measuring improvements uses water quality monitoring equipment. Direct measurement is often used for ambient water quality monitoring at the reach or watershed scale. It also serves as an important tool for calibrating models.

Program designers need to be clear about their level of confidence in quantification methods. There is a lot of uncertainty inherent in whether *estimated* improvements in water quality turn into *real* improvements that buyers and the public can have confidence in. Some of that uncertainty can be addressed with more science, but at some point, other tools may be needed. Other design elements, such as *trading ratios* and monitoring requirements, may be more cost-effective at dealing with some forms of measurement uncertainty. Dealing with uncertainty is not just a scientific question, it is also a policy question. The next section provides guidance on developing ways to deal with risk and build them into program designs.

[5] http://nn.tarleton.edu/NTTWebARS/

[6] www.nutrientnet.org/

4.2.2. How to Select a Method

Program designers should assemble a list of existing methods that are relevant for a program, and develop a set of criteria to help in reviewing those existing methods. Some criteria may include:

- Scale of application—site, watershed, or both;
- Applicability to target BMPs and land cover types;
- Accuracy of calculations for the pollutants of concern, priority conservation actions, and local watershed conditions;
- Sensitivity to changes over time, different BMP effectiveness, and differences in soil, climate, and hydrological conditions; and
- Ease and cost of use, transparency, and repeatability for target users.

When complete, most quantification methods should meet the following design criteria:

- Can be formally adopted for use by a state agency;
- A conservation district staffer with a background in natural resource management, and with days, not weeks, of specialized training, can apply the quantification method to help landowners quantify water quality improvements in hours, not days;
- Methods should rely on data collection techniques that are accessible to people like conservation district staff (e.g. avoid collected water quality samples that need laboratory analysis, but use web-based spatial data and models); and
- Methods should be able to quantify edge-of-field improvements and the delivery of pollutants from the field to other parts of the watershed.

Once a list of appropriate quantification methods and criteria has been established, program designers should evaluate the methods, and with stakeholder input, select one for use. Program designers (or the group in charge of building the quantification method) may take the method into the field to validate outputs compared to measured data, expert judgment, or other information in order to calibrate the method. That validation could be intensive—including years of data and analysis, or it could be a few conversations among experts on whether the outputs "make sense."

Either extreme has its problems. In many places, there are few existing data from direct measurement of BMP efficiency at the farm scale. Background "noise" from surrounding land use, weather, and other events make it difficult to establish a causal link between a BMP and measured reductions. On the other hand, relying solely on best professional judgment may not provide the certainty needed. This is a gap where local universities, U.S.EPA and USDA research, and other experts could provide a lot of value to trading programs. In the near term, program designers will need to do their best with available data, expert opinion, and provisions for monitoring built into trades, while allowing missing data to be filled in over time to improve quantification methods. A final meeting is needed to approve the quantification methods to be used in the program.

Milestone - Methods: *Selection of methods that can: 1) quantify edge-of-field water quality, 2) translate improvements through the watershed, and 3) can be formally adopted for use by a state water quality agency.*

Questions to Ask in Choosing a Quantification Method:

1. What does the program need to measure (pollutants, pollutant forms, and BMPs)?

***Milestone**: Concurrence on near- and medium-term credit types that address TMDL, NPDES permits, or other stakeholder needs; Agreement on the units of trade for each credit type.*

2. What methods and science are available to inform those credit types?

***Milestone**: Agreement on criteria for evaluating existing quantification methods; Evaluate and select methods to build from; Establish technical group to work with technical experts to draft quantification methods for each credit.*

3. How do we develop a method to quantify water quality improvements?

***Milestone**: Technical development and review of a quantification method; Field testing and validation of the method; Revisions and final adoption of method; Process for including new practices and quantification methods as they develop.*

4.3. Design Elements to Address Uncertainty and Risk

Reducing risk and uncertainty is an essential element in designing an effective water quality trading program[7]. Asking "will the trading program help achieve water quality goals" is a question whose answer is full of uncertainty. There are lots of ways to manage different forms of risk, but a program will need to spend its scarce resources wisely to address the most serious forms of risk. Reducing risk and uncertainty is so essential that this report treats many parts of program design as tools to deal with uncertainty, which comes in several forms:

- **Substantive uncertainty** comes from limited scientific understanding of how ecosystems work and what it takes to improve them. Will a buffer strip reduce nutrient loads by 30%?
- **Strategic uncertainty** is generated by interactions among multiple stakeholders. Will stakeholders participate in good faith? Will a point source factory buyer go bankrupt, or will a farmer maintain a BMP for 10 years?
- **Institutional uncertainty** stems from changing regulations and ways those rules are interpreted. Will a lawsuit change the definition of baseline requirements?

Uncertainty generates risk (including the perception of risk), which can keep buyers, sellers, and other parties from embracing a trading program, increase credit prices or transaction costs, or otherwise keep a program from meeting its goals.

A trading program's risk management framework should incorporate the following elements: 1) eligibility screens to ensure nonpoint source obligations are met prior to trading and to get higher quality projects, 2) performance, verification, and registration standards to ensure promised water quality benefits are achieved, 3) *trading ratios*, and 4) contracts, insurance, and other tools. Decisions about these elements need to be made by local stakeholders. Building a risk management framework can be done in three steps:

1) Establish key elements of the credit generation process: These are largely the same across trading programs. A seller investigates their eligibility for generating credits, calculates their pollution reduction, applies trading ratios, installs BMPs, has a verifier confirm correct installation and credit quantities, registers credits, sells credits, and finally settles into long-term monitoring and stewardship.

2) Analyze sources of risk and weave risk management throughout the credit generation process: Within each of the credit generation steps above, there are different ways to address risk and uncertainty. Stakeholders will need to discuss which risk management tools best manage the risks they are most concerned about given the resources they have.

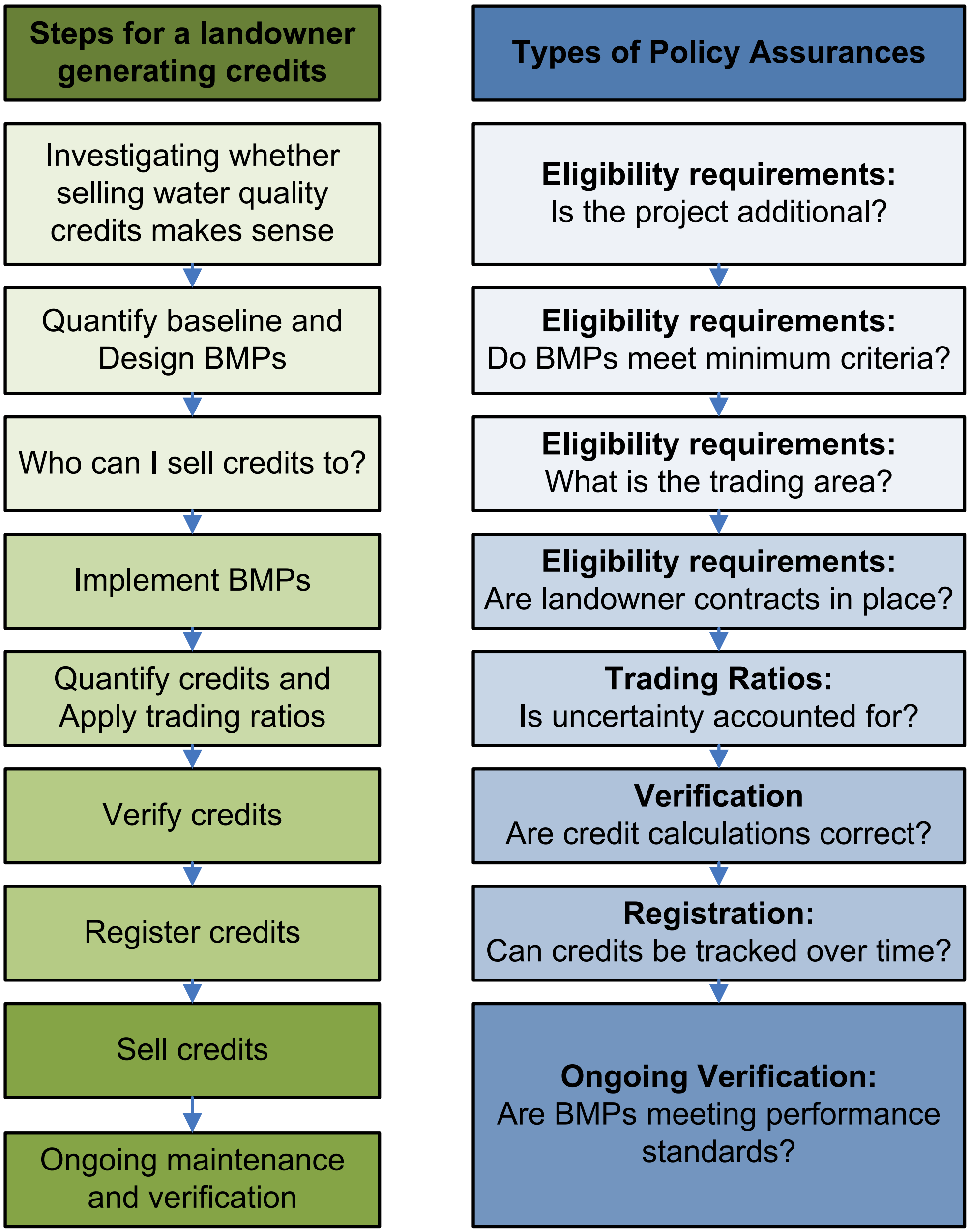
3) Finalize a Crediting Protocol and other Documentation: A *Crediting Protocol* is a core document, combining the chosen quantification methods with risk management in a complete protocol for creating, buying, selling, and tracking credits. Other documents might include manuals on applying methods, protocols for credit verification, monitoring frameworks, etc. Ohio's Great Miami program provides easy access to these documents on its website.8

Work on risk management is necessarily a highly collaborative effort between project designers and stakeholders. Taken as a package (See Figure 4.3), a design that deals comprehensively with risk can give confidence to all parties that the program will maintain water quality and meet state and federal laws.

