# Setting Agricultural Baselines in Water Quality Trading Programs

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AFT's interest in private ecosystem services markets is deeply rooted in our 33-year history and our primary goal is for these markets to succeed. We blend on-the-ground work with farmers and ranchers around the country with academic research and policy work at both the state and federal level, making it possible for us to uniquely leverage work from academics, agricultural and environmental partners, and other key stakeholders and rapidly scale up successful projects by sharing our results with policy makers and federal and state agencies. We are helping the Electric Power Research Institute (EPRI) and other collaborators set up the nation's first regional WQT market in the Ohio River Basin and are also involved in efforts to set up ecosystem services markets in Minnesota, Pennsylvania and Washington. We focus on the farmers who will be selling the credits and how to engage agriculture from the beginning to help set up these markets to improve the chances that farmers will participate in trading.

AFT staff members who contributed to both developing and reviewing this paper, included Ann Sorensen, Jimmy Daukas, Dennis Canty, Brian Brandt and Benjamin Maloney (a graduate student with Northern Illinois University who works with AFT's Center for Agriculture in the Environment). The paper benefited greatly from outside reviews by Mark Kieser and Jim Klang, Kieser & Associates; Larry Antosch, Ohio Farm Bureau Federation; and Jessica Fox, Electric Power Research Institute. However, baselines are a complex topic and any misinterpretations, errors or omissions are solely the responsibility of the AFT staff who slowly and methodically reviewed countless papers, talked to WQT program managers and staff to supplement the papers, laid out the results and arrived at conclusions and recommendations.

**TABLE OF CONTENTS**

## SUMMARY

Reducing nutrient additions to rivers and lakes to improve water quality is one of the most costly and challenging environmental issues faced by our nation. One promising approach to improving water quality is to allow regulated point sources like municipal wastewater treatment plants and utilities to invest in conservation practices that reduce nutrient run-off on farmland. Farmers can often install land-based practices like cover crops or improved manure treatment areas and reduce nutrient run-off from farms at a much lower cost than a point source facing expensive technological upgrades to remove additional nutrients from wastewater discharges. The point sources can then use the resulting nutrient credits to meet part of their permitted discharge limits. Because this approach may offer a compliance alternative that can help point sources meet regulatory requirements more cost-effectively, many states and watersheds have developed or are in the process of developing trading programs. Although water quality trading can involve nutrients, temperature, dissolved oxygen, selenium and other parameters, this paper focuses primarily on agricultural baselines for trading nutrient credits.

Determining what farmers are required to do under current statutes and rules and deciding if they need to do more to reduce nutrient run-off before being allowed to generate a credit is one of the key elements that can affect the outcome of trading when agriculture is involved. Known as “baselines,” these are the pollutant control requirements that apply to both credit sellers (farmers) and buyers (regulated point sources) in the absence of trading. To enter the trading market and generate credits, farmers must first meet the market’s baseline requirements. The wide variability among agricultural baselines in existing markets is notable. Some use the farmer’s current practices as the baseline, some require that farmers install specified conservation practices first (technology-based), others require that farmers reduce nutrient run-off by a certain amount (performance-based) and some use a combination of both technology-based and performance-based requirements. Baselines have an impact on how many farmers qualify for trading. If they require farmers to implement a number of conservation practices at their own expense before selling credits, few farmers may qualify and the rest may only participate if there is a suitable financial incentive for doing so (i.e., credits are selling at a high enough price). On the other hand, if credit prices are lucrative enough, perhaps setting a more stringent baseline can “encourage” farmers to implement more practices in order to qualify to sell credits. This paper addresses this essential element of a WQT system—putting WQT and baselines into context, presenting current practices, identifying critical issues, assessing findings and making recommendations.

## INTRODUCTION

***Nutrient problems are widespread and have enormous impacts***
Almost half of the rivers, streams, lakes, aquifers and estuaries in the United States do not meet applicable water quality standards and excess nutrients are a big part of the problem. Half of the streams have medium to high levels of nutrients, 78 percent of assessed coastal waters are over-enriched by nutrients (eutrophication) and nitrate drinking water violations have doubled in eight years (US EPA 2011a, b). Twenty-seven percent of the nation’s rivers and streams have excessive levels of nitrogen, 40 percent have too much phosphorus and 24 percent are rated poor due to loss of healthy vegetative cover, impacting both temperature and turbidity (US EPA 2013). A decadal assessment of trends in concentrations of nutrients from 1993 to 2003 shows minimal changes in concentrations of studied streams and more upward than downward trends in concentrations at sites with changes. Upward trends were evident among all land uses (Dubrovsky et al. 2010).

***Reducing nutrients in water is one of the most costly and challenging environmental problems faced by our nation***
To reduce nutrients in surface and groundwater, communities must control excess nutrients in stormwater runoff, municipal wastewater and industry discharges, air deposition and agriculture (US EPA 2011b). Currently, laws require only point sources (wastewater treatment plants, industrial sites and other individual sources with discrete, easy to measure discharges including some confined animal feeding operations) to treat their discharges. The costs for communities to treat wastewater discharges and storm water runoff are increasing as communities expand or their treatment facilities age. In its most recent survey, EPA estimated that the nation’s wastewater infrastructure needs totaled $298 billion (in 2008 dollars) (GAO 2013). Costs of treatment upgrades for utilities and other industrial facilities to meet more stringent nutrient standards may be equally high and will be passed on to their customers.

***In most watersheds, reducing nutrient loading by nonpoint sources, especially agriculture, is the key to future improvements in water quality***
Although significant progress has been made in treating discharges from point sources, finding an efficient means to deal with diffuse nonpoint sources (NPSs) of pollution from agricultural land, urban development, forest harvesting and the atmosphere is a more stubborn problem (USGS 2010). The vast majority of our nation’s impaired waters have no possibility of being restored unless nutrient discharges from NPSs can be reduced to acceptable levels (US EPA 2011a). The amount of pollution discharged by NPSs varies hour-to-hour and season-to-season, making it difficult to track and quantify the sources over time. This makes NPSs much more difficult to evaluate and control than point sources so counties, states and the federal government use a mix of education, incentives, disincentives and regulations to try and reduce NPS nutrient pollution. Finding more effective tools to reduce NPS pollution is no longer just desirable, it is imperative.

Although there are multiple types of NPSs in most watersheds, agriculture is the leading source of nutrients for 48 percent of impaired river and stream miles, 41 percent of impaired lake acres (excluding the Great Lakes) and 18 percent of impaired estuarine waters (US EPA 2002). Agricultural lands may often be the primary source of excess nutrients because so many acres are farmed and nutrients are critical for the growth of crops and animals (Lory 2006; Lory and Cromley 2006). The increased use of commercial fertilizers and manure has led to a corresponding increase in the occurrence, loads and concentrations of nutrients in streams, rivers, lakes and estuaries. Even when farmers apply fertilizer at the recommended agronomic rates, only 30 percent to 50 percent of the nitrogen added to the soil is taken up by the plant depending on the species and cultivar, with the rest lost to surface run-off, leaching of nitrates, ammonia volatilization or bacteria competition (US EPA 2009b; McAlllister et al. 2012). The dynamics of nutrient runoff in the Corn Belt have also been affected by the historic changes in land use and hydrology that resulted from converting prairie and wetlands to cropland and the use of drainage tiles to more efficiently drain water from fields (IA DALS et al. 2012). The amount of nutrient runoff from farm fields depends on the weather, intensity and distribution of fertilizer use, the form and timing of fertilizer used, land management practices, soil and aquifer characteristics, and the chemical properties of the nutrient compounds themselves.

***Allowing water quality trading (WQT) between point sources and farmers can save significant money and result in additional environmental improvements***

The costs of preventing a pound of nitrogen (N) or phosphorus (P) from leaving farm fields can be significant to a farm operation and farmers rarely have the option of passing these costs on to their customers. However, these costs are typically four to five and sometimes 10 to 20 times less than the cost to remove the same amount from municipal wastewater or stormwater and industry discharges (NACWA 2011). Actual cost comparisons vary widely. In the Chesapeake Bay region, costs to reduce N loadings from agricultural fields ranged from $1.50 to $22 per pound compared to costs ranging from $15.80 to $47 per pound from municipal wastewater treatment plants. Reducing a pound of N from urban stormwater was more than $200 per pound (NACWA 2011). In the business case completed for the Ohio River Basin WQT market, the costs to reduce N run-off from agricultural fields were two to five times lower than the costs faced by wastewater treatment plants and industrial point sources and two to three orders of magnitude lower than the costs to remove N from urban stormwater (Mark Kieser, personal communication, 8/29/13).

In addition, land-based conservation practices that help absorb nutrients or retard run-off can provide additional benefits for the environment by creating wildlife habitat, improving soil health or sequestering carbon (Schnepf and Cox 2006; Shortle 2010). A recent analysis of the climate co-benefits that could result from WQT in the Chesapeake Bay watershed concluded that Maryland’s agricultural sector could offset half of its greenhouse gas emissions by 2020 primarily through WQT projects (Gasper et al. 2012).

The recognition of this significant cost differential between point sources and agricultural NPS led to the idea that farm-based conservation practices could be used to cost-effectively offset discharges from point sources. Water quality trading is a voluntary option that regulated point sources can use to meet part of their permitted discharge limits. The idea of using a trading market to improve water quality emerged from the early success of markets among electric utilities for transferable sulfur dioxide emission allowances that provided both cost savings and flexibility (Carlson et al. 2000). The primary goal of WQT markets is to improve water quality at a lower cost. However, states cite many additional benefits such as encouraging early progress towards water quality standards and achieving water quality improvements more quickly, providing more flexibility, providing incentives for voluntary NPS load reductions, achieving greater environmental benefits, securing long-term improvements in water quality (through retirement of credits), encouraging a watershed approach and providing incentives to develop new, more accurate and reliable quantification protocols and procedures (See Appendix I: Baselines in State Water Quality Trading Rules).

Projected cost savings generated by allowing trading between point sources and farmers are significant. In the Chesapeake Bay watershed, computer modeling predicts $1.21 billion in savings per year (or a 82 percent reduction in costs) if farmers trade with regulated urban stormwater sources and $182 million per year in savings (or a 49 percent reduction in costs) by allowing watershed-scale trading between 475 significant municipal and industrial wastewater discharge facilities and farmers (Van Houtven et al. 2012). The analysis also finds an increase in potential cost savings as the geographic scope of trading activity increases, rising about 35 percent when in-state trading goes to inter-state trading. It should be noted, however, that an earlier report was less optimistic, concluding that the potential for reducing costs via point to NPS trading in the Chesapeake was limited, partly because of uncertainties in BMP efficiencies, problems with verification and differing approaches to baselines (NAS 2011). Nutrient trading in the Mississippi River Basin was also projected to greatly reduce the costs of meeting water quality goals in the Gulf of Mexico, saving sample wastewater utilities 63 percent over 20 years (Perez et al. 2011).

***Setting the baseline for participation by farmers in WQT can have a critical impact on the success of the program***

When WQT systems include trading with farmers, they can provide critical funding to pay farmers to install conservation practices that reduce the run-off of nutrients. First, however, programs must decide where to set the baseline, what kind of baseline to set and what practices, if any, they will require farmers to implement or install before being allowed to generate credits. This paper addresses this essential element of a WQT system—putting WQT and baselines into context, presenting current practices, identifying critical issues, assessing findings and making recommendations.

## WHY THE INTEREST IN WQT PROGRAMS?

### WQT Can Help Farms Make Water Quality Improvements

***Agriculture is a leading source of nutrients in many watersheds***

While the appeal of WQT lies in the significant cost savings to communities and industries struggling to meet more stringent standards for nutrient discharges, at the same time, WQT can help pay for additional conservation practices on farm and ranch land that provide multiple benefits to the environment. About 80 percent of U.S. croplands, pasturelands and rangelands (829 million acres) require conservation practices to control wind and water erosion, prevent nutrients and pesticides from reaching waterways, enhance wildlife habitat and improve grazing lands (Claassen et al. 2007). Producers voluntarily implement conservation practices or best management practices (BMPs) to reduce nutrient run-off as a condition of receiving federal subsidies (conservation compliance) or because they make sense for their operations. They typically use their own funds but can apply for federal or state cost-share incentive funds to partially cover the costs.

Nationwide, about 51 percent of cropland acres (151 million) have conservation treatment in place to control the loss of sediment and nutrients to acceptable levels (USDA RCA 2011). In the major water basins studied so far, existing conservation practices have reduced edge-of-field sediment loss by 47 percent to 69 percent, the loss of nitrogen through surface run-off by 35 percent to 43 percent, subsurface run-off by 11 percent to 31 percent, and the loss of total phosphorus by 33 percent to 49 percent (USDA NRCS 2010, 2011a, 2011b; 2011c). Despite this progress, significant percentages of cropped acres need additional conservation treatment. In the Ohio-Tennessee Basin, 24 percent of cropped acres lack conservation practices to prevent significant loss of soils and nutrients and 46 percent of cropped acres need additional conservation practices to prevent continuing losses of soils and nutrients (USDA NRCS 2011d). In the Upper Mississippi River Basin, 15 percent of cropped acres lack needed conservation practices and 62 percent need additional conservation practices (USDA NRCS 2010). In the Great Lakes Region, 19 percent of cropped acres are critically undertreated and 34 percent need additional conservation practices (USDA NRCS 2011b). And, in the Chesapeake Bay Region, 19 percent of cropped acres are critically undertreated and 61 percent need additional conservation practices (USDA NRCS 2011a).

***Regulation of agricultural water pollution is not sufficiently effective to achieve water quality goals without significant impact on farm viability***

For the most part, only the most egregious nutrient run-off is penalized. Social, geographic, economic and political factors make the option of directly regulating farms and ranches to reduce nonpoint pollution almost impossible. At the federal level, the Clean Water Act (CWA) (the Federal Water Pollution Control Act (P.L. 92-500)), enacted in 1972, is the principal law that deals with polluting activity in the nation's streams, lakes, estuaries and coastal waters (Copeland 2010). The CWA separates water pollution into two categories of sources: 1) point sources (PS), which include wastewater treatment plants, industrial sites, and other individual sources with discrete, easy to measure discharges (like some confined animal feeding operations); and 2) nonpoint sources (NPS), which contribute pollution from multiple smaller sites spread across a landscape, which include farms, ranches, residential lots, urban housing, forested lands, etc. Since NPSs are numerous, dispersed, variable, small and hard-to-contact entities, the CWA focuses instead on point sources, applying stringent requirements on industries and cities to abate pollution and meet the statutory goal of zero discharge of pollutants (via National Pollutant Discharge Elimination System (NPDES) permits). The CWA also authorized federal financial assistance for municipal wastewater treatment plant construction (replaced by the Clean Water State Revolving Fund, a low interest loan program, in the 1987 Water Quality Act). The CWA relies on states and other entities to work with NPSs to reduce their nutrients.

The only agricultural operations that the CWA technically regulates are Confined Animal Feeding Operations (CAFOs) that are defined as point sources. The States are required to assess their waters and, if streams or rivers don't meet water quality standards, they are listed as impaired. Once waters are listed, States are required to set a Total Maximum Daily Load (TMDL) for the impaired watershed that estimates how much of the pollutant load is attributed to point and nonpoint sources. All sources are then assigned load allocations based on their pollutant loads. In watersheds with farming, the TMDL estimates the nutrient runoff due to agricultural activities and assigns farmers a load allocation that they will need to meet if water quality is to be restored. The CWA requires the States to provide "reasonable assurance" to lower reduction requirements on the waste load allocation entities. Otherwise, the CWA provides no legal authority for the load allocation reductions needed to meet water quality standards. Although State rules may set requirements, the federal CWA does not. The CWA does have planning requirements for delegated authorities to provide a combination of state rules, education and incentives that will work. Nonpoint sources are the primary source of nutrients in 76 percent of all TMDLs (U.S. EPA 2011c). Experience has shown that the TMDL approach has not been successful in securing widespread adoption of required practices and the resulting improvement in water quality (Hoornbeek et al. 2011).

At the state level, over 30 states have laws with provisions that regulate agriculture under certain conditions—usually when voluntary approaches fail to achieve water quality goals. However, enforcement is problematic (Environmental Law Institute 1998). States commonly require farmers to implement conservation plans that contain recommended management practices, such as conservation tillage, nutrient management, pesticide management and irrigation water management. These plans can be required statewide, or in areas particularly vulnerable to agricultural pollution (Environmental Law Institute 1997). States use various mechanisms to make BMPs enforceable—or at least something more than voluntary—by linking them to other enforcement mechanisms. The following examples demonstrate the great diversity in State legislation (all examples taken from Environmental Law Institute 1997). The first approach is to make BMPs directly enforceable in connection with required plans and permits. Vermont prescribes "accepted agricultural practices" which must be implemented across the state and these provide an enforceable baseline standard—other BMPs may be imposed in specific places but only in accordance with limiting authority. A second approach is to make BMPs enforceable, but only after the fact when a "bad actor" is causing pollution. Ohio requires all of its SWCDs to adopt regulatory BMPs and enforceable plans for agriculture to control erosion and sedimentation but action is triggered only when a complaint is filed and if an order requires installation of a pollution abatement practice eligible for a cost-share, it cannot be enforced against the operator unless 75 percent cost-share funds are actually available. Virginia authorizes the state to investigate and “if substantial evidence exists to prove that an agricultural activity is creating or will create pollution” then the Commissioner of Agriculture and Consumer Services must notify the operator and require an “agricultural stewardship plan” to be submitted within 60 days. Upon approval by the SWCD, the activity may continue and the plan must be implemented, otherwise enforcement occurs. A third approach makes BMPs the basis for an exemption from a regulatory program. In New Hampshire, agricultural activities are exempt from the state’s comprehensive shoreland law if conducted in conformance with BMPs. A fourth approach is to make compliance with BMPs an allowable defense to a regulatory violation. For example, a state could be prohibited from taking action under a water pollution control statute against a farm that is implementing BMPs, whether or not the operation is causing pollution. Maine law provides that any method of operation used by a farm may not be considered a violation of any municipal ordinance if it is a BMP. Finally, many states make compliance with BMPs a defense to nuisance actions. For example, a neighboring landowner could not sue under state nuisance laws if BMPs are implemented. Florida exempts farmers using BMPs from liability for replacing water supplies damaged by nitrates.

