

# COMPARISON AND EFFECTIVENESS OF CHESAPEAKE BAY NUTRIENT TRADING PROGRAM POLICIES

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## INTRODUCTION

Over the past 30 years, a series of mostly voluntary approaches were used to reduce nutrient and sediment delivery to the Chesapeake Bay. In the 2000s, states developed Tributary Strategies—voluntary plans for reducing nutrient loads by sector; however, the cost of meeting load allocations led states in the Chesapeake Bay watershed to explore nutrient trading as a more cost-effective option to meet their allocations. Maryland, Pennsylvania, and Virginia introduced nutrient trading programs to provide wastewater treatment plants (WWTPs) with flexible options for meeting and maintaining permitted nutrient load limits. Through these programs, point sources (e.g., WWTPs) may purchase credits or offsets generated by other point sources or from agricultural nonpoint sources that reduce the nutrients they release to water bodies. Programs also include or plan to include options for development and municipal stormwater programs to buy and sell credits and offsets. At least two other Bay states, Delaware<sup>1</sup> and West Virginia,<sup>2</sup> have convened work groups to discuss developing such programs, but they do not have any formal programs or guidance in place.

Subsequent to the establishment of trading programs in Maryland, Virginia, and Pennsylvania, the U.S. Environmental Protection Agency (USEPA) established the Chesapeake Bay total maximum daily load (TMDL) in 2010, allocating nutrient and sediment caps to each state in the watershed, in which the portion of the cap allocated to Clean Water Act permitted point sources is federally enforceable. These allocations, in some cases, are inconsistent with the trading programs previously established by the Chesapeake Bay states. For example, some states' eligibility criteria for agricultural credit generators have not been in line with agriculture's allocation under the TMDL. In addition, in the TMDL,

USEPA recognizes interstate trading (i.e., where trades can be conducted across state boundaries) as a possible strategy for meeting the TMDL, and many stakeholders have also been interested in exploring interstate trading due to its potential to achieve greater cost savings than intrastate programs (i.e., where trades are limited to within state boundaries) are able to achieve alone. However, the states do not have formal guidance for conducting interstate trades.

Because the state trading programs were originally developed prior to the TMDL and independently of each other, they may not be consistent with the TMDL or with each other. These inconsistencies may hinder participation, create public distrust or uncertainty, and create barriers to interstate trading. Harmonizing the state programs to resolve these differences can help to create greater certainty for participants across the watershed, lower transaction costs, ensure compatibility with the TMDL, and accommodate interstate trading.

In light of the TMDL, states are reviewing their trading programs, and in some cases, reopening them to accommodate additional sector offset demands and to achieve greater consistency with TMDL implementation plans. Meanwhile, USEPA is releasing a series of technical memoranda that presents the agency's expectations for trading in the Chesapeake Bay, for the purpose of aiding the states as they revise their programs. The memoranda cover topics such as protecting local water quality, demonstrating credit permanence, and using uncertainty trade ratios. These memoranda are meant to help create consistent expectations among the state water quality programs for ensuring consistency with the TMDL and USEPA expectations.

As states revise and expand their programs, there's an opportunity to review the current and proposed policies and determine if improvements could be made to better align the programs and to increase the efficacy of trading as a cost-effective mechanism for meeting and maintaining the Bay TMDL. From the perspective of economic theory, trading is a valuable mechanism for reducing the costs of meeting pollutant caps; however, how the trading policies are set can greatly affect the degree to which trading makes sense economically (Faeth 2000). If the trading programs are not appropriately structured and implemented, then the efficiencies they are designed to achieve can be hard to come by (Selman et al. 2009). In addition, for trading to ultimately be successful as a useful mechanism to cost-effectively achieve water quality goals, the state's trading markets must be robust. Robustness comes from strong drivers for demand, adequate supply, public trust and confidence in the programs, and efficient processes for participants and administrators.

The purpose of this paper is twofold. Firstly, this paper compares state programs in Maryland, Pennsylvania and Virginia across major program design elements and identifies similarities and differences among the programs. Secondly, this paper identifies potential actions that could help increase consistency among the programs in order to build public trust and lay the groundwork for interstate trading and that could be taken to ensure policies are cost-effective for and consistent with meeting TMDL allocations. The recommendations are based on a literature review of relevant articles and published reports and interviews with program administrators and other trading players (e.g., aggregators) across the Bay watershed.