[7] More on types of risk can be found in a Willamette Partnership white paper (Hosterman, 2008). http://willamettepartnership.org/publications/Practioners%20Working%20Group%20White%20Paper.pdf

[8] www.miamiconservancy.org/water/quality_credit.asp

Figure 4.3. Linking Risk Management to the Stages of Generating a Water Quality Credit



4.3.1. Eligibility Criteria

Eligibility criteria determine who can buy credits and who can sell credits. They also can define when credits can be sold (e.g. after implementing BMPs) and where credits can be sold (e.g. only to buyers in the same watershed). Eligibility criteria act as an early filter to make sure appropriate projects are generating credits and appropriate trades are occurring. Stricter eligibility criteria can be a barrier to land-based pollution reduction projects entering the trading program. However, the ones that do enter have a better chance of resulting in a verifiable reduction of pollution. Setting the level of eligibility is likely to be an iterative process, reflecting conservation objectives and market conditions.

Ideally, trading programs can provide potential credit sellers with an eligibility checklist that they can fill out, and with some formal notification of eligibility before sellers invest too much time and money into developing their credit projects. The Willamette Partnership provides a Validation Notice in response to getting a Validation Checklist from sellers. This gives some assurances to sellers that they can generate some level of credit.

Baselines for Buyers

Both buyers and sellers will need to control their own pollution to some minimum level, or baseline, before generating credits (U.S.EPA, 2007, p29). Buyers may need to first meet a minimal requirement for on-site control, and can only purchase credits for the remainder. That on-site requirement in an NPDES permit is called a *Technology-Based Effluent Limit* (TBEL). For example, a technology limit could require installation of secondary or tertiary treatment technology, which still would not meet all NPDES requirements[9]. That point source could purchase credits to cover the difference between their TBEL and their *Water Quality-Based Effluent Limit* (WQBEL). Usually this means installing at least secondary wastewater treatment technology, but could also include some tertiary treatment.

Baselines for Sellers

Not all nonpoint sources and not all BMPs will be eligible to generate credits. A trading program will need to define which types of nonpoint sources can participate (e.g. can agriculture, forest lands, rangelands, and urban stormwater projects participate?).

Program Consideration:

Eligible point source buyers need to meet technology-based effluent limits prior to purchasing credits.

Eligible practices also need to be defined (e.g. restoring wetland may be important, but the quantification method does not exist, so the practice may not be eligible).

Generally, credits are produced by BMPs that reduce pollution above and beyond what is required under applicable federal, state, and local laws and regulations. In other words, they are *additional*. For non-point sources, a baseline requirement sets a threshold beyond which credits are considered additional (See Figure 4.3.1a.). These rules can also protect against perverse incentives to damage ecosystems only to get credit for repairing them again.

Nonpoint source baselines can be set in TMDLs or in the program design document itself. They might be phrased as a minimum set of BMPs landowners must install before they can generate credits. Baselines might also be set as a percentage reduction (e.g. 20%), consistent with agriculture's *load allocation*, to be achieved before credits can be sold. Setting these baselines has been a challenge for many programs. In many TMDLs, nonpoint sources receive a load allocation for groups of landowners (e.g. farming or forestry), but achieving those load allocations is unpredictable because most states have few tools to ensure or enforce that load reductions occur at an individual property scale.

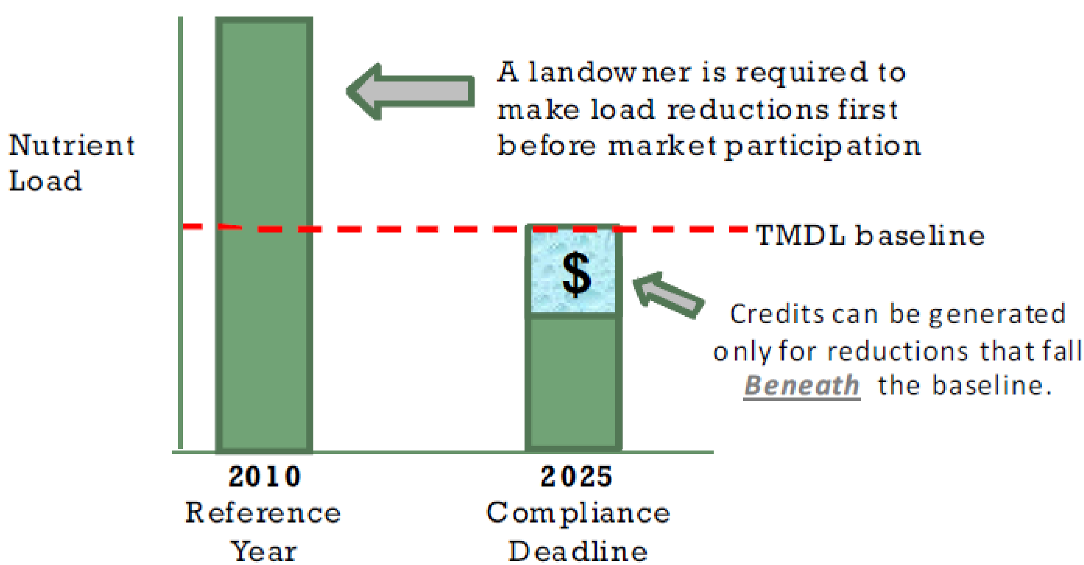
If baseline requirements are set too high, many landowners will not participate in a trading program, or their credit prices will be too high for point sources to purchase. If baseline requirements are set too low, then nonpoint sources may not be achieving the water quality improvements they might otherwise achieve. Setting an appropriate baseline is one of the cornerstones of a successful trading program. It requires finding the right balance between rigor and practicality so that the activities undertaken within program actually achieve environmental outcomes.

The Chesapeake Bay Environmental Markets Team has introduced the concept of a "phased baseline," where

[9] Primary treatment—the physical processes (settling or skimming) that remove a significant percentage of the organic and inorganic solids from wastewater. Secondary treatment—the chemical and biological action to remove fine suspended solids, dispersed solids, and dissolved organics by volatilization, biodegradation, and incorporation into sludge. Tertiary (advanced) treatment—uses a variety of biological, physical, and chemical treatment approaches to reduce nutrients, organics, and pathogens (U.S.EPA, 2012). http://www.epa.gov/tribalcompliance/wwater/wwwastedrill.html

baseline requirements can be met over time to incentivize early adoption of BMPs (2010). Farmers could implement BMPs early, generating revenue from credit sales that could fund additional BMPs to get them closer to their baseline requirements over time. For example, in 2014 farmers must be at 40% of baseline and can trade above that level. In 2017, they must be at 60% of baseline. In 2025 they must be at 100% of baseline and can trade above that level. This approach has not been approved for use, but could achieve the overall nonpoint source reduction goals in the Chesapeake TMDL.

Figure 4.3.1a. Baseline for sellers
(used with permission from Chesapeake Bay Environmental Markets Team, 2010).



Examples of Nonpoint Source Baselines
(Branosky *et. al.*, 2011)

Maryland: Farms must comply with applicable regulations, which include developing and implementing plans for nutrient management and soil and water conservation. They must also reduce their per-acre annual loading of phosphorous and nitrogen to the limits in the TMDL before that can generate any credits.

Pennsylvania: Farms must comply with applicable regulations, which include meeting minimum practice standards: 1) 100-ft manure setback from water bodies, 2) 35-foot vegetated buffers, 3) and reducing the farm's total nutrient load 20% below what is required through applicable regulations.

Oregon: Oregon Department of Agriculture develops regional water quality plans for high priority watersheds in the state. For temperature improvement, baseline is providing a riparian buffer without active agricultural use. Active reforestation of riparian buffers is considered additional.

Program Consideration for Establishing Nonpoint Source Baselines:

All issued credits result from restoration actions that are 1) above and beyond a regulatory threshold for compliance, and 2) above and beyond business as usual, meaning that credits cannot be created from recent, significant, and intentional impacts to the site. For example, the Ohio River Basin looks at the last three years of fertilizer application to make sure reductions are above and beyond common practices for the farm.