***Conservation incentives are important but insufficient in scale to achieve clean water***

States and the federal government provide funding that can help farmers defray the costs of reducing nutrient loading. These programs partially cover the expense of implementing and maintaining conservation practices for farmers who apply and are accepted for cost-share assistance. In fact, many state laws are linked to the availability of cost-share funds to help farmers comply with regulations. However, funding and technical assistance to help farmers implement conservation practices has historically been spread thinly and widely to help farmers address multiple environmental concerns, not just water quality. In the most recent farm bill (2008), USDA NRCS implemented a broad spectrum of initiatives to more effectively address priority natural resource concerns by delivering systems of practices, primarily to the most vulnerable lands within geographic focus areas. However, funding for conservation programs is likely to be reduced in the next farm bill. Current farm bill conservation programs have an average of four times more applications than availability (Blumenauer 2013).

***At best, conservation funding from public sources covers a fraction of what is needed***

The farm bill provides the bulk of the funds used by farmers to install conservation practices through a variety of cost-share programs administered by the USDA Natural Resources Conservation Service (NRCS) and Farm Services Agency (FSA) (Cox 2007). About 12 percent of the pasture, ranch and crop land in the United States are enrolled in over 20 different conservation cost-share programs (Stubbs 2012) designed to improve environmental management on 120 million acres. About 35 million acres are enrolled in land retirement or land restoration programs. Technical assistance to assess conservation needs and design workable conservation systems for farmers reaches almost 25 million acres annually (USDA RCA 2011). The farm bill also requires producers growing subsidized crops on highly erodible land (HEL) to use soil conservation practices, reduce erosion on any lands converted from grasslands and refrain from draining wetlands (conservation compliance). These provisions significantly reduce soil erosion—and some nutrient runoff associated with soil loss—on about 196 million acres, about 19 percent of the pasture, ranch and crop land in the United States.

In 2010, investments to improve environmental management (both technical and financial assistance) totaled $1.93 billion and covered a wide range of environmental improvements. Only 10 percent to 15 percent of this funding was used to control nutrients directly (NACWA 2011). To put this modest level of funding into perspective, about 35 percent of all crop acres use recommended nitrogen BMPs, leaving over 108 million acres still in need of enhanced nutrient management practices at an estimated cost of roughly $1.4 billion/year (Ribaudo et al. 2011). Two states have estimated what it would cost their farmers and ranchers to reduce nutrient loading statewide. Iowa's comprehensive nutrient reduction strategy sets target load reductions for agriculture of 41 percent of the statewide total N and 29 percent of total P to meet the Gulf Hypoxia Action Plan goal. Estimates of initial investments needed for Iowa's 90,000 farmers to meet these targets range from $1.2 billion to $4 billion (IA DALS et al. 2012). In Florida, 13.6 million acres of Florida farm and ranch land may need to spend between $855 to $3,069 million in total capital costs to implement the full suite of BMPs needed to meet EPA's proposed numeric nutrient criteria and $171 to $614 million/year in operating and maintenance costs (Budell et al. 2010). In addition to the costs of the BMPs, the implementation of on-farm water treatment and retention systems could displace 10 percent of the agricultural land resulting in a $621 million direct loss with ripple effects of job losses of $1.148 billion.

***Better targeting of BMPs could improve water quality faster and more effectively***

In most watersheds, there are "critically undertreated" areas that are prone to run-off and lack the necessary conservation practices to prevent run-off from happening. Research has shown that only a small proportion of a watershed is responsible for most of the P loading (Sharpley et al. 2009). For example, by working with just eight of the 61 farmers in the area covering 12 percent of the watershed, researchers can address 73 percent of the P load in Wisconsin's Pleasant Valley Watershed (Nowak 2010a). Ideally, the most cost-effective way to protect water quality is to implement BMPs on watershed areas that contribute the most to water quality impairment—instead of relying on voluntary implementation of BMPs randomly scattered throughout the watershed (Tuppad et al. 2010). By targeting the placement of BMPs, watersheds can reduce annual average pollutant loads by 10 percent using less than half the land area that random placement of BMPs requires. The benefits of targeting are greater for the initial increments of BMP adoption and decrease as the proportion of BMP adoption on targeted land areas increases. However, even though targeting increases effectiveness, it may take more money and effort than random implementation since landowners must be identified, located, approached and persuaded. The most cost-effective strategy may be to transition from targeting during the early phase of implementation efforts when returns (pollutant-yield reductions per dollar invested in implementation) are still high, to random (first come, first served) implementation when returns are lower (Tuppad et al. 2010). If WQT programs focus on securing the most cost-effective credits, they may arrive at a similar outcome.

**WQT Can Improve Water Quality and Save Money**

***WQT programs, if properly designed, can provide the level of incentive and scale to be effective***

EPA first proposed WQT as a draft framework to offer greater efficiency in achieving water quality goals in 1996 and issued a final policy statement in 2003 (U.S. EPA 2003). In endorsing WQT, EPA estimated that annual costs were $14 billion for private point source controls and $34 billion for public point source controls (in 1997). EPA estimated that allowing flexible approaches to improving water quality could save $900 million annually.

By 2011, it cost nearly $60 billion a year to build, operate and maintain some 16,000 municipal wastewater treatment plants nationwide (NACWA 2011). In its most recent needs survey, EPA estimates that the funding to upgrade the nation's wastewater infrastructure totaled $298 billion (in 2008 dollars) (GAO 2013). As stated earlier, WQT programs can target fund to the actions that are the most cost effective and can have the greatest impact. EPA's growing concern that nutrient pollution could potentially become one of the most costly and challenging environmental problems faced in the United States led the agency to revise their strategy to address nonpoint source pollution in March 2011 (U.S. EPA 2011a). One key EPA action is to emphasize using "water quality trading and other market-based tools where appropriate, to improve cost effective clean-up of impaired watersheds."

***WQT could help improve water quality in many of the nation's watersheds***

Trading can occur between two regulated point sources (PS) or between a PS and an unregulated NPS (like a farm or ranch). In the latter scenario, the PS elects to contract with farmers or ranchers upstream or in the same watershed to install conservation practices or BMPs to reduce the amount of nutrients entering water bodies from farm fields. Phosphorus moves about 50 miles or so in rivers and streams before dissipating and is the nutrient of most concern for small watersheds (Garman et al. 1986). In contrast, N is highly mobile so it is of more concern to the much larger watersheds like the Mississippi River Basin (Lory and Cromley 2006) and Chesapeake Bay. The installed BMPs generate nutrient credits that the PS can use to meet CWA requirements (its NPDES permit) if the available technologies they use in a watershed fail to achieve their water quality discharge limits.

Sustained trading between multiple PS and farmers is possible where excess nutrients are the cause of impairments. This happens in 34 percent (710) of the 2,111 eight-digit Hydrologic Unit Codes watersheds in the contiguous United States (150,000 to 1,250,000 acres each) (Ribaudo and Nickerson 2009). Of these, 224 watersheds have enough point sources and farms to sustain active phosphorus trading (about 322,000 farms or 15 percent of all U.S. farms) and 142 watersheds might sustain active nitrogen trading (about 175,000 farms or 8 percent of all U.S. farms). Additional, more limited trading opportunities may arise from the protection or recharge of sole source aquifers, wellhead source protection for small communities, and limited trading between food processors seeking to expand and the producers they buy from.

***WQT protocols, tools and procedures can help improve effectiveness of existing conservation programs***

WQT programs could help drive funding toward farm conservation practices that reduce nutrient loading at the lowest cost and have the greatest impact since those actions will generate the most credits at the lowest cost. The measurement tools used by water quality trading (e.g., credit estimating tools such as USDA's Nutrient Tracking Tool and EPA Region 5's load reduction spreadsheet, and watershed models such as the Watershed Analysis Risk Management Framework (WARMF) for the Ohio River Basin and the Chesapeake Bay model, can be used to improve the effectiveness of traditional conservation cost-share programs including farm bill programs and state water quality programs. The development and streamlining of verification practices (e.g., third-party audits) is equally useful (US EPA 2008; Maroon 2011). In addition, involving SWCD staff in WQT helps them to better recognize which practices are more cost-effective pollutant control approaches. By integrating some of the rigorous protocols of WQT programs, conservation programs can move toward "paying for performance," not just cost sharing practices and thus become more cost effective and accountable. These are important ancillary benefits of developing WQT and other environmental markets.

***Trading at scale may generate significant new funding***

WQT is still in its formative stage and emerging markets have not yet reached a scale large enough to be self-sustaining. Most trading projects first complete a business case analysis to determine if a market exists. This can include an analysis of water quality issues in the pilot project area, potential regulatory drivers, the economic case for point sources and potential cost savings, nonpoint source credit generation potential and stakeholder readiness.

Before the Great Miami River Watershed WQT Program was established, a market analysis estimated that nutrient standards could be met by trades between point sources and farmers at a cost savings of $380 million through implementation of no-till management practices on 50 percent of the row crops in the watershed (Kieser & Associates 2004). Without WQT, the costs for the 334 point sources in the 3,802 square mile watershed which spans 15 counties in southwestern Ohio ranged from $6.45 to $1,500/lb for reducing total P and $2.20 to $313/lb. for reducing total N. The Great Miami program was initiated in 2006 before nutrient effluent limits were set with a $1 million USDA NRCS grant and contributions from wastewater treatment plants (WWTPs) (Newburn and Woodward 2012). By 2010, contributions from the WWTPs had exceeded $1.2 million (half towards load reducing projects and the balance to support administrative and water quality monitoring costs). Five separate entities have contributed funding with one representing three cities and another that has four plants and inter-plant trading options. As of 2012, the trading program had invested $1.8

million on 397 on-farm projects, with contracts for nutrient load reductions of 1.1 million pounds. Nutrient effluent limits are still pending. Although this is one of the largest WQT markets to date involving PS and NPS trading, it represents only a fraction of the PSs and farmers in the watershed. In 2012, U.S. EPA approved a TMDL implementation plan for the 747 square mile upper Great Miami River watershed and the MCD nutrient trading program plays a significant role in that strategy (OEPA 2012).

Give sufficient numbers of motivated PS buyers and NPS sellers, a market should function as a self-sustaining alternative source of funding for farmers to implement conservation practices. However, very few, if any, trading programs have reached a scale where they function as a viable funding source for nonpoint sources. Reasons for low or no trade volumes reported in interviews with program managers include lack of trading partners, lack of adequate regulatory drivers (e.g., limits on effluents are not sufficiently stringent to create a demand for trades), uncertainty about trading rules, legal and regulatory obstacles to trading, high transactions costs, cheaper alternatives for point sources to meet regulatory requirements than trading with nonpoint sources, or simply, the programs being too new to permit trades (Shortle 2012).

## THE ROLE AND FUNCTION OF BASELINES IN TRADING PROGRAMS

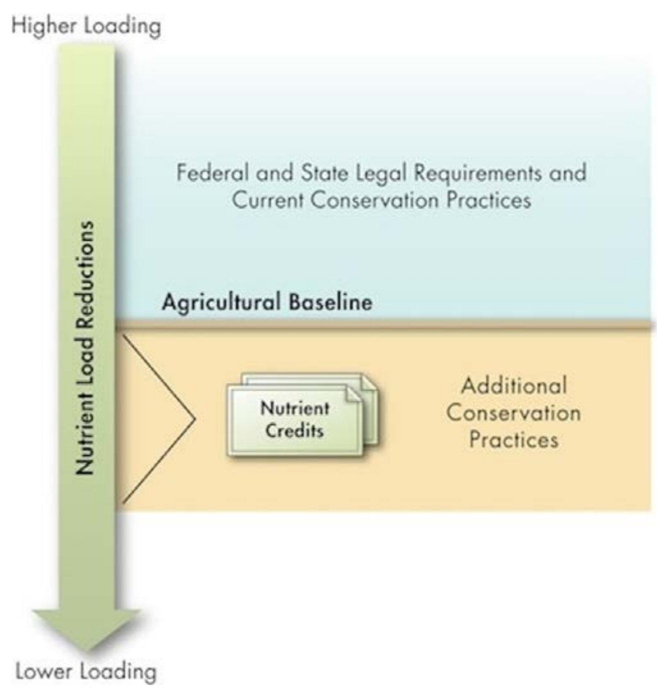
***Baselines are the conservation practices or level of performance that must be in place before credits can be generated with additional conservation practices***

The term "baseline" has three distinct meanings, and this ambiguity adds confusion to an already complicated subject. The term is commonly used to describe <u>an initial condition</u> prior to an action, such as the current rate of residential recycling prior to implementation of an outreach or incentive program. In this context, a baseline can be established empirically and changes from baseline conditions can be readily measured. But the term often has a considerably different meaning in environmental markets or trading, where it is more commonly used to describe a <u>threshold for entry</u> into the trading market (see below). This may be the current condition or another level of environmental performance. Finally, the term baseline is also used to identify <u>a performance goal</u> achieved when projects to improve water quality, habitat projects or other environmental resources have already been widely implemented. This last definition is common among regulatory agencies that use the term to describe the endpoint that follows full implementation of practices to meet load allocations identified in Total Maximum Daily Load (TMDL) studies.

The EPA WQT Toolkit for permit writers (US EPA 2009a) defines Baseline as: "t*he pollutant control requirements that apply to buyers and sellers in the absence of trading. Sellers must first achieve their applicable baselines before they can enter the trading market and sell credits. Buyers can purchase credits to achieve their applicable baselines once they have met their minimum control levels."*

In WQT, producers must meet the baseline established for them before they can start selling nutrient credits or offsets. It can be expressed as a specific pollutant reduction (e.g., producer must reduce phosphorus loadings by 20 lbs/day and can only sell offsets or credits over that amount); a percentage of a pollutant reduction (producer must reduce sediment run-off by 20 percent from his/her current discharge before selling credits); or a minimum level of conservation practice implementation (e.g., producer must install a 35 foot buffer of permanent vegetation between the field and streams before being eligible to sell credits) (CTIC 2006). Since everyone must meet the same requirements, the baseline provides equity among producers and can also help ensure a certain level of water quality improvement in the watershed (CTIC 2006).

Whether credits are generated as a result of going above a baseline or below a baseline, depends on your point of view and can be a potential point of departure between point and nonpoint sources. For example, in the Ohio River Basin Water Quality Trading Project (ORB WQT), producers attending the listening sessions thought in terms of adding conservation practices or going above the baseline to generate credits since their frame of reference was implementing practices. In contrast, permitting authorities focused on reducing nutrient loads or going below the baseline to generate credits. In the trading plan, the ORB WQT project acknowledged these differing frames of reference by explaining: "*The term "baseline" is used in this Plan to define when a water quality credit can be generated. In simplest terms, the agricultural baseline sets the bar that must be achieved by a farm before that farm can generate credits. Once a farm meets the baseline requirements, any further reductions in nutrient runoff achieved by implementing additional BMPs may qualify as Point of Generation Credits. For a nonpoint source to generate a credit, it must reduce its loading of TN or TP below current conditions (i.e., beyond what is currently being achieved with existing land uses and management practices) as of the date that this Plan is fully executed by the states AND otherwise comply with presently-applicable legal requirements*' (EPRI 2012). The following diagram illustrates this concept (EPRI 2012):



***Baselines impact the quantity, costs and quality of credits from agricultural watersheds***

Markets have to decide whether to set baselines that require multiple conservation practices to be in place prior to trading and might limit participation or require fewer practices and maybe increase participation (Chesapeake Bay Environmental Markets Team 2010). This decision can determine which farmers benefit—the ones who have already voluntarily implemented BMPs or the ones who need to but have not yet done so, an equity issue that may be “inherently a political decision” (Ghosh et al. 2011). And regardless where the baseline is set, the need to ensure that the credits generated are a direct result of the market must be balanced against the costs and difficulties of documenting it (Marshall and Weinberg 2012).

***Stringency*:** If the baseline is set at current practices, credit supply should be plentiful but some of the practices that are implemented may have been implemented anyway without the market (Chesapeake Bay Environmental Markets Team 2010). Although this may or may not be the case, one could argue that the watershed benefits if conservation practices go in sooner as a result of WQT as opposed to waiting for farmers to eventually install practices. Conversely, if the baseline requires several additional conservation practices be in place prior to trading, NPS that otherwise could have reduced their loading at a relatively low cost may decline to participate—unless cost-share programs or the buyer can help cover the costs of installing required practices. This could drive up the costs of credits, limit the pool of eligible credit sellers and reduce the effectiveness of the program (Chesapeake Bay Environmental Market Team 2010). Just as with many PS, where the incremental costs of treatment climb steeply from primary to secondary to tertiary treatment, the first BMPs applied to a farm landscape are likely to be the most cost-effective because nutrient loads are still high (Selman et al. 2010). In other words, the selection of the baseline will impact the costs of the NPS credits in the market and, ultimately, the number of credits that NPS can sell to regulated PS (Ribaudo et al. 2009; Ghosh et al. 2009; USDA NRCS 2011c).

***Equity*:** Some farmers in any given watershed have adopted few if any conservation practices to reduce nutrient loading (“late adopters”) while others are voluntarily using a wide array of conservation practices to minimize their off-farm impacts (“early adopters”). Programs have to decide whether it is fair to allow the “late adopters” to participate in the market when there are other producers in the watershed who have already started to implement practices voluntarily and have proved themselves to be good stewards (See Appendix II: Feedback from Agriculture on Baselines). This involves policy and may not be just a program decision— the CWA delegated authority may or may not approve the trading program so they should also be involved with “policy” decisions.

***Baseline documentation:*** To protect the integrity of trading programs, farmers have to implement new BMPs that go beyond what they are already required to do or that they may do voluntarily in the absence of the trading market. The credited practices must be a direct result of market participation and the required level of conservation that must be in place should never be less than existing practices. However, programs may find baseline documentation to be a challenging undertaking (See Appendix III: Difficulties in Measuring and Verifying Baselines) and the need to ensure that the credits generated are a direct result of the market must be balanced against the costs and difficulties of documenting it (Marshall and Weinberg 2012).

***So far, the most active markets have the least stringent baselines***

The WQT programs with the highest number of completed P to NPS trades are those that do not require additional conservation practices before farmers can sell credits—the Great Miami Conservancy District program (Newburn and Woodward 2011) and the Alpine Cheese/Holmes County program (Sugar Creek Project of the OARDC 2006), both in Ohio. Both programs saw WQT as an opportunity to reach out to farmers who were not responding to federal cost-share incentives or other grant opportunities. The Great Miami program required farmers meet existing Ohio regulatory requirements. In Ohio, farmers are assumed to be in compliance unless complaints are filed against them. If there is a complaint, the SWCD asks the farmer to comply, provides any assistance (including cost-share funds) and gives the farmer a voluntary period to correct the problem. The Great Miami program provided a source of funding for farmers who needed additional practices to avoid triggering an enforcement process. The program believed that bringing conservation practices to farms that were not currently using BMPs had a much greater potential to improve water quality. However, the program excluded any nutrient load reductions funded by other cost-share or granting opportunities. Program developers believed that any additional baseline requirements would create yet another obstacle to water quality improvements (Dusty Hall, personal communication). In Holmes County, private funding from Alpine Cheese to implement BMPs was acceptable to the Amish farmers in the county whereas funds from government sources were not (Sugar Creek Project of the OARDC 2006). Since both programs used current farm practices as the baseline and were easy for farmers to understand and implement, they had broad appeal to farmers in their watersheds. Programs that require an additional level of conservation practices are not nearly as active but this may or may not be related to the baseline they have set since so many variables impact activity.

## TYPES OF BASELINES

***Setting baselines for farmers with and without a TMDL***

We find it helpful to separate baselines into two different contexts: without a TMDL and with a TMDL. Without a TMDL, nutrient standards are the regulatory driver for water quality and a point source's NPDES permit stipulates federal and state required effluent limitations. NPS, including agriculture, may or may not have any required reductions. For example, Kentucky's Agriculture Water Quality Act requires all landowners with 10 or more acres that are being used for agriculture or silviculture operations to develop and implement a water quality plan. In contrast, in most TMDL situations, agriculture can be considered part of the solution to achieve water quality goals and is assigned load reductions based on their load allocations, as previously described. As part of the state plans to achieve the TMDL goals, agriculture would have to meet its share of the reduction for the plan to succeed (see Appendix I for short descriptions of the baselines in State WQT rules and Appendix IV for a summary table of current program baselines).

***Baselines in non-TMDL situations***

In non-TMDL situations, effluent limitations serve as the primary mechanism in point source NPDES permits for controlling discharges of pollutants to receiving waters. When developing effluent limitations for an NPDES permit, permit writers consider limits based on both the technology available to control the pollutants (i.e., technology-based effluent limits) and limits that are protective of the water quality standards of the receiving water (i.e., water quality-based effluent limits). For NPDES permit holders, WQT can represent a more flexible compliance tool. For example, buyers who volunteer to purchase credits during the pilot phase of the Ohio River Basin WQT pilot may be eligible for flexible compliance schedules to achieve regulatory reduction requirements that are imposed in the future if those requirements are more stringent than the reductions achieved through pre-compliance trading (EPRI 2012). Here, early participation may make it possible for point sources to postpone upgrades for a short period of time until an upgrade serves multiple purposes or the plant is decommissioned.

Discussions about baselines for farmers center around existing or current land uses, some documentation of prior land use, the use of reasonable or appropriate BMPs, and compliance with local, state and federal regulations—or some combination thereof (coupled with the issues of methods/techniques) (See Appendix III).

Defining “comply with existing regulations” raises two important issues. First, programs must determine if the existing regulations are specific enough to define baseline requirements. Some states have minimal regulations while others establish aspirational goals not to pollute at all that could exclude trading altogether. For example, water quality legislation in Washington State cites “*It shall be unlawful for any person to throw, drain, run, or otherwise discharge into any of the waters of this state, or to cause, permit or suffer to be thrown, run, drained, allowed to seep or otherwise discharged into such waters any organic or inorganic matter that shall cause or tend to cause pollution of such waters according to the determination of the department…*” (Washington State Legislature 2013). Second, programs have to decide what “comply” with existing regulations means. While many states have broad “bad actor” laws that authorize enforcement actions against activities that generate NPS pollution, they typically operate on a reactive complaint-driven basis (U. S. EPA 2011c). For example, Ohio farmers are assumed to be in compliance unless they have been reported or cited as being out of compliance. As such, many farmers may lack some practices or not quite meet the performance envisioned in the regulations but are legally considered in compliance since they haven’t been cited (Environmental Law Institute 2000). How programs resolve these issues affects whether farmers who are poor stewards or good stewards participate and their competitive advantage in offering the lower cost credits.

***Baselines in TMDL watersheds***

A TMDL can create a framework for WQT by setting an overall cap on a specific pollutant and dividing it amongst the various sources (ID DEQ 2010). In some cases, a TMDL can act as the driving force that motivates the participation of key players, particularly PS who may have previously been governed only by effluent concentration limits (US EPA 2008). Under a TMDL, all sectors are included, load allocations are calculated, and reductions are assigned. All sectors are "required or counted on" to reduce nutrients by their load allocation amount. WQT must avoid shifting the reductions that NPS are expected to make without the market as part of the overall TMDL cap to PS who then use them to offset the reductions they are also required to achieve. Recently, EPA re-emphasized the use of WQT to help regulated PS meet the water quality-based effluent limits (WQBELs) in their NPDES permits and reiterated that "*where a TMDL has been approved or established by EPA, the applicable point source waste load allocation or nonpoint source load allocation would establish the baselines for generating credits*" (US EPA 2012). If states would like to allow for trading after a TMDL is established, EPA recommends that the TMDL include provisions for trading to occur and/or develop a trading framework. EPA also points out that there may be situations where implementation activities eventually reveal that the individual load allocations contained in the TMDL cannot be achieved and therefore, credits are not available for point-nonpoint source trading. In these cases, States may decide to re-allocate between the wasteload allocation (WLA) for point sources and the load allocation (LA) for nonpoint sources in the TMDL via a TMDL "revision" to make trading feasible.

To ensure additional reductions, many insist that NPS achieve their assigned TMDL load reductions first (so this becomes the baseline) and then trade any "surplus" reductions. This is understandable but it can be a very stringent trading program requirement especially since the assigned load allocations are future oriented and represent goals of the TMDL over some set time period like 15 years. In addition, unlike regulated PSs, NPSs are, for the most part, expected to meet their TMLD load allocations <u>voluntarily</u>. Only five states require TMDL implementation plans in their state laws (AZ, CA, DE, OR and VA) and only two of those states have laws that can be used to enforce NPS reductions (CA and OR) (Virginia Polytechnic Institute 2008). Experience with TMDL implementation has shown that achieving these targets for PSs and NPSs is extremely difficult (Hoornbeek et al. 2011). Understanding how tools like WQT can help achieve real, verifiable, additional improvements while allowing flexibility in setting and implementing baselines can be important to improving water quality in certain watersheds.

Some observers also call for markets to estimate the future behavior of NPSs in setting baselines to attempt to calculate what would have happened without the market. While theoretically possible, efforts to project "business as usual" or set "dynamic" baselines are inherently imprecise and costly (Marshall and Weinberg 2011). Moreover, achieving nutrient reductions from late adopting farmers remains one of the most vexing challenges in improving water quality and addressing this through enforcement of regulations can be costly and ineffective. As such, if the ultimate goal is improvement in overall water quality, then requiring farmers to meet TMDL load allocations before trading may not be the optimal approach.

After defining what “complying with existing requirements” means in setting baselines, this issue of “setting baselines relative to TMDL assigned load reductions” is the key issue to “address and resolve” in setting baselines for WQT systems. Current WQT programs are struggling to address a number of issues including the future time frame of achieving assigned load reductions versus the near term eligibility of credit generation; agriculture sector assigned load reductions vs. individual farmer assignments; and the challenges of requiring farmers achieve assigned load reductions under a TMDL without broad enforcement mechanisms.

## THE CONTINUUM OF CURRENT BASELINES BASED ON STRINGENCY

***Current baselines span a continuum of stringency***

The baselines established in current WQT programs or proposed in emerging frameworks span a continuum from allowing all farmers to trade to severely restricting the number of farmers who will participate, at least in the short- to mid-term. Program developers must decide among the following types of baselines that are generally arrayed along a continuum of stringency, starting with the least and moving to most (adapted from Kieser 2011).

| Current Practice | Comply with Existing Laws | Set level of BMPs | Comply with Laws & Ad’l BMPs | Phased or Graduated to TMDL | TMDL Load Allocation or higher |
|---|---|---|---|---|---|
| many | ⇒ | # of farmers eligible | | ⇒ | few |
| many | ⇒ | # of credits available | | ⇒ | few |
| less | ⇒ | Additionality | | ⇒ | more |

Appendix I provides a short description of baselines in State WQT rules and Appendix IV provides a summary table of program baselines.

**<u>Farm’s Current Practices</u>**

The least stringent baseline accepts current practices on each farm or is set at existing BMPS that were being used at a specific date for a given farm. Some programs require a few years of farm practice history to help establish that proposed practices are indeed new to the operation. All producers are eligible and any new nutrient load reduction practices they implement could generate credits. This approach allows the maximum number of farmers to participate and the maximum number of credits to enter the market. Good stewards are not eliminated from the market although they may face more competition (Ghosh et al. 2011). This approach lowers the cost of credits and provides an incentive for “late adopters” to adopt BMPs, at least in Pennsylvania where the analysis was conducted (Ghosh et al. 2011). However, the baseline may not result in the same total reductions if farmers in the future fully comply with all target reductions from other rules and regulations. It may also put the best stewards at a disadvantage by pricing them out of the market since they already have adopted all of the appropriate BMPs and have fewer possible nutrient reductions left.

**Examples:**

- The Alpine Cheese Trading Program (Holmes County, Ohio) accepts a farm's current practices. The program offers incentives if 75 percent of producers in tributaries participate and also offers sign-up incentives to new participants (Sugar Creek Project of the ORARDC et al 2006).
- The Rahr Malting Company (Minnesota) accepts current practices but implemented BMPS need to be visually tracked or monitored and some BMPs (like reduced tillage) are excluded though the use of trading ratios (US EPA 2009a).
- Southern MN Beet Sugar Cooperative Permit: Farms submit five years of farm practice history to set a load reduction baseline for each farm (US EPA 2007).
- Minnesota WQT: Baseline conditions are the conditions existing immediately before the execution of the trade. It is the same for post-TMDL or baseline conditions may be specifically established in a TMDL (MPCA 2011).

**Minimum Level of Agricultural Management Practices** (*may be either more or less stringent than compliance with regulations*)

Programs can set a specific minimum level of performance or a minimum set of conservation practices to be the baseline. This could be set based on some measure of appropriate practices for farmers in the watershed. This approach can help address the early/late adopter issue and incentivize farmers to achieve a minimum level to participate in the program. Theoretically, this type of baseline could be set below full compliance with all existing regulations, if the program determines that significant numbers of farmers are not in compliance. This would provide flexibility for the trading program to allow farmers into the market even though they are not in full compliance. By adopting a package of practices, they could get into compliance and produce credits above the compliance level. For example, a livestock farmer who is not in compliance with state regulations that require fencing livestock out of waterways, could adopt a package of nutrient management practices that included fencing, holding ponds and plans for manure management. However, all of the programs to date also assume or require compliance with regulations.

**Examples:**

- Wisconsin WQT framework: In watersheds without TMDLs, farms must meet the applicable statewide performance standard before trading (WI DNR 2011; 2013).
- The WI Red Cedar River Trading Program set the baseline at the applicable statewide performance standard or the TMDL load allocation, whichever was lower (WI DNR 2011).
- The Michigan Kalamazoo River Basin Demonstration Project set generally accepted agricultural management practices as the baseline but producers who were not yet

using these practices could receive discounted credits (50 percent) for practices that brought them into compliance (US EPA 2009a). No trades were ever completed.
- The Michigan WQT rules stipulate the most protective of cap and load allocation of a TMDL, Waste Management Plan, remedial action plan or lake-wide management plans plus three years of farm practice history to set loads (MI DEP 2002).
- Colorado WQT rules stipulate that if the NPS is not subject to applicable requirements, the baseline is existing land uses and reasonable and appropriate BMPs, if any. The "applicable requirements" include loading allocations assigned by a TMDL, a watershed management plan or remedial action plans (CO DPHE 2004).

**Compliance with Existing Regulations**

A few programs deem farmers eligible to sell credits from newly installed conservation practices as long as farmers comply with all local, state and federal regulations. This appears straightforward but programs still must resolve additional issues before proceeding. For instance, determining which farmers are in compliance can complicate implementation. In every state or watershed, some portion of farmers may be out of compliance, having not adopted all the practices required by existing regulations. However, with insufficient funding for technical assistance, verification and enforcement, most areas do not have the means to track these farmers. In many states, farmers are assumed to be in compliance unless the responsible agency is aware of the farm or someone has filed a complaint. So even though the baseline requires farmers to have adopted the practices required by existing regulations, it might allow farmers to participate who have not met those standards but are not considered out of compliance because there are no complaints against them. In this case, the baseline would operate more like those described above depending on whether any minimum practice would be required for farmers to participate even if they are not reported. One option would be if the applicable regulation is practice based, a baseline could allow all farmers to participate but only allow credits generated from practices beyond those required. A second complicating factor is if the state regulation is very stringent or vague, making it either extremely difficult for farmers to comply or unclear whether they are in compliance.

**Examples:**
- The Great Miami River WQT program in Ohio does not require a practice history and all farmers in the watershed are eligible to apply for funding. Practices are eligible for credits if they are voluntary, above or beyond what is required by local, state or federal law, and have not received funding from any federal or state cost-share programs (Newburn and Woodward 2012).
- The Ohio WQT rules use pollutant load associated with existing land uses and management practices and compliance with federal, state and local regulations. These rules also delegate the responsibility down to the entity that creates the WQT management plan and then OH EPA approves the plan (OEPA 2012b).
- Ohio River Basin WQT program requires that farmers must comply with all local, state and federal regulations and submit three years of farm practice history (EPRI 2012).

- The Oregon Temperature and Oxygen Demanding Substances program set the baseline at compliance with existing regulations (OR DEQ 2009).
- Montana WQT rules set baselines at the level of pollutant load associated with existing land uses and management practices that comply with applicable state, local or tribal regulations—even in waters with a TMDL (MT DEQ 2012).
- Oregon WQT rules set baseline at pollutant load level associated with existing land uses and management practices that comply with existing state or local regulations (OR DEQ 2009).

**Compliance and Additional Level of Agricultural Management Practices**

Programs may require both compliance with existing regulations and a specific level of performance or a specific set of conservation practices as the baseline. This level can be set above the requirements already in existing regulations. This approach represents a tradeoff between increasing participation in the trading program and promoting farmers to move to higher levels of performance.

**Examples:**

- In the West Virginia WQ Nutrient Trading Program, farmers must meet existing regulatory requirements and have implemented the BMPs contained in a whole-farm nutrient plan that achieve a stipulated load for the field (WV DEP 2009).
- Pennsylvania WQT Rules use a combination approach. First the seller must meet the legal requirements and the pollutant load associated with the location applicable on January 1, 2005 or later (= “baseline”). The second requirement is the “threshold.” This requirement is defined as either a 100-foot manure set back, a 35-foot vegetative buffer or a reduction of 20 percent in the farm’s overall nutrient balance beyond baseline (PA DEP 2009).

**Phased or Graduated**

In this approach, trading eligibility requirements become more stringent over time. This creates an incentive for farmers to achieve the initial phase baseline in order to trade, while over time working to achieve the higher standard. Phasing in over time gives producers a window of opportunity to install a required BMP or meet a certain load requirement. Within any “phase,” eligible farmers would be able to generate credits for any actions beyond the baseline for that phase. This approach is most applicable with a TMDL that has a future reduction goal for the agriculture sector. As noted earlier, existing regulations are not working to achieve compliance by all farmers for a variety of reasons. Moreover, the CWA does not provide EPA with the authority to directly regulate farms. Finding ways to create incentives for farmers to adopt as many new conservation practices as quickly as possible is critically important to improving water quality.

The Chesapeake Bay Environmental Markets Team provides an excellent, more in-depth review of this approach, presenting a hypothetical example that demonstrates the potential benefits in overall water quality from earlier adoption of BMPs by farmers using a graduated baseline compared to the “TMDL Load Allocation Baseline” (CBEMT 2012). Phased baseline requirements can be defined by the amount of pollutant reduced or by fixed percentages of TMDL achievement so percent achievement required to participate in the market will increase over time. They can be linked to the milestones set out in the TMDL plan. For example: in 2014, must be at 40 percent of baseline and can trade above that level; in 2017, must be at 60 percent of baseline and can trade above that level; in 2020, must be at 80 percent of baseline and can trade above that level; and in 2025, must be at 100 percent of baseline and can trade above that level. In the case of Chesapeake Bay, farmers would sell credits during earlier intervals then take those credits off the market and apply them toward TMDL allocations at the beginning of the next compliance interval (CBEMT 2010).

According to EPA Region 5's response to Ohio EPA proposed changes in the OH WQT rules in 2012: "EPA would not prohibit activities that make progress toward individual load allocations or the portion of the TMDL for that sector concurrent with reductions that are part of a water quality trade. A point source may trade with a nonpoint source prior to the nonpoint source achieving its load allocation (See *Section D* of the *Water Quality Trade Policy (2003)* and *Water Quality Trading Toolkit for Permit Writers (2007)*" (OEPA 2012).