A base year should be set consistent with a TMDL or other regulation, defining the period after which credits can be generated. This base year might be the issuance of the TMDL. Baselines should not be set at levels less than existing practices for a base year (U.S.EPA, 2007, NPS scenario, p6).

Nonpoint source baselines need to be clear and consistent with the baseline *year* and the baseline *calculations* used to establish the nonpoint source Load Allocation in the TMDL, and incentivize nonpoint source reductions needed to improve water quality. Cost share can be eligible to help nonpoint sources meet their baseline requirements. Baseline requirements should be set by applicable federal and state policies, but allow some flexibility on how sources meet those requirements. For example, a programs could phase in baseline requirements over time.

If some landowners have already met baseline requirements, any additional reductions installed after the baseline year should be immediately eligible to generate credits.

Program Consideration:

All trades have trading area restrictions specific to the credit being traded, and in most cases that will be within the same watershed (big or small) or an area defined by the TMDL. Trades occur upstream of a point of concern (e.g. a lake, estuary, or river reach), but are not necessarily restricted to the point of discharge for a particular point source.

Trading Areas

Trading programs will also want to define eligibility for trades by defining trading areas. These areas define where trading can occur and make it clear to program participants which buyers and sellers can conduct trades with each other. Trading areas can be based on watersheds, ecoregions, or other geographic areas. They will often be defined in a TMDL or other regulatory instrument.

Setting a trading area requires a balance between different factors. Groups should consider hydrogeologic conditions, fate and transport of pollutants, ecological parameters, location and types of point sources, parameters to be traded, and regulations and management structure (U.S.EPA, 2007, p12). Dynamic watershed models can be important for appropriately determining trading areas. Economic conditions are also important. Will there be enough buyers and sellers in a trading area to support trades? Political jurisdictions and preferences may shape trading areas too. Some point sources may want to invest their money in their local community and not too far away from their facilities.

There may be challenges in trading across state lines in watersheds that cross those boundaries. U.S.EPA supports interstate trading, under Section 103a of the Clean Water Act that directs U.S.EPA to encourage cooperative activities by the states (U.S.EPA, 2007). Yet, interstate trading requires multiple state agencies to agree to common design elements, which can be challenging if some states have already adopted their own trading programs. States may also need to allow for impacts in their state to be offset with improvements in other states. Several interstate trading efforts have begun in the Ohio River Basin (8 states), Chesapeake Bay (6 states), Spokane River (2 states), Klamath River (2 states), and Lake Tahoe (2 states). The Ohio River Basin framework provides a good example of an interstate trading program.[10]

BMP Performance Standards

BMPs will need to meet some level of performance standards to know they are located in the right places and maintained to achieve their promised water quality improvements over time. Clear performance standards and BMP design specifications help save time and money by ensuring good site selection and project design. Installation of structural best management practices (e.g. riparian buffers and manure management systems) and annualized conservation practices (e.g. cover crops and precision agriculture) need to meet specifications for construction, implementation, and maintenance. Tying performance standards to NRCS practice sheets for the region may be the most direct way to ensure quality. If practice sheets are missing, or are not specific enough, trading programs may need to add detail to these. Technical workgroups are a good place to refine practice standards. Practices also need to be maintained over time. A seller's credit generation contract can include performance standards for operation of maintenance of installed BMPs.

Program Consideration:

Each BMP that can create credits defines minimum quality standards that begin with NRCS practice sheets and expand as needed.

[10] http://my.epri.com/portal/server.pt?Abstract_id=000000000001023610

Willamette Sample Performance Standards for Riparian Planting

1. Less than 10% invasive trees and shrubs, and no more than 20% invasive herbaceous plants.
2. No single species may represent more than 50% of the woody plants in project year five.
3. All plant materials come from locally sourced native seed.
4. Plantings must be based on appropriate plant community based on a local reference conditions.

Crews plant trees to provide shade to Fanno Creek and temperature credits to Clean Water Services

Use of cost share funds

How nonpoint practices are funded may also determine eligibility to sell credits. Almost all programs allow use of cost share and other public funds to help farmers reach baseline requirements, but there are significant inconsistencies in how programs allow cost share to finance portions of projects that generate credits. USDA policy states that all ecosystem credits generated by landowners[11], even if projects use cost share dollars, belong to the landowners. Ten of the 24 active point-nonpoint programs allow use of cost share to generate credits in some form, but other programs and agencies do not take the same approach[12].

The debate centers around whether credits generated by cost share funds are truly additional. On one hand, credit sales alone may not be enough to cover the costs of installing BMPs, so cost share can help make up the difference. On the other, cost share funds traditionally have not been used to offset another source of pollution. So, if cost share is used to generate credits, then the watershed might not be achieving as much pollution reduction as it would otherwise.

Currently, the decision on use of cost share to generate credits is a state-level decision. States like Virginia and Maryland allow cost-shared BMPs to help farmers meet baseline requirements prior to trading, but have restricted those BMPs from generating credits because they do not provide additional benefits. West Virginia trading rules allow those same BMPs to generate credits (Branosky *et. al.*, 2011). A trading program needs to be clear about which portion of a cost-share funded BMP is or is not eligible to generate credits.

Timing of credits

For all Chesapeake Bay trading programs, BMPs must be implemented before they can generate any credits (Branosky *et. al.*, 2011). If credits are released prior to installing BMPs, that risk needs to be accounted for with an appropriate risk factor (U.S.EPA, 2007, p34). Point sources should be incentivized to invest in projects that create water quality improvements in advance of their obligation in an NPDES permit, so long as those projects continue to provide water quality improvements during the NPDES permit cycle. According to U.S.EPA guidance, a point source cannot "borrow" nonpoint phosphorous reductions in 2007 for an NPDES requirement in 2012 if that nonpoint project no longer exists in 2012 (U.S.EPA, 2007, p34).

Program Consideration:

BMPs are installed before any credits can be generated, and credits from one compliance period cannot be "banked" for use in a different compliance period.

Oregon Interagency Recommendations for Use of Public Conservation Dollars in Trading

In 2008, several regulatory agencies in Oregon issued joint recommendations on use of public dollars dedicated to conservation in a trading context. The recommendations stemmed from the case of a mitigation banker, who owned the land, used Wetland Reserve Program dollars to do restoration, and then subsequently sold some of that restoration as wetland credit to offset development impacts. As a result, the joint recommendations state that if a project uses public conservation dollars, then the total credits available to that project need to be reduced by the share financed by those conservation dollars. For example, if Environmental Quality Incentive Program funds 50% of conversion to no-till agriculture, then a farmer can sell roughly 50% of the nutrient benefit as credit. If Wetland Reserve Program funds 100% of a wetland restoration project, then there are no credits that can be sold.[13]

[11] Conservation Reserve Program, 7 C.F.R. 1410.63(c)(6); the Grassland Reserve Program, 7 CFR §1415.10(h); the Environmental Quality Incentives Program, 7 CFR § 1466.36; the Wetlands Reserve Program, 7 CFR §1467.20(b)(1); the Conservation Stewardship Program, 7 CFR § 1470.37; the Farm and Ranch Lands Protection Program, 7 CFR § 1491.21(g); and the Wildlife Habitat Incentives Program, 7 CFR § 363.21.

[12] 33 C.F.R. §332.3(j)(2) (2010); U.S. Fish and Wildlife Service. Guidance for the Establishment, Use, and Operation of Conservation Banks (2003)

[13] http://www.fws.gov/oregonfwo/LandAndWater/Documents/PublicFunding-final.pdf

Credit duration

Credit duration, or compliance period, might be defined in a TMDL or other regulation by monthly, seasonal, or annual pollution reductions. Annual credit duration provides more flexibility to nonpoint sources and point sources to connect on a trade, but they are not always appropriate in watersheds where water quality problems are expressed seasonally. Annual durations are best when looking at long-term average loadings to a water body, when looking at effects further afield (e.g. hypoxia in the Gulf of Mexico or Chesapeake Bay), and the need to reduce average loads overall rather than high loads from any one source (U.S.EPA, 2004). The trading program will also need to define dates for the compliance period. For example, some Chesapeake state trading programs use a point source "compliance year" from October 1-September 30. Others use a "calendar year" from January 1-December 31 (Branosky *et. al.*, 2011). In some cases water quality dynamics may justify a credit duration longer than a year. The duration needs to be consistent with both applicable federal and state policies.

Once the credit duration is set, programs should also define minimum contract lengths (e.g. in the Environmental Quality Incentives Program, the contract generally lasts for 5 years). Securing long-term stewardship of the credit project (land protection, maintenance, and monitoring) is important for securing actual water quality improvements. In setting a minimum contract length, trading program designers need to consider 1) a regulatory agency's focus on the length of time needed to secure pollution reduction, and 2) buyers' interest in assuring the quality and quantity of its credit supply over time.

Program Consideration:

No credit generation project contracts are less than one year. For cultural BMPs (e.g. conservation tillage, cover crops, nutrient management), contract lengths are at least 5 years. For structural BMPs (e.g. manure structures, riparian forest planting), contracts are for 10-20 years. If possible, contracts are recorded or otherwise run with the land.

Programs in the Ohio River Basin, Chesapeake Bay, and Pacific Northwest are all using similar contract lengths.

Program designers should also consider what happens after a contract expires. Can contracts be renewed? In many programs, contracts can be renewed so long as the BMP generating credits continues to be maintained. In some programs, the BMPs become part of the baseline after a certain period of time. Contracts also need to spell out any ongoing obligations of sellers after a contract expires, if any.

Stewardship and maintenance requirements

BMPs are more likely to sustain their benefits if they are protected with contracts or leases, have money set aside for management, and have someone designated in charge of stewardship. Longer term contracts are always preferable to short-term contracts, but that needs to be balanced with landowner interests and associated costs of long-term leases. Contracts provide more certainty for buyers that their credits will be available, to landowners on what their obligations are for maintenance, and to the public that practices will be available over time. If contracts can be recorded and run with the land, then that provides additional certainty even when lands are sold.

In cases where farmers are frequently rotating crops, contracts might not be tied to maintaining specific BMPs, but instead maintaining a suite of BMPs that can change as long as the total amount of pollution reduction quantified remains the same. For example, a farmer may rotate crops between corn, soybean, and a cover crop on a three-year cycle. Different BMPs may be more effective for different crops. So long as a trading program's quantification methods can compare the different combinations of crops and BMPs from year to year, crediting can be focused on the outcome. These details need to be spelled out in any contracts and need to be verifiable.

Program Consideration:

A stewardship plan, stewardship cost estimates covering maintenance for the length of the credit, and contracts for maintenance and verification are in place before credits are released.

4.3.2. Verification and Certification Rules

Verification

Credits that are traded only have value if participants - buyers, regulators, sellers, and the public - are confident that sites are achieving the proposed environmental quality benefits. To this end, *verification* answers two general questions: 1) are project developers (sellers) complying with trading program rules and procedures, and 2) is the site achieving performance standards established by the program?

Program designers need to clarify when and how often verification occurs (e.g. after BMPs are first installed and annually over the length of the credit contract). The first, full verification of a project confirms that the correct methodology is being used to calculate credits and that installed BMPs meet the minimum quality standards. Initial verification also confirms that credit calculations are accurate within some allowable margin of error (e.g. within +/- 15% in the case of the Willamette Partnership programs) and might also confirm the information used to determine a project's eligibility. In subsequent years, verification confirms that installed practices are constructed as designed and that maintenance is occurring as scheduled. Ongoing verification might include some combination of monitoring report review and field visits.

Verification can be conducted by agency staff, independent third parties, or by the buyers and sellers themselves, and it can vary in frequency, intensity, and information reviewed. In general verifiers should be familiar with the credit calculation methods, the crediting protocols, and nonpoint source BMPs.

Who verifies a project is an important consideration for a trading program. Many farmers are hesitant to allow state water quality agencies to inspect their BMPs. Buyers, state agencies, and the public want some way to ensure that BMPs are performing as promised. In some of the sole source offset programs, buyers self-verify their credit projects. Several programs have used third party entities such as soil and water conservation districts or nonprofit organizations to verify BMPs. There needs to be clear guidance for identifying and avoiding conflicts of interest for verifiers. Ideally verifiers are accredited, trained, and included in ongoing updates to trading program rules and tools.

Another important element of verification is a clear dispute resolution clause in case verifiers and buyers or sellers cannot agree on credit estimates.

Certification

Certification is the final review step before credits are issued. During certification a regulatory agency or other trading program administrator confirms that all documentation is complete and accurate. In some cases regulatory agencies may need to certify every credit-generating project. In those cases, verification and certification may be blended into the same process. In other trading programs, a third party can certify credits. For example, the Great Miami Conservancy certifies credits in the Great Miami program.

Agency involvement is important in this final stage, but state agencies may choose to approve the overall trading program design, or a trading plan in an NPDES permit rather than individual projects. With certification in hand, a seller is ready to make trades.

Program Consideration:

All credits, prior to registration are verified by a third party[14] and certified by an agency/program administrator. All credits undergo a full verification as BMPs are first installed, which includes confirmation of credit calculation and the installation of practices as designed. For cultural practices that can change from year to year, annual verification is important. For structural practices, verification of monitoring reports submitted by sellers will be conducted in years 2 – 4 to ensure that sellers are adhering to schedules for monitoring and maintenance. Another complete verification will be conducted in year 5, after which the cycle begins again and continues for the duration of the credit.

[14] For most NPDES permits, the point sources self-verify their monitoring reports. In many trading programs, there is some level of third-party verification that nonpoint sources BMPs have been constructed and maintained as promised.

4.3.3. Reporting and Tracking

Trading programs need a central database, or interconnected databases to track performance and transactions in a centralized way. Several programs are using a specific form of database called a registry. A registry facilitates a number of important tasks for a credit trading program including project registration, credit issuance, credit serialization, and transfer of credits between accounts. It also provides a public view of the program. Some programs may have low enough trading volume that a simpler database may suffice.

Standardization of reporting and tracking tasks increases the transparency and overall credibility of a program by ensuring that credits are only sold once. There is a balance between full transparency and privacy for landowners. Program participants and the public need to know BMPs are in place and operating as designed, and they need to know a contract is in place for the maintenance of those BMPs. They do not necessarily need to know the terms of that contract or all details of a farm operation. The central database can keep public and private versions of documents, so long as the program has a clear policy on confidential information.

Many permits with trading require some level of reporting on trades, but in reviewing 24 active programs for this report, there is currently little systematic way to report activity across trading programs.

Program Consideration:

Although not common, a centralized way to track and report on trades within programs and across programs helps improve transparency and provide information on trading activity. Annual reporting and all documentation from the credit verification process should be readily available for agency and public review.

4.3.4. Trading Ratios

Trading ratios are discounts applied to the estimated pollutant reductions from a credit-generating project that ensure a trade has the same effect as the pollution reduction that would have occurred at the point source without the trade. Trading ratios are used to account for watershed processes, risk, and uncertainty. The types of trading ratios used and the process for setting trading ratios varies widely among programs. Trading ratios are not always based in extensive analysis, but they should be based soundly in science and solid information. Ratios need to be defensible. Ratios are such an important element of trading that a program's stakeholder working group should be centrally engaged in approving trading ratios. The following forms of ratios are adapted from U.S.EPA, 2007, pp30-33:

- *Delivery or location ratios*: Account for the change in pollutant quantity and form as it moves from a point upstream to a further point downstream. Delivery ratios can also account for movement of pollutants from the edge of a field into the stream. Delivery ratios are sometimes included in models (e.g. the Chesapeake Bay Watershed Model), and are reflected in credit calculations themselves (e.g. Nutrient Net as applied in the Chesapeake). Delivery ratios usually incentivize action closer to the point of discharge. This may not always be appropriate. For example, Idaho's Lower Boise River program wanted to incentivize nutrient reductions near the mouth of the river where they were needed most, while delivery ratios in the Lower Boise gave more credit for reductions further away from buyers.
- *Equivalency ratios*: These ratios adjust for trading in different forms of the same pollutant. For example, a point source may discharge nutrients in a form that is biologically available—algae can use it quickly to bloom, but nonpoint sources may reduce less biologically available forms of nutrients. Equivalency ratios can also account for cross-pollutant trades. For example, reducing a pound of phosphorous on farms might equal ten pounds of nitrogen discharged from a wastewater facility.
- *Uncertainty or Reserve ratios*: There are a lot of unknowns in trading. Uncertainty ratios can help account for measurement uncertainty and implementation uncertainty as better science

becomes available. Measurement uncertainty accounts for errors in credit calculation methods. Implementation uncertainty accounts for potential project failure, both from BMPs not performing as anticipated and from unanticipated events such as a flood knocking out filter strips. A portion of credits can be held in "reserve" to account for these failures. The Ohio River program requires that all projects reserve 10% of all credits sold to account for uncertainty and project failures. Sometimes, different BMPs may have different uncertainty ratios.

- *Retirement ratios*: Retirement ratios can help trading create a net water quality benefit. For example, they can ensure that for every pound of sediment discharged into a stream, at least 2-4 pounds of sediment are removed. Retirement ratios can also be used to incentivize projects that deliver environmental benefits beyond water quality (e.g. a lower ratio for BMPs that provide habitat benefits in addition to nitrogen reductions).

The different factors above can be merged together in a single ratio or kept separate. Keeping ratios separate may allow programs to better optimize project location and design to reduce risk, and more easily fold in new information on actual risk. As a final caution, trading ratios can be a significant factor in credit cost and should be developed carefully.

Program Consideration:

Ratios are based in science. If watershed goals, economic feasibility, and appropriate levels of risk need to be considered, they are included in trading ratio decisions carefully and thoughtfully. Setting ratios too high reduces potential cost savings for point sources, but setting them too low places undue risk on the environment.