**Examples**:

- Wisconsin: Wisconsin's proposed WQT Framework (WI DNR 2011; 2013) allows for interim trades to meet TMDL Load Allocations or Statewide performance standards. Under their proposed framework, two types of credits can be generated: interim pollutant reduction credits (to meet baseline) and long-term pollutant reduction credits (after baseline has been met). The baseline (credit threshold) is set at applicable statewide performance standards or at the load allocation calculated in the TMDL. Farmers can generate interim pollutant reduction credits for reductions achieved above the credit threshold for a maximum of five years. At that point they are lost and need to be replaced with new interim pollutant reduction credits or final pollutant reduction credits. The interim credits help agricultural sources come into compliance with the performance standards. [Note: EPA Region 5 NPDES staff have expressed concerns about the proposed framework (Personal communication with Jim Klang, 8/29/13 who has discussed the framework with Kevin Kirsch, WI DNR).
- Florida (SB 754, effective July 1, 2013): Does not discuss baselines per se but appears to provide language that indicates a willingness to consider a phased or graduated baseline: "*In developing and implementing the TMDL for a water body, the department, or the department in conjunction with a water management district, may develop a basin management action plan that addresses some or all of the watersheds and basins tributary to the water body. Such plan must integrate the appropriate management strategies available to the state through existing water quality protection programs to achieve the TMDLs and may provide for phased implementation of these management strategies to promote timely, cost-effective actions as provided for in S. 403.151"* (Florida Senate 2013).
- Idaho: Idaho basically anticipates pending TMDL load allocations for the NPS and sets this part of the load reduction as a "water quality contribution." The remaining credits can be traded. In a phased-in fashion, the water quality contribution equals 10 percent of the NPS credit amount up to five years when the TMDL is completed

and 20 percent for any time remaining until the point source compliance date. When the implementation plan is complete, the water quality contribution is set at 20 percent of the NPS credit amount. Once fully implemented, the baseline becomes the load allocation amount (ID DEQ 2010).

**TMDL Load Allocation**

Collectively, farmers in watersheds with a TMDL have an assigned TMDL load reduction target that they are expected to reach (e.g., a 40 percent reduction in nitrogen within 10 years). In these watersheds, the TMDL load allocation becomes the baseline and farmers cannot generate credits until that farmer achieves the farm level performance or has adopted all the practices spelled out in the U.S. EPA-approved TMDL implementation plan. With this baseline, every credit generated is truly additional after considering full compliance with all regulations and achieving the future TMDL target for agriculture (possibly as many as 15 years in the future). The tradeoff is that there will be fewer credits at a higher cost and less incentive for farmers to adopt conservation practices earlier. Recently, the Ohio EPA, in commenting on changes to its WQT rules, rejected this option as too restrictive saying it would seem to preclude any point source-nonpoint source trading from happening, at least in the near term (OEPA 2012a). An analysis of credit supply and demand in the Chesapeake Bay expressed similar concerns (Selman et al. 2010). A more recent report on accountability for WQT in the Chesapeake Bay recommended that states must ensure that NPSs met a minimum baseline (e.g., a suite of BMPs) that is calibrated to meet the TMDL sector load allocation and is strict enough that the total reductions will be significant but leave sufficient room to allow for trading to be profitable (Steinzor et al. 2012).

**Examples:**
**Specific BMPs**

- In Virginia's Chesapeake Bay Watershed Credit Exchange Program, producers must *first* implement the five priority BMPs required as part of the state's plan to achieve its TMDL reduction targets, called their Tributary Strategy (soil conservation plans, nutrient management plans, cover crops, livestock stream exclusion and riparian buffers) within an entire USDA Farm Service Agency tract before generating credits (VA DEQ 2008).

**Specific pollutant reduction**

- In the Idaho Snake River WQT plan, producers must reduce their loading *below* the load allocation set by the TMDL before they are eligible to generate credits (ID DEQ 2003).
- In the Lower Boise Effluent Trading Demonstration, the TMDL load allocation is applied to each BMP where the percent load reduction required is retired for the TMDL and the remaining reductions are creditable for trading (ID DEQ 2003).

**TMDL Load Allocation Plus Additional Requirements**

A few programs require farms to meet their TMDL load allocation baseline and then some:

**Examples**

- The Pennsylvania WQT rules require producers to be in compliance with any load allocation specified under a TMDL and they must implement a 100 foot mechanical setback or a 35 foot buffer or achieve a 20 percent reduction *below* the farm's total nutrient balance beyond baseline compliance before being eligible to sell credits (PA DEP 2009). If the setback or buffer are not in place, the Commonwealth reduces the amount of credit generated by 20 percent.
- In the Maryland WQT program, farmers must meet the Tributary Strategy load allocation and the TMDL load allocation for the *portion* of the farm that is being used to generate credits and also have a current nutrient management plan and an updated Soil and Water Conservation Plan (MDA 2008).

## THE COMPLEXITY OF APPROACHES

***Existing trading programs use a variety of approaches to set baselines and a wide range of baselines have emerged***

The establishment of baseline requirements (and even the definition of the term) is subject to a great deal of professional judgment. In addition, other WQT program elements like the tools being used to quantify a credit or program decisions—whether a program wants to increase net benefits for the water resource—can play a role in setting the baseline. In the case of higher trading ratios, additional benefits for the water resource may be placed directly on the buyer and do not involve the seller so these programs can have less stringent baselines and more will be accomplished because the buyer has to buy more credits. For example, the Southern MN Beet Sugar Cooperative permit set a 2.6 to 1 trade ratio. For every one credit used as an offset, the point source must purchase 2.6 credits. One credit is retired for the net benefit of the river and 0.6 credit is retired to meet the "engineering safety factor reflecting potential site-to-site variations," leaving the remaining credit for the basic load offsetting (i.e., 1 + 0.6 + 1 = 2.6) (Fang et al. 2005).

In addition, a baseline and/or the trading program must be structured in such a way that sufficient credits can be generated for the life of the buyer's proposed discharge so context is important. For example, if the Chesapeake Bay plans to collect and treat stormwater-related nutrient loads down to, or near zero in the future, a graduated baseline for trading to allow for new growth may be justified. If all sources have to reduce to a very low limit to make a TMDL work then requiring TMDL load allocations be achieved before generating credits makes more sense. If the water body is slightly impaired, then using the load allocation as the baseline in the short-term may not make sense (personal communication with Jim Klang 8/29/13).

In reviewing the variety of approaches (see Appendix I and IV) and in informal discussions with program managers, a few observations stand out:

- Considering that all the states are bound by the federal CWA and EPA's WQT rules, the wide variability among baseline standards is notable.

- Several of the programs, including the Great Miami River program that is the most active point-to-nonpoint program in the United States, have baseline requirements that simply require complying with existing regulations. In other words, participating farmers do not have to meet any specific baseline requirement (performance or practice-based) on their land to be eligible to participate in the trading program.
- There appears to be a growing trend to specify a baseline at a community norm, whether based on a defined requirement (several states use specified BMPs) or on historic practices on the participating farms.
- Several programs currently use the TMDL load allocations as a hard-and-fast eligibility requirement, while others propose using load allocations as a target over time, allowing farmers and ranchers to get partial or temporary credit for actions prior to the accomplishment of load allocations. Those using a strict load allocation standard typically have few transactions.
- When dealing with TMDLs, programs tend to require individual farmers and ranchers to meet individual load allocations based on the TMDL even if the load allocations are established collectively for agriculture in an entire sub-basin or watershed.
- Montana is the only state which sets the baseline for NPS in TMDL watersheds at the level of pollutant load associated with existing land uses and management practices that comply with applicable state, local or tribal regulations rather than at the applicable NPS load allocation within the TMDL. In response to comments from EPA on its trading policy, the MT DEQ stated " *One of the reasons for allowing a nonpoint source to generate credits as soon as it begins to reduce its nutrient load is that the load allocation in a TMDL is typically aggregated for all similar nonpoint sources throughout an entire watershed. Defining "baseline" so that all nonpoint source contributors need to achieve (collectively) the watershed load allocation before a credit may be generated would eliminate the majority of trading opportunities and greatly reduce the effectiveness of this policy*" (Bodine 2013).

## WHICH BASELINES WORK?

**There are a wide variety of baselines but we can only speculate which are more likely to lead to better environmental results**

***Accept current practices*:** This baseline emphasizes credit quantity. It allows the creation and sale of credits for most environmental improvements in the subject community, regardless of the current environmental practices of participating landowners. Just as with many PS, where the incremental costs of treatment climb steeply from primary to secondary to tertiary treatment, the first BMP's applied to a farm landscape are likely to be the most cost-effective because, in the absence of conservation practices, the farm may be generating a large nutrient load (Selman et al. 2010).

Another potential advantage of a current practices baseline is that it offers program managers the opportunity to target the small percentage of rural landowners who are responsible for the majority of serious environmental problems and achieve water quality improvements more rapidly with fewer transactions before switching to more random procurement of credits. However, producers on critically undertreated acres may be hard to identify and even more difficult to engage, driving up costs. Current markets might not offer enough of an inducement to persuade poor stewards to implement conservation practices since farmers who are actively trading are only partially reimbursed for the costs of the conservation practices they install. Still, the University of Maryland School of Public Policy recently suggested that the current level of nutrient loadings is an appropriate baseline which would allow credit for coming into compliance with regulatory requirements: "*One option to consider thus is whether agricultural baselines should be set at less than the full legal requirements for agriculture, acknowledging the uncertainty of immediate legal compliance, and thus potentially accelerating the improvement of farmer nutrient management practices (a particularly important goal given the large share of total Bay nutrient loads that originate in agriculture and the low cost of many potential agricultural nutrient reductions)*" (Bodine 2013).

***Ask for more practices***: Setting a minimum level of performance before generating credits may result in better environmental performance— but only if that level of performance can and will be implemented on a widespread basis. In many cases, a lower baseline that leads to greater participation and more practices being installed should have a better environmental result than a higher baseline where fewer farmers participate and have fewer reductions they can make—or at least conventional wisdom indicates it might. The USDA Conservation Effects Assessment Project analyses indicate that the key to reducing nutrient loading is to get a few basic conservation practices on critically undertreated acres where loads are the greatest (USDA NRCS 2010; USDA NRCS 2011a; USDA NRCS 2011b; USDA NRCS 2011d). To be effective, this kind of baseline would require a crediting tool like the USDA NRCS Nutrient Tracking Tool that can calculate the load reductions achieved by the required BMPs as a whole and then calculate the additional load reductions when new BMPs are added.

***Require TMDL load allocation reduction first***: Similar concerns about discouraging early participation and having few qualified sellers surface when establishing a baseline at an aspirational level far above current environmental practices. The TMDL load allocation may take farmers decades and considerable expense to achieve. Here, the concern is that few farmers are likely to reach the high market entry point at their own initiative and expense, limiting the number of potential sellers and early trades. Furthermore, even if they do, most of the environmental improvements that are possible (particularly the high-impact, low-cost opportunities) are likely to have been achieved before the market engages, reducing demand and increasing costs.

An analysis of credit supply and demand in the Chesapeake Bay (Selman et al. 2010) predicts that the cost of generating agricultural NPS credits will be higher than the cost of achieving the reductions needed to achieve their TMDL load allocations baselines. For example, in 2007, the average N load of a farm on Maryland's Eastern Shore was 20 lbs/N per acre, while a farm that had met baseline requirements would have a total N load of approximately 11 lbs/ace. If that average farm installed a grass buffer on one acre, the total N reductions would be approximately 41 lbs/N per year. If the same buffer is placed on a farm that has already met higher baseline requirements (i.e., reduced its nutrient load), the buffer is treating a lower nutrient load and the total N reductions resulting from the new buffer are approximately 22.5 lbs/N per year. Since riparian grass buffers cost about $200 a year to install and maintain, if the costs are equal for both farms, the cost of reducing a pound of N on the first farm is nearly $5/lb; the cost of reducing a pound of N on the farm that has met baseline requirements is closer to $9/lb.

In other words, the marginal nutrient reductions that can be achieved by implementing additional BMPs on farms that have already reduced their nutrient loads are small and will likely be more costly per pound of nutrient reduced than those reductions from farms that have not met their baseline.

In summary, TMLD load allocation reduction baselines likely mean: 1) Fewer farmers, at the outset, will qualify to generate credits because only a few farms will initially meet baseline requirements; and 2) There are fewer possible reductions to be generated beyond the reductions that are already required to meet baseline. To make trading work, the Chesapeake Bay may need to facilitate the financing of practices that help farmers meet baselines (Option Five below), encourage innovative practices for reducing nutrients, and allow for interstate-interbasin nutrient trading (Selman et al. 2010).

## BASELINE OPTIONS THAT MAY STRIKE THE RIGHT BALANCE

**Several baseline options seem like they might strike the right balance to harness the power of a market**

The challenge in defining baselines is finding the right balance between stimulating lots of credit transactions—a key factor in the extent and pace of water quality improvements in the program area—and maintaining and encouraging a higher level of stewardship overall by harnessing the potential incentive power of markets to facilitate environmental improvements. Theoretically, if farmers can make money by selling credits, participation will not be a problem. We're currently speculating that the following options achieve this balance. We need more research and analysis to confirm their actual impacts. The proposed options listed below are not mutually exclusive:

***Option One: Use Phased or Graduated Baselines***

A phased or graduated baseline is established at a low to moderate level initially and ramps up over time. This gives farmers and ranchers the immediate opportunity to participate and stimulates a high level of trading activity rapidly, but ensures that the program meets high standards for credit quality over time. Phased eligibility requirements can be defined by the extent of practices implemented, the amount of a specific pollutant reduced, or the extent to which TMDL targets are achieved. Under Wisconsin's proposed WQT Framework (July 1, 2011), two types of credits can be generated: interim pollutant reduction credits (to meet baseline) and long-term pollutant reduction credits (after baseline has been met). The baseline (credit threshold) is set at applicable statewide performance standards or at the load allocation calculated in the

TMDL. Farmers can generate interim pollutant reduction credits for reductions from practices that help them reach the baseline standard for a maximum of five years. The interim credits help agricultural sources come into compliance with the performance standards (WI DNR 2011; 2013).

This strategy takes advantage of the tendency of markets to evolve towards higher quality credits over time and reinforces it through a phased increase in standards for market entry over time. The principal benefit of this strategy is it initially opens the market to a wide range of credit producers and sellers, achieving a higher level of environmental improvement more quickly. Not only would water quality improve, but the conservation practices installed as a result would generate additional environment benefits for the watershed like carbon sequestration, improvements in air quality and wildlife habitat (Shortle 2010). Gradually, the standards for credit generation would rise, ensuring that credit transactions (consisting of a mix of old and new credits) would exceed the exacting standards of offset markets and trading programs.

***Option Two: Allow Credits for a Percentage of NPS Load Reduction***

Although this idea was suggested as an approach to encourage early trading in the Chesapeake, it might be compatible with other TMDL implementation plans as well depending on the assumptions plans make. In the Chesapeake Bay TMDL, the state implementation plans make the assumption that most of the BMPs will not be applied on 100 percent of available land. If the state assumed a BMP would be applied on 75 percent of available acres, then it could approve credits for BMPs on 25 percent of available acres, even if the BMPs had not yet been installed on the remaining 75 percent of acres. This approach would be consistent with EPA's goal of using trading to achieve early reductions (Bodine 2013).

***Option Three: Use a Community Practice Standard***

In this strategy, farmers and ranchers would be required to achieve certain levels of BMP installation or practice use before being eligible to participate in the trading program. This could be based on community norms in the trading area or it could be a fixed baseline. To maximize water quality benefits and level the playing field, community standards should apply broadly to all agricultural operations. Programs would need to determine the level at which to set community standards (county, watershed, state, federal) and who would be included in setting those standards. Examples of individual practices that could be part of community-wide standards include vegetative buffers, land application setbacks, winter manure application prohibitions, livestock exclusion requirements and fall fertilizer restrictions (Dexter et al. 2010). For example, in the West Virginia Water Quality Nutrient Trading Program, farmers must meet the *more restrictive* of: a) any existing regulatory requirements or effluent limits related to nutrient management; or, b) implementation of a whole farm nutrient management plan and an average per-acre nutrient load on the to-be-credited site based on the 2005 average Edge of Segment nutrient load for the specific agricultural land use (WV DEP 2009). The loading rates are to be modified to reflect the Bay TMDL agricultural nutrient allocations when final. Farmers entering the trading program who have implemented BMPs that exceed the baseline are eligible to receive credits for their prior commitment to land stewardship.

The most likely level at which to set community standards is the state. A number of states have regulations that require comprehensive pollution management planning and implementation of applicable BMPs although all fall short on enforcement and monitoring (Dexter et al. 2010). At present, several states are pursuing certainty programs that provide regulatory certainty to farmers who implement practices that protect water quality (e.g., Virginia, Pennsylvania, Minnesota). These programs basically establish community-wide standards and are being encouraged by both EPA and USDA (Executive Office of the President et al. 2011). The agencies view certainty agreements as a way to increase farmers' interest and willingness to adopt the most effective land stewardship practices.

Provided that the baseline is set at a reasonable level, this option is likely to provide immediate access to markets for early adopters of BMPs and practices, stimulate trading activity in the area, and ensure that credits are not available to those who are far below the norm in pollution control and treatment. The community norm may change upward as the market or trading program is implemented and peer pressure and outreach efforts increase.

***Option Four: Leave participation open but only purchase credits that meet program standards***

Another option for achieving high rates of program participation and high standards for credits is to establish a baseline at current practices but purchase only the credits that meet program standards and expectations. This is essentially the model used in Great Miami program, which has a "current practice" baseline but which uses a reverse auction system to solicit proposals from farmers and ranchers, ranks them by cost and effectiveness, and buys the most cost-effective credits proposed. This has proven to be a very successful approach, with 11 funding rounds to date providing more than $1.8 million to nearly 400 on-farm conservation projects. It is also quite selective, with 35 of 132 proposals funded in the latest round. On the other hand, an auction system may not be the most equitable system for farmers because bidding always drives prices down. In comparing the range of costs covered by EQIP for selected BMPs to the costs covered through the Great Miami program, the WQT program often paid less although the average cost for BMP payments in both programs were generally comparable (Klang and Kieser 2008).

Over time, the competitive nature of such a program will require that farmers and ranchers achieve higher standards or lower prices to receive funding. The results are likely to rival programs with high eligibility standards, but levels of community participation are apt to be higher. At the same time, the credits will still meet program standards and expectations.

***Option Five: Use Cost-share Incentive Payments in tandem with WQT***

Currently, most programs do not allow farmers to sell credits from practices they've installed with the use of state or federal cost-share funds. Although USDA permits the sale of federally financed credits, most programs chose to avoid the appearance of "double dipping" (Horan et al. 2004). However, "double dipping" might actually improve the performance of a trading program (Horan et al. 2004). The degree of improved performance achieved by using cost-share incentive payments in tandem with WQT depends on whether the programs are coordinated or not, whether "double dipping" is allowed and whether the cost-share incentive payments are targeted. If the programs are coordinated, allowing state or federal cost-share funds to generate credits increases efficiency because both programs jointly influence farmers' marginal decisions. Without coordination, double dipping may either increase or decrease efficiency, depending on how the cost-share incentive payments are targeted. Finally, double dipping may not solely benefit farmers since it can result in a transfer of the cost-share incentive payment subsidies to point sources.

To avoid double dipping, markets could discount credits that result from federal or state cost-share payments. For example, if the cost-share incentive payment covered half of the cost of installing a grass buffer, the resulting credits would be discounted by 50 percent. In this case, the WQT program is covering the other half of the costs of installing and maintaining the buffer. Another option would to keep a higher baseline but make more farmers eligible to trade by targeting federal and state cost-share payments to bring them up to the higher baseline. The state and federal cost-share payments could be used to get farmers and ranchers to a level of BMP adoption that would make them eligible for trading programs. Conceivably, a buyer could also help pay for these practices and negotiate pricing for additional practices that could generate credits. Using public funds in this manner seems to have universal support (see Appendix II).

However, linking programs might be challenging to execute, requiring a level of targeting that is unusual in incentive programs. The most likely partnership for WQT programs is with the Environmental Quality Incentives Program (EQIP), a very popular program that is habitually over-subscribed (Breetz and Fisher-Vandem 2006). The challenge is that EQIP is a blunt tool for addressing water quality and with its limited environmental targeting, fuzzier accounting of benefits, weaker focus on cost-effectiveness, lower eligibility requirements and minimal monitoring, it may not meet the requirements for project selection within WQT programs. On the other hand, EQIP and WQT policy are more or less aligned philosophically and some state ranking procedures now favor targeting, benefit calculation and cost-effectiveness. In these cases, the Soil and Water Conservation Districts (as local EQIP administrators) could recruit farmers for EQIP and later target the same farmers for WQT once they have met the baseline requirements. To make this happen, WQT programs would have to work directly with the state and county NRCS technical advisory committees—and obtain the blessing of USDA NRCS at the federal level.

In cases where there is a large gap between current practices and market entry thresholds, using conservation incentive programs, most of which are under-funded and allocate funds widely across the landscape, might make this option untenable for any but the smallest initiatives. However, this option is potentially compatible with the current practice of establishing market entry at the TMDL load allocation. There would also need to be thought given to larger and multi-phase projects that might comingle market and incentive payments, whether such behavior is acceptable, and, if so, how credits would be allocated. Finally, the management role in a mixed market/incentive program would be challenging and expensive.

Regardless of what programs decide, it makes intuitive sense for WQT to partner with at least some of these over-subscribed public cost-share incentive programs as a way to identify and possibly recruit farmers whose applications addressed water quality issues but were not funded (Breetz and Fisher-Vandem 2006).

## CONCLUSIONS

**WQT can have a very meaningful impact on water quality by focusing a larger share of investments in cleaner water on nonpoint problems**
The improvements in water quality from WQT may be particularly important when nonpoint contributions are the dominant source for tradable water quality parameters (nutrients, temperature and dissolved oxygen) in a watershed; where these parameters are having a very considerable impact on downstream waters, such as the creation of hypoxic zones; and/or where point source treatment costs are extraordinarily high or nonpoint source treatments are unusually inexpensive.

**Baseline determination will have an important impact**
The selection of the baseline will impact the costs of the NPS credits in the market and, ultimately, the number of credits that NPS can sell to regulated PS (Ribaudo et al. 2009; USDA NRCS 2011c). If the baselines are set too loosely for NPS, the credit supply will be plentiful but some of the practices that are implemented may have been implemented anyway without the market. One can argue, though, that WQT can result in much earlier adoption and reduce loads faster. Conversely, if the standards are set too high, NPS that otherwise could have reduced their loading at a relatively low cost might decline to participate. This could drive up the costs of credits, limit the pool of eligible credit sellers, and reduce the effectiveness of the program. If baselines are established at a low level, simple and inexpensive actions will produce trading credits, while higher baselines will require upfront investments by farmers to install conservation practices before they can participate in markets. Some of these costs may be offset by cost-share funds or if buyers chose to help. High baselines are apt to increase the costs of nonpoint options, decrease the cost differential and decrease the motivation for point/nonpoint trading.

**Baselines play a key role in regulating market activity to accelerate NPS treatment, serving as both the gas pedal and the brake on trading activity**

Where the proper circumstances exist—watersheds with a lot of PSs and NPSs, severe downstream impacts, and very low NPS treatment costs—the use of a low baseline can rev up trading activity and investment in nonpoint treatments. In the opposite circumstances, a higher baseline can put the brakes on trading. This seems to provide a good rationale for a baseline that ratchets up over time, initially taking advantage of the highly effective and least expensive improvements with the first treatment actions, then requiring more sophisticated nonpoint treatments as point and nonpoint options reach parity in effectiveness and cost. The potential for lower baselines to stimulate earlier adoption of practices that reduce nutrient loads may mean that a flexible policy that allows differing baseline levels that are responsive to the unique and evolving needs of each watershed is more desirable than a single national baseline standard.

**Substantial differences and issues exist in setting baselines under a TMDL with a NPS load reduction target compared to other regulatory drivers**

In most TMDL implementation plans, agriculture is counted on to be part of the solution to achieve water quality goals and farmers are assigned load reductions based on their load allocations, as previously described. As part of the state plans to achieve the TMDL goals, agriculture must meet its share of the reduction. In other words, a TMDL creates a framework by setting the overall cap on a specific pollutant and dividing it amongst the various sources (Idaho DEQ 2010). However, enforcement that could bring all participants to the table only applies to the point sources for the most part. A growing number of programs are concerned that TMLD load allocation reduction baselines likely mean: 1) Fewer farmers, at the outset, will qualify to generate credits because only a few farms will initially meet baseline requirements; and 2) There are fewer possible reductions to be generated beyond the reductions that are already required to meet baseline (Selman et al. 2010).

In contrast, in watersheds without TMDLs, nutrient effluent limits may be the regulatory driver for water quality and point sources must meet these effluent limits in their NPDES permits. NPS, including agriculture, do not have any required reductions. Discussions about baselines for farmers center around existing or current land uses, some documentation of prior land use, the use of reasonable or appropriate BMPs and compliance with local, state and federal regulations—or some combination thereof (coupled with the issues of methods/techniques). In the case of NPDES, the permit only applies to the PS. Discussions do not have to consider if any of the farmer reductions already are “counted” in the overall plan to reduce nutrients. However, there can be questions about whether existing regulations are specific enough to define clear baseline eligibility and exactly what “complying” with existing regulations means since many “bad actor” laws that authorize enforcement actions against activities that generate NPS pollution are on a reactive complaint-driven basis (U. S. EPA 2011c). How programs resolve these issues affects whether farmers who are poor stewards versus good stewards participate and their competitive advantage in offering the lower cost credits.

**Lack of clarity in guidance and consistency among existing programs in setting baselines creates barriers and holds back the implementation and expansion of WQT programs**

Although WQT is gaining traction as a tool that can help minimize costs and provide flexibility in meeting water quality goals, there is a lot of disparity in how WQT programs are developed in various states and watersheds. This lack of consistency may put some programs at risk. If some WQT programs are perceived to lack rigor, this may also affect public perception. There are significant differences in the types of baselines being used and the way in which they are chosen, how they are justified, how they are documented and what procedures are followed. In addition, there are differences in the types of tools used to calculate and register credits, how uncertainty in models is addressed, how verification and certification are carried out and how adequate rigor is ensured in registering and tracking credits. As trading programs mature and begin to handle credit transactions, they come under increased public scrutiny. As a result, at least one pending lawsuit challenges the validity of using WQT under the CWA to meet a TMDL obligation (NACWA 2012).

**Regardless of the type of baseline, protocols must verify that the farmer has met the baseline requirement**

Programs need some way to measure and verify that: 1) the farm has met the baseline conditions and is eligible to trade; and 2) that surplus nutrient load reductions beyond those achieved by meeting baselines requirements are creditable. This can involve questioning the farmer and inspecting the farm operation, working with the farmer to assemble and review his or her farm practice records, applying computer models to calculate existing run-off from the operation and collecting spatial data about the operation. Ideally, the trading market can strike a balance between the need to document existing and prior conditions on the farm with the need to simplify paperwork and minimize time requirements. Although this sounds achievable on paper, in practice it can be challenging (See Appendix III). Many farms, particularly smaller operations, do not keep detailed records on conservation practices and some annual practices, like cover crops or certain types of tillage, may be difficult to document with remote sensing. If a farmer has participated in State or Federal conservation incentive programs, there may be records available that will document when and where conservation practices have been implemented. However, many farmers voluntarily implement conservation practices without help from government programs.

**Depending on where the baseline is set, programs may be accused of either "bailing out the bad actors" or "being unfair to early adopters"**

Baselines are designed to improve water quality but can also have indirect policy impacts.

***Dealing with critically undertreated acres:*** Several recent studies have indicated that critically undertreated acres—those where little or nothing has been done to prevent water pollution—can contribute disproportionately to water quality problems (USDA NRCS 2010; USDA NRCS 2011a; USDA NRCS 2011b; USDA NRCS 2011d). In the Pleasant Valley watershed in Wisconsin, eight of the 61 farms occupy only 12 percent of the area but are responsible for 73 percent of the estimated runoff of phosphorus

(Nowak 2010a). Because these farms are engaging in inappropriate behaviors in vulnerable times or places, the watershed won't achieve significant water quality improvements until solutions are developed that work for them (Nowak 2010b). Many obstacles may prevent or discourage farmers from implementing practices to reduce nutrient run-off so it may be premature to categorize these farmers as "bad actors" (USDA NRCS 2005). At the same time, there are significant concerns about using funding from WQT—which is often in limited supply—to resolve the worst problems, on the grounds that this money would be "bailing people out" who have neglected their basic responsibility to prevent pollution. This may support a baseline that assumes water quality practices that are slightly below average for the agricultural community as a whole and setting a slightly higher eligibility for the trading program. Farmers who don't meet the baseline could not produce tradable credits and would potentially be subject to state or local regulation. Alternately, a baseline could be phased in, allowing all farmers to participate at first then raising eligibility standards over time.

***Being fair to early adopters*****:** Prior adopters of BMPs can apply their experience of installing and maintaining conservation practices to newly installed practices in a WQT market, reducing the risk of practice failure in the market. On the other hand, if they have already significantly reduced nutrient run-off on their farms, additional opportunities to reduce run-off may be limited and more expensive to install and maintain. This can increase the cost of the credit. Limiting participation to early adopters may also affect the supply of credits in a market and that will increase their costs as well. Since these producers have a history of using conservation practices above and beyond what they are legally required to do, how can a market prove that they wouldn't have gone ahead and implemented the credited practice in the absence of the market?

Stakeholders have proposed a number of different approaches to honor early adopters such as paying early adopters to provide credits for the reserve pool; using a starting date for a program (all practices implemented after this date are eligible), assigning a value or multiplier that would be reflective of the credit and providing an opportunity for point sources to give preference to farmers with higher stewardship scores by denoting stewardship status (See Appendix II). It is important to note that the concern about penalizing early adopters was raised independently as an issue by farmers, point sources, State permitting authorities, key agricultural stakeholders and the environmental community during the development of the Ohio River Basin WQT Plan (See Appendix II). Programs can also consider setting up tiers to provide incentives for good decisions. The first tier (the baseline) might include high residue cover and nutrient management as a prerequisite for a site before a credit can be generated. The program can then adjust trading ratios to encourage progressively higher levels of stewardship; Tier 2: the next BMPs adopted will have a trading ratio of 2.5 to 1; Tier 3: when a farmer has implemented a whole-farm management plan, the trading ratio drops to 2:1.

**Markets must strike a balance between ensuring sufficient participation by farmers while maintaining confidence in overall net water quality improvements from the market**

Several analyses have shown more stringent baselines eliminate many low cost credits from the market, raising the overall cost of credits and reducing the number of credits trading in the market. More stringent baselines also fail to provide an adequate incentive for poor stewards to adopt BMPs (Ribaudo et al. 2009). This, in turn, may lessen the chances of improving water quality because fewer farmers are trading and the farmers responsible for much of the pollution (critically undertreated acres) are not eligible to trade. A date-based baseline (current practices from a designated point forward) may be the most efficient by providing incentives for poor stewards to adopt BMPs while not pushing good stewards or early adopters entirely out of the market (Ghosh et al. 2011). However, in the end, it might not be possible to define a baseline that is acceptable to all parties. Because of its distributional impacts, choosing the baseline is inherently a political decision (Ghosh et al. 2011).

## RECOMMENDATIONS

**Baselines should not be set in a vacuum but instead result from a discussion with stakeholders**

Input from farmers and from other key stakeholders in a watershed can provide guidance on how to achieve a balance between ensuring sufficient farmer participation while maintaining confidence in overall net water quality improvements from the market (See Appendix II). Programs should also reflect state and local watershed policies. For example, some states have agricultural practice standards or are working on certainty agreements that describe standards or baselines that exempt producers from future regulations. These types of standards may help programs decide on baselines. Since all programs will require farmers to comply with local, state and federal regulations, they may need to decide how to handle regulations that consider farmers to be in compliance unless a complaint has been filed. In these cases, farmers may not be fully following regulations but, because they haven't been reported, they are technically considered to be in compliance. Some challenging nuances in regulations may emerge. Also, if NPDES permits are involved, gaining the approval of the State Permitting Authorities is critical if credits are to be used in the permitting process. The option to trade must be incorporated into the permit language. Approaching them early in the process of setting a baseline may influence decisions on baselines.

**EPA should relax its policy guidelines regarding baselines set at the level of load allocations in TMDL basins**

Current EPA guidelines that state the baseline should be equal to the TMDL load reduction target stifles research and experimentation with alternative approaches that could result in improved results. EPA should modify its guidelines to allow experimentation with setting baselines. This might encourage projects to test graduated baselines in the field. All of these challenges are clearly demonstrated in the case studies evaluated for this project, which indicate that trading programs that require load allocation baselines have virtually no trading activity, while those using more creative approaches are trading actively. By setting the baseline for participation equal to the future target performance level, EPA has foreclosed the potential for faster and more effective trading activity using more attainable standards and farmer-friendly approaches.

**WQT could benefit from more experience on the ground with pilot trades to field test approaches**
Funding of trading pilots could and should be used to test creative approaches to defining baselines. EPA, USDA and other funders have taken an active interest in stimulating water quality trading through a variety of grant programs, and these early investments have been pivotal in implementing pilots that establish new tools and techniques for environmental markets. We recommend that these agencies target some funding from these discretionary sources to field-test alternative approaches to baselines. The options identified in this paper—phasing, credit for percentage of NPS load reduction, using a community practice standard, high-grading credits in procurement, and combining incentives and trading programs—could benefit from further testing and refinement before they are ready for widespread application. The different approaches suggested to honor early adopters should also be tested and refined.

**More research and testing would help refine and accelerate the use of WQT**
Programs could benefit from more research and analysis that helps us to better understand the impact of different approaches to setting baselines on overall water quality (e.g., the impact of a TMDL load allocation baseline on numbers of eligible farmers and the resulting impact on the cost savings assumptions of achieving overall water quality goals with less activity in WQT due to stringency and timing of baselines for farmers). We should also consider research to calculate the potential impact on improving water quality of approaches to baselines and eligibility that result in more farmers taking action sooner. It may be possible to achieve better water quality, sooner, at lower cost with an approach that stimulates earlier action on behalf of farmers. In particular, using graduated baselines that increase over time and allow all farmers to trade but discount their credits by the target load reduction seems promising.

**At the same time, we need to identify and document best practices within existing WQT programs**
If groups working on WQT can agree on best practices, we can move toward unified national guidelines for setting baselines (even if allowing for some flexibility for localized conditions). This will help the development and proliferation of markets, which in turn will result in improvements in water quality.

At the moment, one can make a strong case that the proliferation of different baseline models is useful in the evolution of trading programs, allowing a wide range of options to be tested and evaluated in a short period. However, over time this variability is likely to retard the development of trading programs. Agencies developing new trading programs need to evaluate which of many models is likely to work best and pass muster with the federal government. Multi-state trading programs may be hindered or challenged by different baselines among participating states, as is currently the case for trading in the Chesapeake Bay (NAS 2011) and, to a much lesser extent, for the Ohio River Basin trading program. In addition, many very promising strategies, such as Wisconsin's very progressive approach, will not get the attention and replication that they may deserve.

**We need continued national leadership from USDA and EPA along with better coordination among major WQT programs in addressing these issues to finally unleash the potential of WQT**

Water quality trading has been around in various guises since the 1970's. EPA policy was started in 2002 and finalized in 2003 in just 14 months. USDA and EPA signed a Memorandum of Understanding shortly after that. But trading was relegated to the "back burner" about five years later (personal communication with Mark Kieser 8/29/13). The initiative has been stuck in a process of piloting, with nationally recognized best practices and national guidelines slow to develop and often contradictory, balancing between the desire to stimulate widespread improvements in water quality but hold to the highest standards for every transaction. Gathering all the program developers and other stakeholders to develop best practices, and move toward a national baseline model, fashioned after several of the more successful and advanced state and regional programs profiled in this report, would be a good place to start. Ultimately, the guidance on baselines must be flexible enough to encourage programs to set baselines that are responsive to the unique and evolving needs of each watershed.