4.3.5. Liability, Enforcement, and Other Forms of Risk Management

In water quality trading, buyers almost always retain the regulatory permit liability and the performance liability for the BMPs they purchase credits from to meet permit limits (U.S.EPA, 2003). This is different than wetland mitigation banking where credit buyers do not have any liability once they have purchased credits. That liability can make buyers hesitant to use trading as an option, and/or can significantly reduce the prices they are willing to pay nonpoint sources for credits.

To ensure accountability, an NPDES permit with trading will have special considerations. Those provisions will discuss what happens if a point source buyer fails to acquire the right amount of credits or if purchased credits fail. They might also include reporting requirements, monitoring, accounting of trades, and assessment of BMP effectiveness. It may also include fines for noncompliance (U.S.EPA, 2007). The City of Medford's NPDES permit includes a fine schedule if temperature credits are not acquired by required time periods.

Trading programs use several approaches to help share some of the performance liability. In North Carolina's Tar Pamlico program, an association of point sources shares liability. In Oregon, the City of Medford (buyer) and The Freshwater Trust (aggregator) share any regulatory agency fines in cases of non-performance.

Some programs have built in a *true-up (or reconciliation) period*, where point sources can purchase credits at the end of their compliance period. The true-up period provides a bit of extra time to make sure all credits in hand match the limits in an NPDES permit. The Ohio River Basin program maintains an insurance pool of extra credits that can be purchased in cases where other BMPs fail because of challenges like floods or inadequate maintenance.

In general, trading programs can help buyers manage their liability through contract templates that clearly articulate who is responsible and what remedies are available in cases where BMPs are not implemented and maintained as promised—either because of a force majeure event like flood or fire or through the actions of a seller.

4.3.6. Packaging a Program Design that Manages Risk

A program design should create a predictable system of rules for trading program participants to avoid inappropriate trades, incentivize the BMPs that create the greatest water quality improvements, and deliver on the promises sellers make to buyers. The risk management elements of the program design need to be shaped and endorsed by water quality agencies, buyers, sellers, and other stakeholders.

The program design should be complete, but not burdensome. It should improve on existing practices while targeting the highest priority risk factors and incentives that stakeholders want to capture.

Having received comments on draft credit calculation methods and draft assurances, the program design leads can put them together into a draft Crediting Protocol document.

4.4. Establish Infrastructure (marketplace, registry, calculator, etc.)

Building the infrastructure to operate a trading program is an essential and potentially costly undertaking. Below are some standard infrastructure elements. Groups should review existing materials that have been developed by other programs and fully explore the range of existing tools and platforms that are available online in order to save on both start up time and costs. Regulatory agencies will also need to approve the infrastructure elements that operationalize the program design. Required infrastructure elements include:

- *Calculator:* A tool that quantifies environmental improvements. The calculator automates a quantification to transform the results of management practices at a specific site into actual water quality credits that can then be traded.
- *Standard forms*: Contract templates, verification documentation, etc.
- *Transaction process*: This could be as simple as a memo on who to notify when credits are bought and sold, or as sophisticated as an online exchange platform for buying and selling credits.
- *Reporting database*: A system that allows the management (registration, verification, issuance, serialization, tracking, buying, selling and retiring) of water quality credits.

Milestone - Program Design that Manages Risk through:

- ✓ *Eligibility Criteria including defined baseline requirements, defined trading areas, performance standards for BMPs, rules for how cost share can be used, and rules about the timing and duration of credits.*
- ✓ *Verification & Certification Rules including what gets verified and certified, by whom, and when.*
- ✓ *Reporting and Tracking of all credits on a centralized database that is publicly accessible.*
- ✓ *Defined Trading Ratios accounting for delivery of pollutants, equivalency across different forms of pollutants, risk and uncertainty, and environmental benefit.*
- ✓ *Other liability considerations that ensure BMPs are maintained over time.*

Examples of Web-based Software Tools that Support Trading

Planning Tools & Credit Calculators

LandServer: LandServer[15] allows landowners to quickly identify their property and generate a report of the important natural resources on their property including the programs that the property might be eligible for. LandServer currently is operational in the Chesapeake Bay states, but can be adapted to other areas.

Nutrient Tracking Tool: Nutrient Tracking Tool (NTT)[16] is a web-based interface accessing the Agricultural Policy Extender Model. NTT is used in several trading programs to quantify nutrient reductions at the edge of a farm field. NTT also produces estimates of crop production, sediment reduction, and flow.

Workflow management, Registries, and Exchange platforms

Bay Bank Marketplace: The Bay Bank Marketplace[17] allows buyers, the public, and others to view credits available for sale in the Chesapeake Bay. Information includes credit quantities and prices, but Bay Bank is not a registry.

Markit Environmental Registry: Markit Environmental[18] is a private entity available to register projects and credits, and supports the transfer of credits from seller accounts to buyer accounts. Markit can support registration of multiple credits and is currently the registry for PENNVEST and Willamette Partnership programs.

NutrientNet: NutrientNet[19] supports all aspects of nutrient trading programs. It is customized for individual programs, and can support credit calculations, registrations, and matching buyers and sellers. NutrientNet is being used by several of the Chesapeake Bay state's trading programs.

Ecosystem Crediting Platform: The Ecosystem Crediting Platform (ECP)[20] helps organize a lot of the documents needed to register water quality credits. It allows landowners to map their project, select credit types for multiple ecosystem services, and input data on credit quantities. It also facilitates interaction with third party verifiers and securing agency certifications where needed. The ECP is not a registry and does not support transactions.

***Milestone – Establish Infrastructure**: Assess existing infrastructure for use in your watershed, and adapt the minimal infrastructure for the projected volume in your program (e.g. do not build a supermarket if you only need a lemonade stand). Pilot the program before too much is invested. At a minimum, programs should have a credit calculation spreadsheet available to download, standard forms that can be filled out by hand, and a web-accessible central database where registration can occur. Registration is often seen as an expense, but it is critical to maintaining trust and transparency as programs grow, and can be easily incorporated in the cost of a credit as a fee.*

15 http://www.landserver.org/

16 http://nn.tarleton.edu/NTTWebARS/

17 http://www.thebaybank.org/marketplace

18 http://markitenvironmental.com

19 http://www.nutrientnet.org/

20 http://willamettepartnership.ecosystemcredits.org/; http://baybank.ecosystemcredits.org/

4.5. Pilot Testing: Do a Reality Check on Your Design with Local Capacities, Economic needs, and Needs of Potential Investors.

Through the process, credit calculation and policy guidelines must be checked against local capacity, economic realities, and business needs. For example, do methods really perform (i.e. rapid, highly repeatable, and accessible) as anticipated? Similarly, simple methods of accounting for risk may yield greater participation in the program (Hosterman, 2008).

Early pilot projects can provide a base of data and early lessons before program designs are rolled out on a broader scale. Pilot projects can range from "mock" transactions where the trading program design is used, but not tied to an actual permitted discharge. Yet, a true pilot test needs to complete a transaction between a real buyer and seller with full agreement from the necessary regulatory agencies. Those real transactions in the first year or two inform what changes need to be made to credit calculation techniques and policy guidelines to support greater volumes of transactions.

Milestone – Reality Check on Program Design*: Confirmation that credit calculation techniques and policy guidelines line up with local capacities and economic needs.*

Final Milestone - Design: *Complete program design including clearly articulated goals, appropriate methods, a risk management framework, program infrastructure, and a reality check that program design meets local capacities and needs. With these elements in place, the group is prepared to draw up the formal agreement that will be signed by stakeholders.*

V. Agreement

By this stage in program development, stakeholders will have invested significant hours and dollars in design. Several programs in the U.S. have completed program designs only to have political leadership at state agencies change, lawsuits filed against the TMDL, or other external shocks that keep trades from occurring. A formal *Trade Agreement* among stakeholders can help reinforce support for the program design.

The most effective Trade Agreements have state water quality agency director-level and field-level staff support. A written agreement signed by the directors of each organization represented in the stakeholder group can be a powerful tool during operations. If stakeholders are in regular contact with policy leads in their organizations regarding the process and its progress, enough trust may exist for smooth approval. Project design leads should expect to budget time to accompany or support stakeholders in regular meetings to brief their policy level decision-makers, especially before asking for agreement.

The agreement is stronger with full support of stakeholders, but some groups may not be ready to sign a formal agreement. At a minimum, program designers should confirm with key, but hesitant stakeholders that they can live with piloting the trading program for a specific time period even without their signature.

Asking for a formal, signed agreement from stakeholders and directors inevitably leads to a more thorough review of the draft agreement and can generate last-minute concerns. Notifying stakeholders and their directors exactly when and what they will be expected to sign as early as possible can help avoid snags and disruptions. Yet, some stakeholders may need a lot of discussion time before they are willing to think about a formal agreement.

Joint Statement of Agreement in the Willamette

Twenty-five stakeholders signed a Joint Statement of Agreement to pilot water quality trading and other ecosystem service markets using the Counting on the Environment Standard in the Willamette River Basin. Director level signatures followed[21].