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# APPENDICES

I. BASELINES IN STATE WATER QUALITY TRADING RULES

II. FEEDBACK FROM AGRICULTURE ON BASELINES
   A. Feedback from producers in the Ohio River Basin WQT project
   B. Feedback from Agricultural Stakeholders in the Ohio River Basin WQT project.

III. DIFFICULTIES IN MEASURING AND VERIFYING BASELINES

IV. SUMMARY TABLE OF PROGRAM BASELINES

# APPENDIX I - BASELINES IN STATE WATER QUALITY TRADING RULES

The following information was excerpted or summarized from the various State rules, draft rules or exploratory analyses.

**RULES IN PLACE**: TMDL implementation for NPS **voluntary** unless otherwise indicated

**Colorado: State Wide Guidance** (CO Dept. of Public Health and Environment 2004)**:**
Stated Purpose of WQT:

- Encourage early reductions and progress towards meeting water quality standards pending development of Total Maximum Daily Loads (TMDLs) for impaired waters.
- Reduce the cost of implementing TMDLs through greater efficiency and flexible approaches.
- Establish economic incentives for pollutant reductions from point and nonpoint sources within a watershed.
- Reduce the cost of compliance with water quality-based requirements.
- Offset new or increased discharges resulting from growth in order to maintain levels of water quality that support all designated uses.
- Achieve greater environmental benefits than those realized under existing regulatory programs.
- Secure long-term improvements in water quality through the purchase or retirement of pollutant credits by an entity.
- Encourage a watershed approach that achieves multiple environmental and economic benefits, such as wetland restoration or the implementation of management practices that improve water quality and habitat.

General Baseline:
If not subject to applicable requirement, baseline is existing land uses and reasonable and appropriate BMPs, if any. If subject to an applicable requirement, the most protective of: a) pollutant specific cap and loading allocation specified in TMDL; or b) pollutant specific cap and loading allocation or the management practices specified in a watershed management plan approved by the Division; or c) a pollutant specific cap and loading allocation or the management practices determined by the Division to be consistent with water quality standards and specified in a remedial action plan.
Guidance on Trading and TMDLs:

- Trading encouraged in impaired waters prior to completion or approval of a TMDL if trades projected to help achieve progress towards attaining water quality standards. Where pre-TMDL trading occurs and eliminates impairment, the water body no longer needs to be listed.
- During development of a TMDL, any reductions in loading to generate credits for pre-TMDL trading will be considered in developing load allocations and the Department will seek to have the TMDL include load and wasteload allocations that are consistent with any pre-TMDL trade.

- Where TMDL has been approved, NPS must meet load allocation before generating credits.

**Connecticut: Point Source Trading in limited area** (CT DEP 2010):
(Nitrogen Credit Exchange for Long Island Sound; does not currently include NPS)
Stated Purpose of WQT:
Nitrogen Credit Exchange created in 2002 to provide alternative compliance mechanism for 79 publicly owned treatment works (POTW) to meet the nitrogen wasteload allocation (WLA) of the TMDL adopted for Long Island Sound. Estimated that trading through the NCE will have saved $300-$400 million for the POTW in attaining the 2014 WLA in the Long Island Sound TMDL.
Guidance on Trading and TMDLs:
Enabling legislation does allow the possibility of including stormwater (point source) and NPS in the nitrogen trading program but evaluation of projected cost differentials don't yet support this.

**Idaho** (ID DEQ 2009)**:**
Stated Purpose of WQT:
Business-like way of helping solve water quality problems by focusing on cost effective, local solutions: pollutant trading is voluntary and trading allows parties to decide how best to reduce pollutant loadings within the limits of certain requirements.
Guidance without TMDLs:
They expect that NPS will be subject to a load allocation for P and the trading system is designed to ensure that NPS are responsive to this future allocation by means of a "water quality contribution" that is required of each trade involving a NPS reduction. They also assume that the TMDL NPS load allocation will be less than what the NPS are discharging at the time the TMDL is issued. NPS P reductions made in response to water quality regulatory obligations are not creditable. Using NPS reductions for trading may help ensure early NPS participation in addressing pollutant problems in the watershed. All NPS reductions are determined in relation to the baseline conditions used to establish the TMDL. This means assumptions regarding the determination of marketable credits must be consistent with the TMDL.
Guidance on Trading and TMDLs:
*Note: As of June 2013, TMDLs were still pending*
TMDLs are typically a prerequisite because they create a framework by setting the overall cap on a specific pollutant and dividing amongst the various sources. NPS can generate credits that are surplus to the reductions the TMDL assumes the NPS is achieving to meet the water quality goals of the TMDL. The BMPs implemented must be on the approved TMDL BMP list.
Parties involved in pre-TMDL trading are urged to contact DEQ early in the TMDL development process to ensure that future revisions to trading agreements do not create disincentives for early action.
Scaling up to meet TMDL obligations—three trading phases:
Phase 1 begins with first trade and continues through December 31, 2001 (deadline for Lower Boise River TMDL). The water quality contribution = 10 percent of the NPS

credit amount for up to five years and 20 percent for any time remaining until the point source involved is required to comply with its P limit.
Phase 2 runs from January 1, 2002 to completion of TMLD implementation plan (mid 2003). Water quality contribution is 20 percent of the NPS credit amount until the point source compliance date.
Phase 3 begins at Implementation Plan completion and runs indefinitely. All trades will have a water quality contribution that ensures each trade fully conforms with the TMDL.

Each NPS trading participant is expected to be in full conformance with implementation plan targets and actions. P-related actions required for compliance and/or conformance will not create creditable P reductions after the prescribed dates.

**Maryland (Chesapeake)** (MDA 2008):
Stated Purpose of WQT:
WQT is a market-based approach that offers greater efficiency in achieving water quality goals on a watershed basis.
Guidance on Trading and TMDLs:
Agricultural operations must first meet baseline requirements before generating credits. Farm operations must meet the level of reduction called for in the Tributary Strategy for their basin and where a TDML is required, they must meet the level of reduction prescribed in the related documents. Additionally, they must be in compliance with all federal, state and local laws and regulations. Farms must have a current nutrient management plan, an updated Soil and Water Conservation Plan including, if applicable, a Water Management System Plan. To calculate baselines, Maryland's Tributary Strategy/TMDL goals are translated into a numeric per are annual loading for each watershed. Loading allocations are based on 2010 cropland's Tributary Strategy goals (calculation of N and P edge-of-segment loads in pounds per acre as modeled by Tributary Strategy Basin in the Chesapeake Bay Model). Only the portion of the farm being used to generate credits must achieve this loading rate.

**Michigan** (MDEQ 2002):
Stated Purpose of WQT:
Improve water quality; optimize costs; create economic incentives for voluntary NPS load reductions; facilitate implementation of TMDLs; provide incentives to develop new, more accurate and reliable quantification protocols and procedures; and provide greater flexibility.
General Baseline:
For Kalamazoo trading plan, baseline was generally accepted agricultural practices. Improvements to achieve generally accepted practices will be discounted 50 percent. Agricultural practices better than generally accepted practices will be given full credit for trading. For MI WQT rules, baseline is the following:
Guidance on Trading and TMDLs:
NPS have to meet TMDL load allocation before trading or most protective of any of the following:

- pollutant-specific loading from existing agricultural operations that are not subject to a applicable requirement.

- pollutant-specific loading achieved after implementing BMPs required by an applicable requirement.
- pollutant-specific cap and loading allocation specified in a watershed management plan
- pollutant-specific cap and loading allocation specified in a remedial action plan

**Oregon:** (OEQ 2009)
***To achieve TMDL, implementing NPS pollution control practices is regulated***:
<u>Stated Purpose of WQT:</u>
Allows facilities facing higher pollution control costs to meet their regulatory obligations by purchasing environmental equivalent (or superior) pollution reductions from another source at a lower cost. Trading may also allow Oregon to achieve water quality improvements more quickly than would otherwise be possible (achieves early reductions and progress towards water quality standards pending development of TDMLs). Achieves greater environmental benefits than those produced by existing regulatory programs by producing ancillary benefits. Also secures long-term improvements in water quality through the purchase and retirement of credits.
<u>Guidance on Trading and TMDLs:</u>
For pre-TMDL water quality limited waters, existing sources must conduct an analysis of current pollutant loadings to establish a target or loading cap below current conditions that represents progress in the attainment of water quality standards. Trades must make progress toward meeting this cap. The baseline for NPS is the pollutant load level associated with existing land uses and management practices that comply with existing state or local regulations.
WQT is intended to encourage and potentially reward active restoration of riparian areas and the associated incremental environmental gains that will occur in a shorter time when compared to passive management activities in riparian areas.
For post-TMDL, trades need to be consistent with the assumptions and requirements upon which the TMDL is established. TMDLs provide a useful framework for developing trades and evaluating the impacts of trading activities. DEQ does not support any trading activity that would delay implementation of a TMDL or would, over time, cause the combined NPDES permit and NPS loadings to exceed the total loading capacity established by a TMDL.

**Ohio** (OEPA 2012):
<u>Stated Purpose of WQT:</u>
Facilitates watershed-based approach to improving water quality, improves water quality and minimizes the costs of achieving and maintaining water quality standards, provides economic incentives for voluntary pollutant reductions from point and nonpoint sources and achieves additional environmental benefits beyond pollutant reductions.
<u>Guidance on Trading and TMDLs:</u>
For NPS, baseline is the pollutant load associated with existing land uses and management practices. Existing management practices must comply with any applicable federal, state or local requirements (three year practice history).

- No approved TMDL; trading ratio is 2 lbs of pollutant reduction equals 1 lb of water quality credit

- Approved TMDL: trading ratio is 3 lbs of pollutant reduction equals 1 lb of water quality credit.

**Pennsylvania** (PA DEP 2010):
Stated Purpose of WQT:
Approach is to improve water quality by using market mechanisms to produce pollutant reductions at lower costs. Provide income to farmers and flexibility for the regulated community.
Guidance on Trading and TMDLs:
First, the generator must meet "baseline" requirements (the legal requirements and pollutant load associated with the location applicable on January 1, 2005, or later). The second requirement is "threshold." This requirement is defined as either a 100-foot manure set back, a 35-foot vegetative buffer or a reduction of 20 percent in the farm's overall nutrient balance beyond baseline compliance. It provides an added level of nutrient and sediment reduction that would not necessarily be accomplished without the financial incentives of trading. Where a TMDL has been approved or established, the nonpoint source load allocation establishes the baseline for generating credits. This is an additional baseline requirement. For trading in the Chesapeake Bay region, Pennsylvania has set a NPS trading cap for each watershed segment to ensure that the Trading Program is not trading away reductions that are needed to meet the PA Tributary Strategy goals for NPS reductions. Tradable loads are the difference between the level of reductions listed in the Tributary Strategy and an estimate of the maximum reductions that could be achieved by using the BMPs listed in the Tributary Strategy.

**Virginia** (Chesapeake Bay Watershed Nutrient Credit Exchange Program) (VA DEQ 2008):
Stated Purpose of WQT:
Allows for nutrient reductions in timely and cost-effective manner; could bring additional resources from the private sector to nutrient reduction efforts.
General Baseline:
NPS must achieve the level of BMP implementation called for in the nutrient tributary strategies to achieve nutrient reductions before generating credits. NPS are presumed to meet the baseline if they implement all of the following BMPs that are applicable to their operations:

- Soil conservation (achieve soil loss tolerance value of T or less using RUSLE2)
- Implement nutrient management plan
- Use cover crops (cropland only)
- Implement livestock exclusion fencing (pasture only) with 35-foot riparian buffer
- Maintain 35-foot vegetative buffers

**West Virginia** (WV Water Research Institute and WV University 2010):
Stated Purpose of WQT:
Approach is to improve and maintain water quality using market mechanisms to produce nutrient reductions at lower cost. WQT has the potential to achieve water quality and other environmental benefits more cost-effectively and generate greater economic and environmental benefits than traditional regulatory programs.

Guidance on Trading and TMDLs:
West Virginia doesn't have sector specific regulatory control requirements applicable to agricultural NPS. At a minimum, the NPS must develop a nutrient management plan before generating credits. Additional baseline requirements will be calculated and applied on a basin-by-basin basis to reflect the specific trading and watershed situation.

**Potomac:**
The baseline was very contentious and many thought there shouldn't be a requirement in order to maximize farmer participation. However, the issue of equity won out. They decided NPSs must meet the *more restrictive* of: a) any existing regulatory requirements or effluent limits related to nutrient management, or b) implementation of a whole farm nutrient management plan and an average per-acre nutrient load on the to-be-credited site based on the 2005 average Edge of Segment nutrient load for the specific agricultural land use. The loading rates are to be modified to reflect the Bay TMDL agricultural nutrient allocations when final. NPSs entering the trading program who have implemented BMPs that exceed the baseline are eligible to receive credits for their prior commitment to land stewardship.

**UNDER DEVELOPMENT**
**Delaware:**
In 2008, point sources discharging into the Indian River, Indian River Bay, Rehobooth Bay, Little Assawoman Bay or their tributaries under the NPDES program could choose to engage in WQT on a case-by-case basis and subject to approval by the Department in accordance with: 1) trades must occur in the same watershed as the point source discharge is located; 2) trades must involve a trading ratio of at least 2:1 between the NPS and PS; and 3) the nutrient load reduction involved in the trade must constitute reductions that occur beyond the baseline or the PS or NPS nutrient reductions required under the TMDL and this Pollution Control Strategy (Delaware DNREC 2008).
From Delaware DNR website:
Once a TMDL is promulgated, a Pollution Control Strategy (PCS) will be developed. A PCS will specify the necessary pollutant load reductions that need to occur such that loadings will be less than or equal to the TMDL. Plans are for reductions to be achieved through voluntary (for those activities that are voluntary now) and regulatory (for those activities that are regulated now) actions. However, TMDLs will provide watershed-wide pollution reduction targets which DNREC (and EPA) will be legally obligated to meet. This obligation will require new approaches for addressing point and nonpoint sources of pollution. Concepts such as "pollution trading" between different sources of pollution, geographic targeting, and pollution prevention will all be considered as part of the PCS. Meeting these targets may require regulation under existing law.

**Florida** (Lower St. Johns River - now expanded to whole state)(FL DEP 2009):
***To achieve TMDL, implementing NPS pollution control practices is regulated***
Stated Purpose of WQT:
Innovative approach to achieve water quality goals more efficiently.
Guidance on Trading and TMDLs:

Baseline for NPS is the source's load allocation specified under the Lower St. Johns River Basin Management Action Plan (LSFR BMAP) or, for NPS that covered under categorical load allocations, the load expected following implementation of applicable BMPs and the additional reductions required for agricultural sources.
*Final Proposed Rule*: Includes voluntary trading of water quality credits to achieve the needed pollutant load reductions in basin management action plans. For a trade involving credits generated by a NPS (typically related to stormwater), the pollutant loading must be less than that expected following the implementation of BMPs and any other reductions required in the BMAP. Goes into effect July 1, 2013 (Florida Senate 2013).

**Montana** (MT DEQ 2012):
Stated Purpose of WQT:
Provide cost-effective method for achieving compliance with Montana's base numeric nutrient standards, offset new or increased discharges resulting from growth, establish economic incentives for reductions from **all** sources within a watershed, reduce the cost of implementing nutrient TMDLs or water quality-based effluent limits and to achieve greater environmental benefits than through the existing regulatory framework.
Guidance on Trading and TMDLs:
Impaired waters with TMDL: "Where a TMDL has been established or approved, the applicable point source wasteload allocation would establish the point source's baseline for generating credits. In distinction, the baseline for nonpoint sources is the level of pollutant load associated with existing land uses and management practices that comply with applicable state, local or tribal regulations. See §75-5-317(2)(a) and (b), MCA. A nonpoint source may generate credits by achieving greater nutrient load reductions than required by any statute or rule governing its nonpoint source activity. A nonpoint source may not, however, terminate an existing Best Management Practice (BMP) to reduce the baseline requirement in order to generate credits for future trading purposes."
Waters without a TMDL:
"In this instance, like the previous instance, the baseline for nonpoint sources is the level of pollutant load associated with existing land uses and management practices that comply with applicable state, local or tribal regulations. A nonpoint source may generate credits by achieving greater nutrient load reductions than required by any statute or rule governing its nonpoint source activity. A nonpoint source may not, however, terminate an existing BMP to reduce the baseline requirement in order to generate credits for future trading purposes."

**Minnesota** (MN PCA 2011):
Stated Purpose of WQT:
Optimize costs of achieving and maintaining water quality; provide for voluntary NPS reductions and point source discharge reductions beyond those authorized by the existing NPDES permits, allow for new and expanding NPDES discharges prior to completion or implementation of a TMDL and facilitate the implementation of TMDLs.
Guidance of Trading and TMDLs:

For pre-TMDL, baseline conditions are the conditions existing immediately before the execution of the trade.
For post-TMDL, baseline conditions are the conditions existing immediately before the execution of the trade or baseline conditions may be specifically established in a TMDL. A seller may generate credits by achieving reductions below site-specific limitations established in the load allocation portion of the TMDL. If the TMDL or TDML implementation plan has developed or assigned site-specific interim limits, credits may only be generated by achieving reductions below the interim limits.

**Wisconsin** (WI DNR 2013):
***To achieve TMDL, implementing NPS pollution control practice is regulated***
Stated Purpose of WQT:
Market-based tool that may be economically preferable to other compliance options; develop new economic opportunities in a region.
Proposed Guidance of Trading and TMDLs:
The baseline (= credit threshold) is set at the current pollution load (pollution load prior to trading agreement). Long-term credits are given for reductions that go above and beyond the statewide standards or TMDL load allocations. Interim credits (good for five years) are available to NPS who implement BMPs to come into compliance with applicable statewide performance standards or TMDL load allocations.