Final Milestone - Agreement*: Formal statement of agreement on Version 1.0 program design including credit calculation methods and program rules, signed by key stakeholders.*

[21] http://willamettepartnership.org/ongoing-projects-and-activities/nrcs-conservation-innovations-grant-1/Joint%20Agreement%20all%20signatures.pdf

VI. Operations

The final phase of the process is programmatic implementation and market operations. This means rolling out a beta version of the program's methods and protocols, identifying a Program Administrator to see projects through the credit issuance process, and adaptively managing to resolve conflicts and address new needs. The relationships built during the design phase can help keep transaction costs low and program operating efficiency high.

Relationships and understanding gained though the design process will also be valuable in implementation, especially at first when only a handful of people understand how the trading program works and must champion it within their organizations. Land and water trusts may use the trading program to channel investment, or if program rules allow, public funds may be used for demonstration projects or backstop funds. Agencies can encourage regulated entities to use the market to meet permits, and permittees can implement innovative compliance strategies that would be risky without the trust, relationships, and good will built though the design process.

Program administration can be taken on by the organization that led the program design. Alternatively, an agency can host operations, or a new organization can be founded. The Program Administrator can be funded by fees from credit sales, grants, or public funds.

6.1. Governance

Every trading program needs some form of ongoing governance once it begins generating transactions. A Program Administrator is needed to approve and coordinate trades. This Administrator might be the state water quality agency, a third party (e.g. a soil and water conservation district), or a committee of organizations. The Administrator performs the day-to-day functions that ensure programs operate efficiently and in accordance with approved standards. A governing body can oversee the program operations and make official program improvement decisions on an annual basis.

6.2. Transaction Roles and Process

No matter how well written a program's protocols and documentation is, trading participants still need a step-by-step description of how the transaction process works and which organizations will fill which roles. The text below articulates a first-person scenario for a wastewater buyer (River Town), purchasing a nutrient credit from a soil and water conservation district (Lake County SWCD) who works with multiples farmers, via a market administered by the Clean River Cooperative and overseen by a state agency (Department of Environmental Protection). There are many iterations of how this scenario can be built depending on a program's trading design and which organizations are involved in trading in a given trading area. The scenario below is meant as just one example.

6.3. Pricing and Transaction Costs

Many trading design processes jump quickly into how the pricing of credits will work, exploring options like reverse auctions and other innovative approaches. Those discussions can consume a lot of time, especially if the design elements that define the pollutants being traded and how transactions will work are not in place. There are two basic approaches to pricing credits: 1) a fixed price for all credits, and 2) letting negotiations and the market determine prices. Each has pros and cons. There are also a number of transaction costs involved in water quality trading operations (e.g. brokerage costs, verification, registration, ongoing monitoring, maintaining a program's credit calculators and updated protocols, etc.).

There is also a timing element to pricing. Buyers will usually purchase credits on an annual cycle, so landowners and aggregators will likely get paid on annual cycles. In some cases, landowners may get larger payments upfront to increase participation. The sections below discuss different pricing models and how to estimate/control transaction costs.

Milestone - Governance: *Establishment of governance structure for water quality trading program.*

6.3.1. Pricing

Fixed pricing

Fixed prices provide a standard price per credit for all sellers. The price is usually set by either an individual buyer or the trading program. Fixed prices are predictable, making it easier for both point and nonpoint sources to compare costs of trading to other technology or management alternatives. This can reduce a lot of transaction costs. It also promotes equity among sellers, ensuring that farmer Jack does not get a better deal than farmer Joe for installing the same BMP. Yet, fixing the "right" price can be difficult, and fixed prices miss the opportunity for point and nonpoint sources to compete in order to lower prices for everyone. If programs choose a fixed-price approach, there needs to be a mechanism for adjusting prices on a regular cycle (e.g. every two years) based on feedback on cost of BMPs and on point source willingness to pay.

Auction pricing

Reverse auctions, where point sources request bids for selling credits, are common across several programs. Bilateral negotiations between buyers and sellers also occur. Some of the auction forms are described in the box below:

Market pricing

In theory, market pricing gets closest to an optimal price because lots of buyers and sellers trade back and forth, creating information about the right price. The challenge is that market pricing requires a large enough volume of transactions to arrive at the market price, and most water quality trading programs have very low volumes of trades. Generally, auction pricing is a simpler way to start for most trading programs wanting to use variable forms of pricing.

Packaging credits for sale

The forum for buying credits also differs across programs. Point sources may buy from a clearinghouse, which has packaged up bundles of credits for point sources to buy (e.g. Ohio's Great Miami program). They might also buy from aggregators via a contract to provide credits (e.g. The Freshwater Trust in Oregon's Rogue River program). Point sources might also go directly to landowners to purchase credits (e.g. Minnesota Sugar Beet Cooperative). In a few examples, point sources have also created their internal capacity to generate credits to meet their needs (e.g. Clean Water Services in Oregon's Tualatin River program).

Forms of Auction Pricing

Sealed bid: Under this form of auction, bidders submit a bid in a concealed manner. Submitted bids are compared against each other and the person with the highest bid wins the auction, and pays the amount of the bid to the seller.

Sealed bid, paying highest or second highest bid: Under this form, bidders simultaneously submit their bids to the auctioneer in a concealed manner. The bidder with the highest bid wins the auction with the price set at an amount equal to the amount of the second highest bid.

Open descending, multiple bid: Under this model, the starting price is set at a high enough level to deter all bidders and then is progressively lowered until a bidder indicates that he is prepared to buy at the current price. That bidder wins the auction and pays the price at which they bid.

Milestone - Credit Pricing: *Policies for pricing of water quality credits.*

Trading Scenario Using a Third-party Aggregator

In 2012, River Town had a challenge. Its wastewater plant sits alongside Clean River, but Clean River has a nutrient problem in the summer time that causes algae blooms harming fish and impacting a big recreational boating industry. The state Department of Environmental Protection recently issued a nutrient TMDL and a Waste Load Allocation for River Town that will require them to reduce their nutrient discharges to Clean River by 50% over the next 5 years. River Town's engineers had a choice—they could upgrade their existing treatment plant technology to include biological nutrient removal and filtration, or they could work with farmers to reduce their nutrient loads into Clean River.

The Clean River watershed is about 80% agricultural land, and the Clean River Cooperative, a nonprofit coalition representing farms, business, and environmental interests, has been working for two years to set up a water quality trading program. That effort had confirmed that farmers were interested and eligible to sell credits to River Town. That trading program design was formally endorsed by the Department of Environmental Protection in 2012.

River Town worked with its engineers to complete a facilities plan that analyzed the costs and risks of several technology upgrades vs. the trading option. The trading option may have been more uncertain than building technology, but it was half the cost of most technology options. River Town decided to install some treatment technology and purchase credits to meet the remaining portion of its waste load allocation.

As soon as River Town decided to use the trading option, Lake County SWCD began working with local farmers using the Clean River Cooperative's eligibility criteria to make sure farm BMPs reduced nutrients above and beyond requirements in the TMDL and other rules, that farmers were willing to maintain BMPs for the required time (e.g. 10 years), and that the BMPs were ones where nutrient reductions could be quantified and had broader water quality benefits. If farms eligible, the SWCD entered into contracts with individual farmers to implement those BMPs and provide those assembled credits to the SWCD to deliver to River Town. Those contracts will specify who owns the credits, how much a farmer should be compensated, and the farmer's responsibilities for maintenance. The Clean River Cooperative or Dept. of Environmental Protection may also have given the SWCD written assurances that those BMPs would be eligible to generate credits.

Prior to implementing BMPs, the SWCD would secure a contract with River Town to purchase a certain quantity of nutrient credits at a particular price for eligible BMPs. With that contract in hand, the SWCD would work with farmers to run Nutrient Tracking Tool or another Department of Environmental Protection-approved credit calculator to quantify current/baseline conditions and the predicted nutrient reductions after BMPs are installed. The SWCD would prepare a credit estimate form and submit to the Clean River Cooperative with a request for verification.

The Clean River Cooperative will have accredited third party verifiers, and will assign a verifier to visit the projects proposed by the SWCD to confirm 1) the BMPs have been installed according to plan and standards, and 2) the credit quantities are accurate. At that point the verifier will prepare a report, review that with the SWCD for their approval, and submit it to the Clean Water Cooperative. The Clean Water Cooperative will review the verification report, consult with the Department of Environmental Protection, and will certify that all documentation is in place and that credits are ready to be sold.

With that certification in hand, the SWCD will enter their credits into an online registry approved by the Clean Water Cooperative and Department of Environmental Protection. The registry will assign serial numbers to credits, place them into the SWCDs account, and allow them to transfer the credits to River Town's account.

As credits are transferred to River Town, River Town will write a check to the SWCD for the credits. Over time, the SWCD will submit annual monitoring reports to the Clean Water Cooperative's verifier, who will either visit the site each year or every five years depending on the BMP installed.