**BEING ASSESSED**
**Iowa** (IA DALS, DNR and ISU 2012):
Iowa State University examined WQT as a policy instrument to support the TMDL implementation process (Feng et al 2006). Iowa nutrient reduction strategy (IDAL, IDNR and ISU 2012) prioritizes nutrient credit trading and states that Iowa point sources, IDNR, IDALS and the WRCC will work to develop an environmental credit trading program based on need and available resources. They may establish and implement voluntary market-based approaches or incentives such as prioritized use of State Revolving Funds.

**Missouri** (Geosyntec Consultants 2013):
(Geosyntec report on critical policy factors and program recommendations 2/13) - "Ag baselines effectively behave like a trading ratio and can limit trading activity."
Stated Purpose of WQT:
Efficiency is the most important criterion.
Guidance on Trading and TMDLs:
"For nonpoint sources, EPA (2007) distinguishes between baselines for sellers located in watersheds with and without a TMDL. Where TMDLs exist, EPA guidance indicates the baseline should be derived from the nonpoint source's load allocation (LA) in the TMDL. However, establishing the nonpoint source baseline as the LA could have the unintended consequence of discouraging trading and reducing the likelihood of the LA ever being achieved. Not only would this significantly raise the cost for entering a WQT program, it potentially leaves little room for additional credit generation. Under this scenario, trading may not be feasible or cost-effective. Without other forms of financial incentives, the LA may never be achieved."

In the absence of a TMDL, EPA's Trading Policy (2003) states that state and local requirements and/or existing practices should determine a nonpoint source's baseline. Agricultural operations would be expected to meet minimum "baseline" nutrient management requirements to be considered eligible to sell credits in a nutrient trading program. Baseline requirements help assure that producers participating in a trading program are already managing nutrient runoff to an extent that is common for reputable farming practices.
Suggested baseline: basic nutrient management plan or "basic option" of NRCS Practice 590 (develop plan and conduct soil tests).
Conclusions from Report: "Agricultural baselines effectively behave like a trading ratio. Any baseline set above and beyond current nutrient management practices would result in additional trading costs. These costs would be passed on to WWTPs purchasing credits and, in effect, would act as a trading ratio because credit supplies would become more limited and trading would be less cost-effective. Baselines also raise issues of equity as WWTPs are effectively paying for nutrient removal activities beyond that required by regulation. Additionally, as demonstrated in the South Fork Salt and Spring River Basins, WWTPs may be challenged to identify a sufficient supply of nonpoint source credits—applying a high agricultural baseline will only exacerbate the situation."
Implications for WQT in Missouri: If the agricultural baseline is set higher than current nutrient management practices, WQT will be less cost-effective, fewer WWTPs will be able to trade, and issues of equity will be raised. Implementation of the "Basic Options" of the Missouri NRCS Nutrient Management Conservation Practice (Practice Code Number 590) is the suggested baseline requirement for participation in a Missouri water quality trading program. Nutrient management practices that are in place prior to participation in a water quality trading program should not be considered eligible for nutrient trading credits.

**Summary of State approaches to Baselines for Farmers**

| | Existing Land Use | Prior Land Use | Comply with Laws | Reasonable appropriate BMPs | Meet load allocation pre-TMDL | Meet T.S. load allocation | Meet TMDL load allocation | Add BMPs or plans | More load reduced |
|---|---|---|---|---|---|---|---|---|---|
| CO | X | X | X | X | X (WMP) | | X | | |
| ID | | | X | | X = water quality contribution | | X | | |
| MD | | | X | | | X | X | X | |
| MI | | | X | X | | | X | | |
| OR | X | | X | | X | | X | | |
| OH | X | X | X | | use 2:1 trading ratio | | use 3:1 trading ratio | | |
| PA | | X | X | | | | X | and X | or X |
| VA | | | | | | X (use all BMPs) | | | |
| WV | | X | | X | | | X | | |
| DE | | X | | | | | X | | |
| FL | | | | | | | X (BMAP) | | |
| MT | X | | X | | | | | | |

| | Existing Land Use | Prior Land Use | Comply with Laws | Reasonable appropriate BMPs | Meet load allocation pre-TMDL | Meet T.S. load allocation | Meet TMDL load allocation | Add BMPs or plans | More load reduced |
|---|---|---|---|---|---|---|---|---|---|
| MN | X | | | | | | or X | | |
| MO | X | | X | X | | | | | |

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# APPENDIX II - FEEDBACK FROM AGRICULTURE ON BASELINES

**A. Feedback from Producers in the Ohio River Basin WQT Project**

Since baselines are the principle design element used to qualify farmers and ranchers for participation in WQT markets, they are an important issue for the potential credit sellers. If the baseline sets highly stringent or burdensome requirements for participation, it becomes an impediment to the market. If it is too lax, it may miss an opportunity to utilize the incentive power of markets to facilitate environmental improvements (Chesapeake Bay Environmental Markets Team 2010). In addition, lax baselines may be perceived as "rewarding" producers who should have doing more to reduce nutrient run-off by allowing them to sell credits and be strongly opposed by stakeholders. Most producers feel that WQT should be an incentive for both early adopters of BMPs who have already significantly reduced nutrient run-off and late adopters of BMPs whose farm operations may have high reduction potentials. They struggle with the resulting issues of fairness in trying to balance these two competing objectives (Klang et al. 2008).

In the Ohio River Basin WQT project, AFT convened several listening sessions with producers in the basin. We also convened a listening session in Iowa. Producers who attended these sessions had been invited by their local SWCDs or county farm bureau. When we discussed baseline issues, they raised concerns over fairness issues for both "early adopters" and "late adopters" (AFT, 2009; AFT 2010; Fox 2010a; Fox 2010b; Fox 2010c; Fox 2011).

Concerning "early adopters," participants concluded that all farms had marginal land (e.g., areas of soil compaction) so that even early adopters would have additional practices they could install. The producers thought the market should consider adding a "premium" factor for those farmers who had gone through a certification process or something similar and reward farmers for this certification by paying more for the credits they generated. For example, the market could award stars based upon certain factors. Out of a three to five star range of farms, a purchaser would then be able to recognize potential value from purchasing from a five star farmer provider. This is analogous to the bond rating of municipalities which helps sort out quality versus quantity. They also mentioned the model that already exists within the electric power industry in their purchases of renewable energy. They mix their purchases of different environmentally beneficial power (or less destructive power).

Concerning "late adopters," producers who attended the listening sessions did not feel it was fair to allow producers who were not meeting minimal standards to benefit from selling environmental credits in a trading market.

The two reoccurring recommendations from producers were: 1) set equitable baselines; and 2) avoid rewarding producers with a poor history of BMP implementation. Based on these findings, the baseline established for the ORB WQT project pilot trades was: "*For a nonpoint source to generate a credit, it must reduce its loading of TN or TP below current conditions (e.g., existing land uses and management practices) and otherwise* *comply with applicable legal requirements. Agricultural nonpoint sources will need to provide three years of farm practice history to document current conditions*."

The final language used to describe the baseline for the trading plan uncovered an important difference between point and nonpoint sources. Producers attending the listening sessions thought in terms of adding conservation practices or going above the baseline to generate credits since their frame of reference was implementing practices. In contrast, permitting authorities focused on reducing nutrient loads or going below the baseline to generate credits (EPRI 2012).

**B. Feedback from Agricultural Stakeholders in the Ohio River Basin WQT Project**. The ORB WQT Agricultural Stakeholder Advisory Committee identified at least three possible concerns with baselines (taken from committee conference call notes recorded by Ann Sorensen, AFT). If all farmers were eligible to trade, the market might inadvertently reward farmers who have done little if anything to reduce nutrient runoff on their farms. This was a fairness issue. On the flip side, the committee warned that farmers who were currently using BMPs (early adopters) might be priced out of the market because they had already significantly reduced nutrient runoff and additional practices might be prohibitively expensive. The committee did not want to create a disincentive or penalize farmers who are "doing the right thing." However, some members felt there would always be room for enhancing or improving conservation practices (e.g., doing minimum surface tillage to work in surface broadcast of P and N. Finally, if credit prices were high enough, the market might encourage back-sliding (i.e., taking out existing practices and coming back three years later to re-install practices to generate credits). However, most members felt that farmers tended to put in practices because of a land ethic, not profits.

The committee discussed the possibility of providing smaller payments to early adopters to maintain or enhance existing practices to generate a reserve pool of credits for the project. They also discussed an approach being tested by The Ohio State University to reward farmers in small watersheds with a percentage payment based on practices they are installing and the number of acres they install them on—a peer-to-peer approach where everyone gets a share of the reward for generating a pool of credits.

To honor early adopters, the committee considered several ideas proposed during the ORB WQT listening sessions and proposed their own ideas:

1. Provide a lower credit payment to maintain or enhance an existing practice: This approach did not gain traction with the committee.
2. Pay early adopters to provide credits for the reserve pool: The Great Miami River trading program had a back-up pool of credits and paid high-end farmers to put credits in the back-up pool. This helps ensure that only new reductions are credited but still allows early adopters (high end farmers) to participate.
3. Have all of the entities agree on a starting date for the program. Any practices that are implemented after this date are eligible.
4. Use a Conservation Security Program type payment (payment based on stewardship level plus enhancement payments for adding additional practices):

Although the CSP-type approach made sense to the committee, they worried that many producers were soured on CSP after the initial signing-up process. They agreed there was less risk in buying credits from proven producers (early adopters) since they have gained experience in implementing, maintaining and enhancing BMPs.

5. Use a tiered structure for approved practices: Another suggestion was a tiered structure for approved practices (Tiers 1, 2 and 3) that would determine the value of that practice with Tier 1 practice providing the greatest reductions. Alternately, the Tiers could identify practices that provide increasing levels of co-benefits (additional ecosystem services).
6. Provide an opportunity for point sources to give preference for farmers with higher stewardship scores by denoting stewardship status in on-line registry: The ability to maintain confidentiality was a huge concern for the committee.
7. Assign a value or a multiplier that would be reflective of the credit itself (a risk-type consideration analogous to a AAA bond credit rating versus a penny stock bond credit rating). For example, the Michigan Agriculture Environmental Assurance Program offers the different levels of certification but the committee felt the program was too complicated with too many costs associated with verification. They felt a simpler approach might be the Ohio livestock assurance program where producers receive extra points for participating in that program when they apply for EQIP funding.

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# APPENDIX III - MEASURING AND VERIFYING BASELINES

**Measuring and Verifying Baselines**

Regardless of what baseline is chosen, programs need some way to measure and verify that the farm has met the baseline conditions. This can involve questioning the farmer and inspecting the farm operation, working with the farmer to assemble and review his or her farm practice records, applying computer models to calculate existing run-off from the operation and collecting spatial data about the operation. Ideally, the trading market can strike a balance between the need to document existing and prior conditions on the farm with the need to simplify paperwork and minimize time requirements.

Information needed to establish compliance with baseline may include:

- Location of farm, type of operation (cropland, livestock, other)
- Description of farm operation (crop rotations, crop rotation sequence, crop residue management including each crop within the rotation for each field, yield per acre per year and units, date of planting, date of harvest and whether residue is removed from field; if a perennial hay crop is grown, provide typical seeding date, number of cuttings and per acre yield; and for tree crops, provide month and year of establishment)
- Field operations (tillage information for each field including equipment used, soil penetration depth, type of residue managers)
- Crop nutrient input (field identification, crop and yield goal, date of application, formulation of material applied, method of application and actual lb/ac of actual N, P and K that was applied)
- Irrigation water management (if BMP involves tile drainage)
- Location and type of conservation practices (buffer strips, filter strips, structural conservation practices such as terracing)
- If the operation includes livestock, information about the livestock inventory, grazing system documentation, manure handling and location of barns/feeding areas/drainage may be needed

Most producers keep field records but these may vary from scribbled notes to detailed logs to digital records. These records may include field identification or description, parcel size, cropping history, crops grown, cultural practices used and yield information, current field activities and soil test data. If the farmer does not keep records, then the market administrator will have to decide if a farm practice history questionnaire signed by both the farmer and the verifier who goes through the questionnaire with the farmer will suffice as documentation of the farm's baseline or if remote sensing is a possibility.

Farmers typically use three types of conservation practices—structural, vegetative and management—and each type needs a different type of "verification" (Widman 2012). Structural or durable practices (like livestock exclusion fencing or heavy use pads) are easy to see once they are installed. However, they may involve some operation and maintenance and require a review of the producer records (e.g., drainage water management). Vegetative practices (e.g., filter strips) can also be easy to observe once they are established. Again, there may be some operation and maintenance and it will require a review of producers' records to verify this (e.g., filter strips). Management type practices are applied annually (e.g., cover crops, rotations, nutrient management). They can sometimes be verified visually if the farm is visited at the right time of year. Otherwise, they have to be verified via producer records. Typically, practice verification is based on the specifications in the practice plan and some specifications can be observed in the field while some require reviewing producer records. For example, a cover crop plan would have a field number and acres, the species of plants to be established, seeding rates, recommended seeding dates, establishment procedure, planned rates and timing of nutrient application and planned dates and method to terminate the cover crop. Nutrient management plans would have fields/location maps, application restrictions and setbacks, soil types, water, compost, manure, organic by-product, plant tissue sample analyses applicable to the plan, realistic yield goals for the crops, complete nutrient budget for nitrogen, phosphorus and potassium and time of application(s) and weather conditions, method(s) of application, nutrient sources, nutrient rates and crop yields. Residue management (mulch till) would include field number(s) and acres, purpose(s) for this practice, crop(s) where this practice will be used, type and timing of soil disturbing operations and estimated surface residues following each operation.

For producers who have worked with their local SWCD office, that office may have conservation plans and nutrient management plans on file for the producer that can provide most of the information needed. Examples include: 1) <u>NRCS SWCD Conservation Plan</u>: May include aerial photo or diagram of fields; soil map and soil descriptions; resource inventory data, which can include crop production potential or livestock carrying capacity; list of treatment decisions; and location and schedule for applying and maintaining conservation practices; and 2) <u>NRCS SWCD Comprehensive Nutrient Management Plan</u>: e.g., the Comprehensive Nutrient Management Plan Agronomy Inventory worksheet lists components and resources needing protection including potential contaminant sources and pathways for contaminants to each resource.

Emerging technologies may reduce the costs and increase the efficiency of doing site inspections. Spatio-temporal imagery and Geographic Information Systems may allow programs to do some monitoring and analysis with remote sensing. Robust "smart" mobile devices that combine Global Positioning Systems, digital cameras, wireless connection, voice, data and video communication and GIS may help streamline on-farm visits and inspections. The USDA Farm Service Agency is looking ahead to owner/operator submissions from producers who have "smart" devices, providing application software (a mobile "app") to facilitate submissions—producers would then submit images of the BMP embedded with location, time and date and these submitted images would be linked with GIS (Cook 2012).

The Coalition on Agricultural Greenhouse Gases (C-AGG) has offered several recommendations to the California Air Resources Board (ARB) regarding verification requirements in compliance offset protocol for the agricultural sector (C-AGG 2013). These verification methods apply to both establishing and confirming the baseline and implemented projects: *remote sensing*, including aerial and satellite imagery, at a level of resolution appropriate to the parameter being verified; *monitoring technologies for data capture and logging* (like date-stamped in-field digital photos, precision agriculture equipment records*); farmer management records and sales receipts*; *telephone interviews* in lieu of some site visits (combined with remote sensing); and s*ite visits* for practices or parameters that are difficult to verify remotely. However, although tools and technology can reduce the costs of verification, obtaining data from farmers comes with a cost and this must be factored into a trading framework.