In the end, River Town is happy because they saved money, farmers and the SWCD have found a way to finance conservation as a new crop, and Clean River is cleaner.

6.3.2. Transaction Costs for Sellers

As sellers work to identify the credit price, they need to think about recovering transaction costs. Some of the transaction costs include:

Cost of getting to baseline: Depending on rules, sellers may need to reduce some percentage of pollution prior to being able to sell credits. This creates a cost.

Opportunity costs: There are opportunity costs to installing BMPs (e.g. taking marginal riparian land out of production, lowering yields from reducing fertilizer, fixing farm management for long contracts, etc.).

Recruitment costs: Landowners will need to be recruited and signed up, and it takes time to market credits to potential buyers.

Land rental payments: For BMPs like riparian forest restoration, credit prices might include the cost to rent land for 5-20 years.

Planning/Site preparation: Once a contract is signed, BMPs need to be designed, equipment may need to be purchased, and the site may need to be prepared.

Construction: This can be one of the costlier parts of implementation, but it is often one of the most predictable in terms of budget and timing.

Maintenance: BMPs need to be maintained, in many cases from 5-20 years. Those costs plus a contingency for events like flood and drought can be significant, but are critical to achieving actual water quality improvements. Budgeting adequately for maintenance is a shift from many current conservation practices.

Monitoring/Verification: Most programs will require some kind of annual compliance monitoring and verification.

Registration: There are likely to be costs to register and transfer credits.

Risk & Profit: Buying and selling credits involves risk. No one party should assume all of this risk without compensation. If buyers retain all risk for performance of BMPs, there may be little room to pay landowners as much. The more risk a landowner is willing to take for performance, the greater the potential for higher payments.

6.3.3. Administrative Costs

Program administrators need a strategy for financing the ongoing operations of the program, especially when there are likely to be few transactions in the first few years of the program. Administrative costs include:

Outreach and education: Program administrators will need to do a lot of outreach informing different stakeholders about the program, answering questions, and problem-solving. This also includes providing training to program participants.

Reviewing project eligibility: There is generally a screen for whether a given project is eligible. For simple projects, this can take minutes. For more complex projects with multiple funding sources and BMPs, an eligibility screen can take several days or longer. Program rules can also shape the cost of eligibility review.

Accrediting and assigning verifiers: Program administrators need to have trained verifiers ready and available. Buyers or sellers will pay for verification.

Reviewing verification reports and other project materials: In preparing to certify credits, program administrators will need time to review documents, ask questions of their verifiers, and interact with water quality agencies.

Updating protocols and credit calculators: In the first few years of the program, there will be regular updates to program tools and designs based on information coming in from early transactions. Program updates should occur on a scheduled basis, but incorporating new information takes time.

To date, most program administrator costs have been covered by grant sources. This is not sustainable over the long-term and transaction fees applied to each credit will likely come to represent a small portion of the total cost of program administration in most cases. Each program administrator should have a business plan in place early on, so they can sustain their operations over time.

6.4. Elements of Transaction Agreements

Generally, transactions will have two types of agreements: 1) one between the point source and the supplier of credits, and 2) where aggregators or clearinghouses are involved, an agreement between the landowner and the aggregator.

Templates for each type of contract can be provided by programs and can ease negotiation costs for these agreements. In general, the simpler the contract, and the more consistent the contract with what buyers and sellers are used to seeing, the better. Below are some minimum items necessary for each contract:

Point source to Seller

- Quantity of credits to be purchased at a price per credit
- Boundary conditions on where credits can be produced from which types of BMPs, or other preferences from point sources
- Benchmarks for timing of credit delivery and payments
- Actions to be taken in case seller fails to deliver credits
- Standard language for termination, dispute resolution, insurance, and indemnification

Aggregator to Landowner

- Amount and timing of payments
- Length of contract
- Landowner and aggregator responsibilities for maintaining BMPs
- Clear assignment of ownership of credits to Aggregator
- Permission to regularly inspect BMPs
- Standard language for termination, dispute resolution, insurance, and indemnification
- Compliance with applicable federal, state, and local requirements

6.5. Training/Capacity Building

Water quality trading programs have a lot of moving parts and bring together a lot of people from different backgrounds. In almost any program, there will need to be some level of training and capacity building to prepare buyers, sellers, agencies, and third parties to interact efficiently. To operate a trading program, program administrators need to have a basic understanding of the Clean Water Act (TMDLs and NPDES permits), stormwater/development issues, wastewater technology and business constraints, how farming works, and what drives water quality in the watershed. Buyers need to understand the risks and liabilities of purchasing water quality credits. Sellers providing credits need to understand how to properly implement BMPs and how to apply the credit calculators to estimate the water quality benefits of those practices. Verifiers need to understand both the credit calculations and their role in confirming benefits.

Trust, transparency, and policy support for the trading program are also important to maintain. This often means an annual meeting of stakeholders to check in on program results, and other regulator communications. During program design, only a small subset of stakeholders may be involved. As a program moves into operations, it is important to expand that network of people involved via meetings, presentations, email, website, etc. This is particularly important for water quality agency, wastewater engineering firms, and environmental group staff who might not be as involved in the day-to-day operations of trading like farmers, third parties, and wastewater facilities.

Training Can Build Capacity

An annual training program can be a great way to build capacity and bring new stakeholders up to speed on the details of the program. Training could include a program overview, use of the credit calculation methods, and accreditation of verifiers.

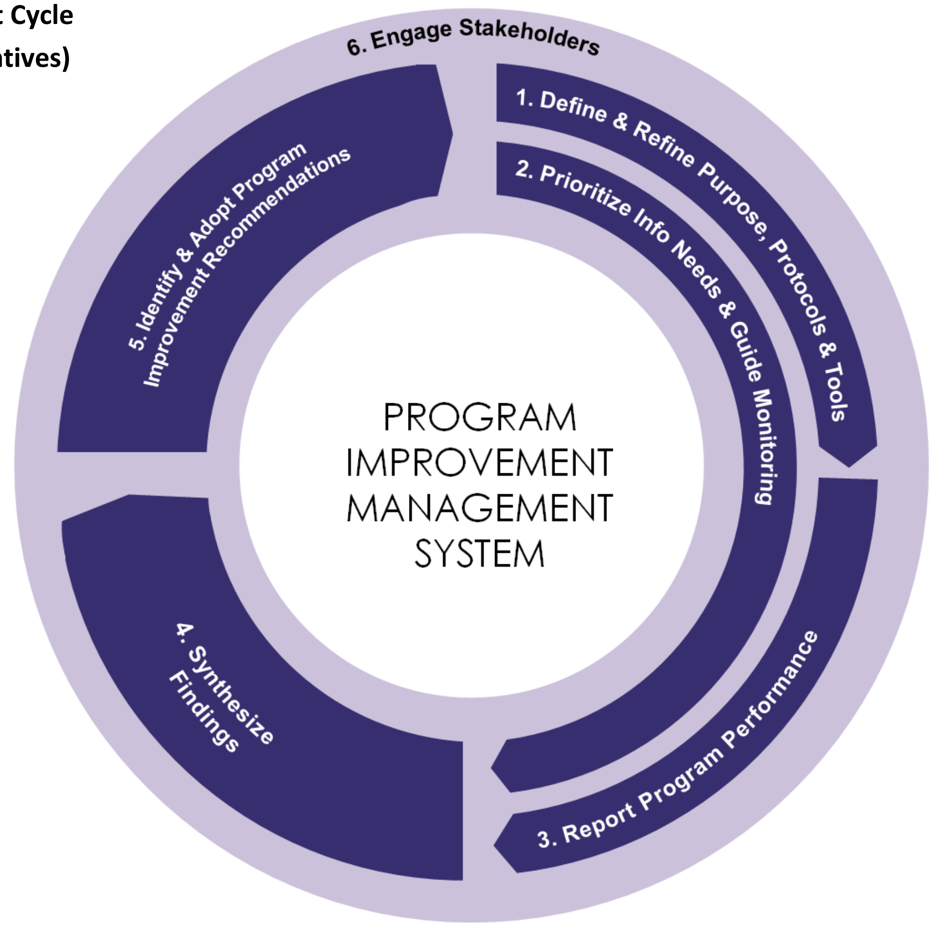
Final Milestone - Operations*: Agreement on implementation plan; establishment of long-term program management, review process, and funding; Agreement on a business plan for self-sustaining market infrastructure.*

VII. Adaptive Management

No one designs a perfect trading program in the first years of operation, and very few have designed robust mechanisms for adaptive management and monitoring of nonpoint source projects into their trading programs (Selman *et. al.*, 2009). Largely, these programs are new and represent a small fraction of the total conservation or development activity in a region. That said, programmatic monitoring and a defined adaptive management plan can go a long way toward mitigating risk. There needs to be a process for rolling up verification and site-level monitoring reports into a program-level evaluative process that is ideally linked to monitoring at the watershed level. There also needs to be a mechanism for incorporating new quantification methods or BMP technologies as they are developed over time.

A predictable schedule and process for updating credit calculation methodologies and market rules can help a program respond to lessons and feedback generated by market activity and new science. As elements of the trading program get updated, existing contracts must be honored so participants have certainty of consistent performance for a consistent price. Feedback loops that are transparent and fixed for some specific period of time allow for learning. But they also adapt in a predictable way, allowing significant investments with a higher degree of certainty regarding return on investment. The Lake Tahoe Lake Clarity Trading Program and the Klamath Tracking and Accounting Program both use a standard adaptive management framework to improve their programs (see Figure 7.1).

Figure 7.1 Program Improvement Cycle (courtesy of Environmental Incentives)



7.1. Different Forms of Monitoring in Water Quality Trading Programs

There are several different types of monitoring that can occur in a water quality trading program (from Selman *et. al.*, 2009):

- Compliance monitoring: Answers whether BMPs have been constructed and maintained according to trading program standards.
- Effectiveness monitoring: Provides information on whether those BMPs are providing the anticipated environmental, economic, and social benefits envisioned when the group's overall goals were established.
- Feedback loops: The combination of outputs from compliance and effectiveness monitoring should be collected and reported in a way that informs feedback for program management and adaptation.

Early on, pilots should test both the credit calculation methods and the credit issuance process in order to answer questions such as:

- How do we know methods are repeatable, accurate, and cost effective?; and
- How do we know the credit issuance process is reasonable and effective at targeting investment in priority actions and places?

Programs will need to prioritize what they evaluate, and how they collect data. A program might maintain a running list of research questions, monitoring activities and needs, as well as strategies for filling gaps in information. On an annual or biannual basis, most trading programs should assess potential changes to:

- Program purpose and goals;
- Credit calculation methods, assurances and rules; and
- Operational processes and practices.

That assessment should be collected into an annual report of achievements, challenges, and lessons learned that is provided to trading program stakeholders and the public.

Milestones - Monitoring*: Annual report on program results; Agreement on changes needed to quantification methods and program designs; List of information and research needed to improve the program over time.*

Final Milestone - Adaptation*: Agreement on implementation plan; Establishment of long-term program management, review process, and funding; Agreement on a business plan for self-sustaining market infrastructure.*

VIII. Conclusions

Building and operating a water quality trading program is not simple, but it is doable. The program considerations in this Trading Reference are meant to help new trading programs get a head start toward success. The ideas are drawn from decades of experience with water quality trading and examples from point-nonpoint trading program around the country. Figures 8.1. and 8.2. provide a checklist for program designers linking key milestones to each phase of 1) building a trading program, and 2) operating a successful program.

Figure 8.1. Milestones for Each Phase of Building a Trading Program

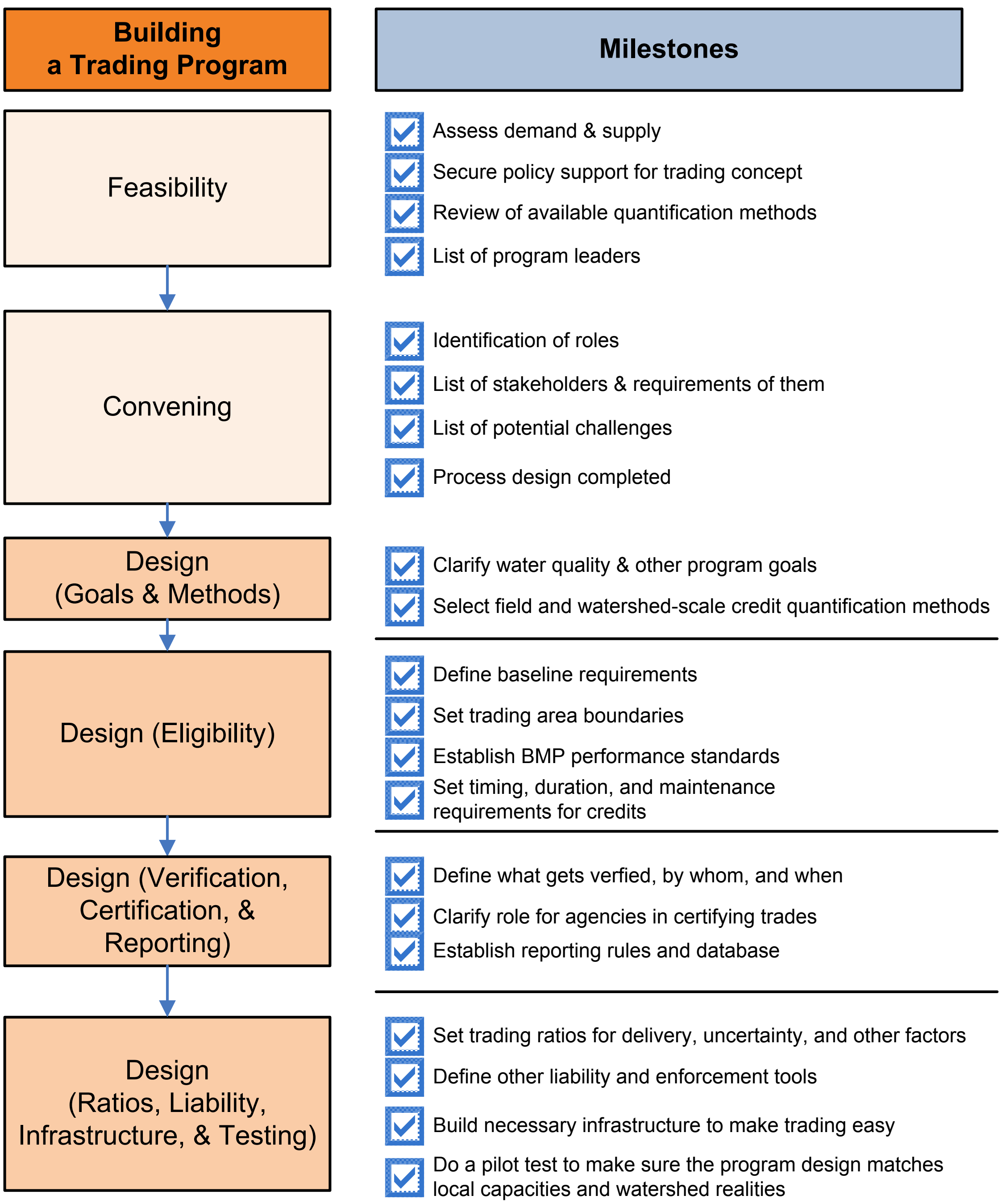
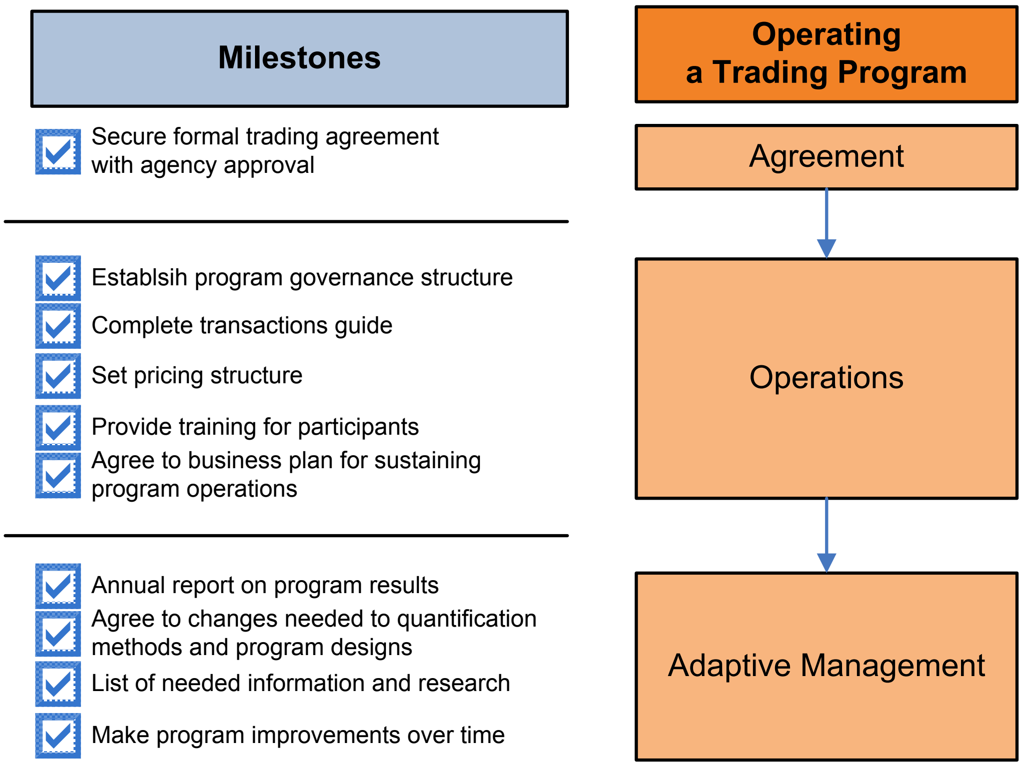


Figure 8.2. Milestones for Each Phase of Operating a Trading Program



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