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# APPENDIX IV - SUMMARY TABLE OF PROGRAM BASELINES

(Table adapted from Kieser & Associates Memo, Ohio River Basin WQT Synopsis of U.S. WQT Programs-Baselines produced for the Electric Power Research Institute April 22, 2010)

| Program or Rules | Guidance | Type of Baseline | NPS baseline | Notes |
|---|---|---|---|---|
| **Each Farm's Current Practice** | | | | |
| Alpine Cheese, Holmes County, Ohio[i] | Alpine Cheese Trading Plan<br><br>Sugar Creek under a TMDL completed in 2002. Focuses on phosphorus.<br><br>Half of the nutrients come from only 31% of the land. | Each farm's current practices | Accepts a farm's current practices.<br><br>Among the first to start a trading program when guidance was limited. EPA wanted to set in and set benchmarks for each farm but this approach was eventually ruled out as too expensive. | Targeted mostly dairy farms, mostly Amish and not participating in traditional conservation programs. Used traditional BMPs and project/OEPA "innovative practices." Offered incentives to high participation tributaries (75% participating); also sign up incentives to new members. |
| Rahr Malting Company permit, MN[ii] | NPDES permit incorporating trading issued in 1997<br><br>P, N and sediment loading reductions | Each farm's current practices | Rahr selected BMPS that provided equivalent water quality improvement to downstream point source reductions, could be visually tracked or monitored, and promoted additional NPS reduction opportunities that were not widely used. BMPS that were already widely used (e.g., reduced tillage) were excluded through the use of trading ratios. | BMPs could stabilize gully and bank erosion, exclude livestock from stream or river riparian zones, rotate grazing with livestock exclusion from riparian zones, or treat stormwater runoff with constructed wetlands. |
| Southern MN Beet Sugar Cooperative Permit, MN[iii] | SMBSC NPDES permit | Each farm's current practices.<br><br>5 years of farm practice history sets load reduction baseline | Farmers must provide 5 years of farm history. NPDES permit specifies formula used to calculate P credits from each BMP. Acceptable BMPs to reduce P included cattle exclusions, buffer strips, constructed wetlands, set-asides, alternative surface tile inlets, soil erosion BMPs, and cover crops, all of which are designed to reduce the runoff of P to surface water. | Approximately 200 trades/year—as of 2007, contracts on 579 NPS sites totaling over 58,000 acres[iv] |

| Program or Rules | Guidance | Type of Baseline | NPS baseline | Notes |
|---|---|---|---|---|
| Minnesota proposed Permanent Rules[v] | Minnesota Pollution Control Agency | Conditions existing immediately before trade | For TMDL watersheds, either conditions existing immediately before trade or baseline established in a TMDL | If TMDL has site-specific interim limits, NPS needs to reduce below to generate credits |
| **Minimum Level of Agricultural Management Practices** | | | | |
| Wisconsin (WQT framework proposed July 2011)[vi] | Framework report from WI DNR | Meet applicable statewide performance standard<br><br>Baseline allows for interim trades to meet TMDL load allocations or Statewide performance standards (=phased baseline) | Either the applicable statewide performance standard or the TMDL load allocation, whichever is lower. For example, for P runoff the credit threshold is set to a P index (PI) of 6 (s. NR 151.04, Wis. Adm. Code). For total suspended solids (TSS) or sediment, the credit threshold is set equal to tolerable soil loss or "T" (s. NR 151.02, Wis. Adm. Code). For ag sources that do not have numeric statewide performance standards, such as barnyard runoff and stream bank erosion, the credit threshold shall be set using a method approved by the DNR. For ag areas addressed by a TMDL, the credit threshold is set equal to the load allocation calculated in the TMDL. | Proposed framework under review |
| Red Cedar River Trading Program Wisconsin[vii] | City of Cumberland NPDES permit | Meet applicable statewide performance standard or TMDL load allocation | Farmers had to meet TMDL load allocation or applicable statewide performance standards, whichever was lower.<br><br>Little concern given to additionality. | First trades in 2001; eight rounds of credit purchases. Farmers compensated $18/acre for no-till and $15/acre for minimum till (cost/lb of P is $1.70. Farmers willing to use no-till or conservation tillage for 3 years. Paid $3.85/lb of P (included soil testing fees) |
| | | | | |

| Program or Rules | Guidance | Type of Baseline | NPS baseline | Notes |
|---|---|---|---|---|
| Michigan Kalamazoo River Basin Demonstration Project[viii] | Demonstration project | Baseline at generally accepted agricultural management practices | Set generally accepted agricultural management practices (GAAMPs) as the baseline but producers who were not yet using GAAMPs could receive discounted credits (50 percent) for practices that brought them into compliance. | No trades ever completed |
| Michigan WQT[ix] | MI WQT Rules | Baseline at performance standard required by management plans | NPS subject to applicable requirement, most protective of cap and load allocation of: 1) a TMDL, 2) WMP, 3) remedial action plan, or 4) lake-wide management plan. Data from 3 years of farm practice history sets load reduction baseline | Formulas for calculating each of the NPS baselines described are included in the Michigan WQT Rules, R 323.3011 and R 323.3013. Program is non-operational. |
| Colorado WQT[x] | Colorado WQT Rules | Existing land uses and reasonable/ appropriate BMPs | NPS subject to applicable requirement, most protective of cap and load allocation of: 1) a TMDL, 2) WMP, or 3) remedial action plan | Trading encouraged prior to completion of TMDL |
| **Compliance with Existing Regulations** | | | | |
| Great Miami River WQT[xi] | Operations Manual<br><br>Not part of NPDES permits | Baseline to meet legal requirements | Voluntary actions above and beyond what is required by local, state or federal law.<br><br>Must be EQIP-eligible<br><br>No requirement to implement a minimum set of BMPs.[xii]<br><br>3 years of farm history not required in application | Responsible for most of the PS to NPS trades to date. Targets farmers not previously engaged in USDA programs. Large diversity of BMPs. Have invested $1.8 million on 397 on-farm projects, 1.1 million lbs reduced. 11 funding rounds completed 1/12[xiii] |
| Ohio WQT[xiv] | Ohio WQT Rules | Baseline to meet legal requirements | For NPS, pollutant load associated with existing land uses and management practices (must comply with federal, state and local requirements) must be established:<br>1) By accurate and representative available flow and monitoring data, pollutant loading data, and | Proposed changes 8/14/12 disallow credits generated through other funding; revise baseline provisions for areas where there is no approved water quality plan or where water quality supports designated uses |

| Program or Rules | Guidance | Type of Baseline | NPS baseline | Notes |
|---|---|---|---|---|
| | | | records deemed acceptable by director<br>2) Using information/data representative of three years period before change to generate credits | |
| Ohio River Basin WQT project[xv] | Trading Plan signed by IN, KY and OH 8-9-12 Interstate trading program led by Electric Power Research institute | Baseline to meet legal requirements | For pilot trades, NPS submit 3 years of farm practice history (from 8-9-09 forward) to ensure additionality. Must meet all local, state and federal regulations. Must be EQIP-eligible (condition of grant funding) | Pilot trades to begin in Spring 2013 with credits available in Fall 2013, Functional market expected in 2015 |
| Oregon: Temperature and oxygen demanding substances[xvi] | Trades incorporated into NPDES permits | Baseline to meet existing regulations | Credit only given for actions that are not currently required by existing regulation or are above and beyond the minimum regulatory requirement. | Tailored baseline to what farmers were willing to do<br><br>Trades being challenged as not legally robust |
| Montana WQT[xvii] | Montana DEQ Policy for Nutrient Trading | Baseline is existing land uses that comply with regulations | Baseline remains the same for TMDL watersheds - existing land uses and compliance with all regulations | |
| Oregon WQT[xviii] | WQT in NPDES Permits Internal Management Directive | Baseline is existing land uses that comply with regulations | Oregon regulates NPS to achieve TMDL so baseline remains the same for TMDL watersheds | |
| **Compliance and Additional Level of Agricultural Management Practices** | | | | |
| West Virginia Water Quality Nutrient Trading Program[xix] | West Virginia Water Quality Nutrient Credit Trading Program Guidance | Compliance and implement BMPs in whole-farm Nutrient Management Plan that achieve stipulated load for the field | Baseline is the set of management requirements to maximum extent practicable. Ag NPSs must meet the more restrictive of the following:<br>- Existing regulatory requirements or effluent limits related to nutrient management; or<br>- Practices contained in a whole-farm NMP plan and a stipulated average per acre nutrient load for the | Once a TMDL is approved by EPA, any load allocations and individual waste load allocations established to meet water quality standards apply. This may mean that adjusted "baseline" requirements must be implemented before credits can be generated |

| Program or Rules | Guidance | Type of Baseline | NPS baseline | Notes |
|---|---|---|---|---|
| | | | field or livestock production areas where credits are being generated.<br>The per acre annual loading rate is based on the edge of field nutrient load goal for the specific land use (from Chesapeake Bay Model). | |
| Pennsylvania WQT[xx] | PA Dept. of Environmental Protection Trading of Nutrient and Sediment Reduction Credits – Policy and Guidelines | Compliance and achieve pollutant load associated with location on Jan. 1, 2005 with additional threshold practices required | For ag NPSs, compliance with Erosion and Sedimentation regulations, nutrient management plan, CAFO requirements (if applicable), and any load allocation specified under a TMDL. In addition, operations must meet one of the following three "threshold" requirements:<br>- 100 foot mechanical setback or equivalent.<br>- 35 foot buffer or equivalent<br>- 20% reduction below farm's total nutrient balance beyond baseline compliance | Trading threshold also applies for NPSs proposing to generate credits to meet WQ standards (e.g., agriculture must have select BMPs in place or not be located adjacent to surface water)<br><br>Baseline was developed prior to TMDL so is now being revisited. |
| **Phased or Graduated** | | | | |
| Wisconsin (WQT framework proposed July 2011)[xxi] | Framework report from WI DNR | Baseline allows for interim trades to meet TMDL load allocations or Statewide performance standards (=phased baseline) | Either the applicable statewide performance standard or the TMDL load allocation, whichever is lower. For example, for P runoff the credit threshold is set to a P index (PI) of 6 (s. NR 151.04, Wis. Adm. Code). For total suspended solids (TSS) or sediment, the credit threshold is set equal to tolerable soil loss or "T" (s. NR 151.02, Wis. Adm. Code). For ag sources that do not have numeric statewide performance standards, such as barnyard runoff and stream bank erosion, the credit threshold shall be set using a method approved by the DNR. For | Proposed framework currently under review. Interim credit suggestions may be challenged. |

| Program or Rules | Guidance | Type of Baseline | NPS baseline | Notes |
|---|---|---|---|---|
| | | | ag areas addressed by a TMDL, the credit threshold is set equal to the load allocation calculated in the TMDL. | |
| Florida WQT Rules[xxii] | Proposed legislation SB 754 | Language indicates willingness to consider phased baseline | In developing and implementing a TDL, a basin management action plan may provide for phased implementation of management strategies | Legislation goes into effect July 1, 2013 |
| Idaho WQT Guidance[xxiii] | Idaho DEQ water quality pollutant trading guidance | NPS generates credits that are surplus to the reductions the TMDL assumes NPS must achieve | Anticipates TMDL -NPS makes "water quality contribution" of 10% initially, later 20% with remainder being creditable - tied in stages to development of TMDL and later its implementation. | TMDLs were anticipated in 2003 in the 2 watersheds where trading was tested but have still not been implemented. No active trading. |
| **TMDL Load Allocation: Specific BMPs** | | | | |
| Virginia's Chesapeake Bay Watershed Nutrient Credit Exchange Program[xxiv] | Nutrient Credit Exchange Guidance | Implement specific BMPs required in Tributary Strategy | For agriculture, BMPs required as part of the Tributary Strategy must be implemented, including:<br>- Soil conservation plan on certain crops must be implemented<br>- Nutrient management plan on certain crops must be implemented<br>- Cover crops must be planted on cropland<br>- Livestock stream exclusion in pastures<br>- Riparian buffers must be planted (following NRCS standards) | A producer must implement baseline BMPs within an entire USDA FSA tract before generating credits<br><br>Baseline with load reduction retirement for each farm |
| **TMDL Load Allocation: Specific pollutant reduction** | | | | |
| Idaho Snake River WQT[xxv] | Idaho Pollutant Trading Guidance | Reduce loading below the load allocation set by the TMDL | NPS must implement BMPs that reduce their loading below the load allocation set by the TMDL to generate credits | Any PS may voluntarily participate in trading by purchasing credits in the same month in the same watershed from a PS or NPS to meet their effluent limit as long as trading is part of their NPDES permit.<br>Baseline with load |

| Program or Rules | Guidance | Type of Baseline | NPS baseline | Notes |
|---|---|---|---|---|
| | | | | reduction retirement for each farm. |
| Lower Boise Effluent Trading Demonstration Project, Idaho[xxvi] | Lower Boise River Nutrient TMDL for P | Reduce loading below the load allocation set by the TMDL | Credits can only be generated after the TMDL reduction is met. To calculate this, the NPS's baseline load is multiplied by a water quality contribution percentage. The P reduction eligible for sale as credits is calculated as the difference between the estimated P reduction generated by the BMP and the P reduction required to achieve the TMDL load allocation | No trading to date – does not have support of EPA Region 10<br><br>Baseline with load reduction retirement for each farm |
| **TMDL Load Allocation Plus Additional Requirements** | | | | |
| Pennsylvania WQT[xxvii] | PA Dept. of Environmental Protection Trading of Nutrient and Sediment Reduction Credits – Policy and Guidelines | Meet TMDL load allocation plus specified BMPs that achieve a 20% reduction | For ag NPSs, compliance with Erosion and Sedimentation regulations, nutrient management plan, CAFO requirements (if applicable), and any load allocation specified under a TMDL. In addition, operations must meet one of the following three requirements:<br>- 100 foot mechanical setback or equivalent.<br>- 35 foot buffer or equivalent<br>- 20% reduction below farm's total nutrient balance beyond baseline compliance | Trading threshold also applies for NPSs proposing to generate credits to meet WQ standards (e.g., agriculture must have select BMPs in place or not be located adjacent to surface water)<br><br>If setback or buffer not in place, amount of credit reduced by 20%<br><br>Baseline was developed prior to TMDL so is now being revisited. |
| Maryland WQT[xxviii] | MD Draft Nutrient Trading Policy and Credit Generating Guidance | Baseline with per acre load reduction required in order to trade | Producers must meet minimum requirements and load allocations of the Tributary Strategy or the level of nutrient reductions called for in an applicable TMDL [e.g., to generate credits on cropland, seller must achieve annual load allocation on a per acre basis (calculated from 2010 cropland Tributary Strategy goals)]. | Producer doesn't have to meet the load allocation for the entire farm operation, but only for the portion of the parcel that is being used to generate credits. Web-based MD Nutrient Trading Tool calculates baseline eligibility and credit potential. |

## TABLE FOOTNOTES

[i] Sugar Creek Project. 2006. A Plan to Reduce Phosphorus Loading and Improve Stream Ecological Function in the Middle Fork and Adjoining Watersheds of the Sugar Creek Watershed: Joint Recommendations for the Alpine Cheese Phosphorus Nutrient Trading Plan. January 1, 2006. 49 pp
[ii] U. S. EPA. 2009. Water Quality Trading Toolkit for Permit Writers. Appendices. 208 pp. (See Appendix A)
[iii] U. S. EPA. 2007. Water Quality Trading Toolkit for Permit Writers. Appendices. 208 pp. (See Appendix A)
[iv] U.S. EPA 2007. Water Quality Trading Toolkit for Permit Writers.
[v] Minnesota Pollution Control Agency. 2011. Draft from Revisor. Pollution Control Agency: Proposed Permanent Rules Relating to Water Quality Trading. April 25, 2011. 7054.0010. 11 pp.
[vi] Wisconsin Department of Natural Resources. 2011. A Water Quality Trading Framework for Wisconsin. Report to the Natural Resources Board. July 1, 2011. 62 pp.
[vii] Wisconsin Department of Natural Resources. 2011. A Water Quality Framework for Wisconsin. A Report to the Natural Resources Board. July 1, 2011. 62 pp.
[viii] U.S. Environmental Protection Agency. 2009. Water Quality Trading Toolkit for Permit Writers. EPA Office of Wastewater Management, Water Permits Division. EPA 833-R-07-004. Published August 2007 and Updated June 2009. 203 pp.
[ix] Michigan Office of Regulations and Rules (2002). *Part 30 Water Quality Trading Rules*. Rule 323.3006(8). Available at: http://www.state.mi.us/orr/emi/arcrules.asp?type=Numeric&id=1999&subId=1999-036+EQ&subCat=Admincode. (K&A memo)
[x] Colorado Department of Public Health and Environment. 2004. Colorado Pollutant Trading Policy. Water Quality Control Division. October 2004. 20 pp.
[xi] Miami Conservancy District, 2005. *Great Miami River Watershed Water Quality Credit Trading Program - Operations Manual*. Section 3.1.2 (Buyer Eligibility and Trading Ratios). Miami Conservancy District, 2005. *Great Miami River Watershed Water Quality Credit Trading Program - Operations Manual*. Section 3.1 (Credits). (K&A memo)
[xii] Newburn, D. A. and R. T. Woodward. 2011. An Ex Post Evaluation of Ohio's Great Miami Water Quality Trading Program. *Journal of the American Water Resources Association* 48(!): 156-169. February 2012
[xiii] Taken from article in Ohio Farmer. November 2012.
[xiv] Ohio Environmental Protection Agency, 2007. *State of Ohio Water Quality Trading, Chapter 3745-5 of the Administrative Code*. Division of Surface Water Standards and Technical Support Section. Rule 3745-5-09. (K&A memo)
[xv] Ohio River Basin WQT project: See http//: wqt.epri.com.
[xvi] Wisconsin Department of Natural Resources. 2011. A Water Quality Trading Framework for Wisconsin. Report to the Natural Resources Board. July 1, 2011. 62 pp
[xvii] Montana Department of Environmental Quality. 2012. Circular DEQ-13. Montana's Policy for Nutrient Trading. December 2012. 14 pp.
[xviii] Oregon Department of Environmental Quality. 2009. Water Quality Trading in NPDES Permits Internal Management Directive. December 2009. Updated August 2012. 79 pp
[xix] West Virginia Department of Environmental Protection. *West Virginia Water Quality Nutrient Credit Trading Program*. Available at: http://wvwri.nrcce.wvu.edu/programs/pwqb/pdf/WVDEP_Trading_Guidance_finalDEP8%2015%2009.pdf (K&A memo)
[xx] Pennsylvania Department of Environmental Protection (2009). *Final Trading of Nutrient and Sediment Reduction Credits - Policy and Guidelines*. Available at: http://www.dep.state.pa.us/river/Nutrient%20trading.htm#Policy. (K&A memo)
[xxi] Wisconsin Department of Natural Resources. 2011. A Water Quality Trading Framework for Wisconsin. Report to the Natural Resources Board. July 1, 2011. 62 pp.
[xxii] Florida Senate. 2013. Senate bill 21-00279C-13. Senator Grimsley. April 25, 2013. 15 pp.
[xxiii] Idaho Department of Environmental Quality. 2010. Water Quality Pollutant Trading Guidance. July 2010. 55 pp.

[xxiv] Virginia Department of Environmental Quality, 2008. *Trading Nutrient Reductions from Nonpoint Source Best Management Practices in the Chesapeake Bay Watershed: Guidance for Agricultural Landowners and Your Potential Trading Partners*. Available at: http://www.deq.virginia.gov/export/sites/default/vpdes/pdf/VANPSTradingManual_2-5-08.pdf and State Water Control Board, 2008. *General Virginia Pollutant Discharge Elimination System (VPDES) Watershed Permit Regulations for Total Nitrogen and Total Phosphorus Discharges and Nutrient Trading in the Chesapeake Bay Watershed in Virginia*. 9VAC 25-820-10 et seq. Available at: http://www.deq.virginia.gov/export/sites/default/vpdes/pdf/9VAC25-820-NutrientDischargesGP2007-Amd2008.pdf (K&A memo)
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[xxviii] Maryland Department of Agriculture, 2008. Maryland Policy for Nutrient Cap Management and Trading in Maryland's Chesapeake Bay Watershed Phase II - Guidelines for the Generation of Agricultural Nonpoint Nutrient Credits. Available at: http://www.mda.state.md.us/nutrad/docs/Phase%20II-A_Crdt%20Generation.pdf. (K&A memo)

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