## BRIEF BACKGROUND OF WATER QUALITY TRADING PROGRAMS IN THE CHESAPEAKE BAY

### Pennsylvania

The Pennsylvania Department of Environmental Protection (PADEP) began considering nutrient trading in 2005 as a mechanism for providing flexibility and lowering costs of compliance with forthcoming national pollution discharge elimination system (NPDES) limits on nitrogen and phosphorus. Nutrient trading offered the ability for new and expanding WWTP loads to be offset. PADEP issued its "Final Trading of Nutrient and Sediment Reduction Credits—Policy and Guidelines" in 2006, followed by trading regulations in 2010 (Pennsylvania Environmental Quality Board 2010) addressing the use of offsets and tradable credits from pollution reduction activities in the Chesapeake Bay watershed (see Appendix B for names of policies and regulations). The regulation codified the 2006 guidance, with some revisions. The Pennsylvania trading program allows for point-to-point trading as well as point-to-nonpoint source trading as a means to meet current regulatory obligations as well as to offset new and expanding loads.

### Virginia

Interest in nutrient trading in Virginia originated with WWTP operators in 2004 when the State Water Control Board proposed regulations for implementation of a nutrient permitting strategy (Pomeroy et al., 2005). The proposed regulations called for upgrades at 120 "significant" WWTPs that would achieve "limits of technology" for nitrogen and phosphorus (considered to be 3.0 mg/L for total nitrogen and 0.3 mg/L total phosphorus). The "limit of technology" permit limits were to go into effect on January 1, 2011. Nutrient trading was seen as a means to provide flexibility in compliance schedules and reduce costs of meeting the upcoming nutrient caps. The Chesapeake Bay Watershed Nutrient Credit Exchange Program was signed into law in March 2005 (Virginia General Assembly 2005). The law allowed for point sources to purchase credits from other point sources for the purpose of compliance with wasteload allocations (referred to as "compliance credits"). To facilitate trading, the legislation also established the Virginia Nutrient Credit Exchange Association (VNCEA) to coordinate and facilitate trading among its members. New or expanding wastewater facilities are also required to offset any increase in nitrogen or phosphorus load. This could be done by acquiring wasteload allocations from other point sources or nonpoint source credits traded at a 2:1 ratio. Virginia's Department of Environmental Quality (VADEQ) regulation that implements this statute is 9 VAC 25-820, *General VPDES Watershed Permit Regulation for Total Nitrogen and Total Phosphorus Discharges and Nutrient Trading in the Chesapeake Watershed in Virginia* (Virginia Department of Environmental Quality 2014a).

The Virginia General Assembly passed additional legislation in 2012 (Senate bill 77) that modified and expanded the trading program (Virginia General Assembly 2012). This legislation made it possible for new and expanding wastewater facilities to acquire point source credits rather than wasteload allocations to offset new loads. Equally important, the bill also expanded the trading program to authorize municipal separate storm sewer systems (MS4s), industrial stormwater, and concentrated animal feeding operations (CAFOs) to acquire point source and nonpoint nutrient credits for the purpose of complying with nutrient load reduction requirements in their permits.

Virginia also allows the use of trading to meet post-construction phosphorus load requirements that are implemented through the construction stormwater general permit. The Virginia Stormwater Management Program (VSMP) established post-development phosphorus load requirements for both new development and redevelopment (Virginia Department of Environmental Quality 2013). State law and regulation allow the use of phosphorus offset credits from offsite under certain circumstances. Sites greater than 10 acres must provide at least 75 percent of the post development requirement onsite and demonstrate that onsite conservation practices cannot achieve the full phosphorus runoff requirement. Sites less than 10 acres may trade without providing onsite water quality controls. Offset credits must be generated within the same or adjacent eight-digit hydrologic unit code (HUC) and must be permanent (i.e., generated from projects with a perpetual lifespan). If no credits are available within these HUCs, a VSMP authority may authorize the use of credits generated elsewhere in the watershed (Virginia Department of Environmental Quality 2013).

### **Maryland**

Maryland developed the first phase of its nutrient trading policy in 2008 in order to implement its Chesapeake Bay Tributary Strategy. Maryland's Tributary Strategy required all existing significant point sources to have an NPDES permit with a technology-based effluent limit of enhanced nutrient removal (ENR) defined as 4 mg/L total nitrogen and 0.3 mg/L total phosphorus (Maryland Department of the Environment 2008). Maryland passed the Chesapeake Bay Restoration Fund Act to establish a fund that would pay for up to 100 percent of the costs of ENR upgrades as well as some septic upgrades and cover crop programs. The Fund was funded by a wastewater fee levied on residential, commercial, and industrial accounts of wastewater utilities and owners of onsite sewage disposal systems (OSDS), commonly known as septic systems.

In 2008, Maryland developed a Phase I policy for Nutrient Cap Management and Trading for point sources. The policy addresses both the need to achieve nutrient load reductions from significant point sources through ENR upgrades and the need to offset new or increased point source nutrient loads associated with a growing population. Unlike Pennsylvania and Virginia, Maryland does not allow significant WWTPs to trade in lieu of upgrading to ENR. The policy provides various offset/trading options for offsetting planned growth, among them credits involving the retirement of septic systems and connections of homes to ENR facilities. It established definitions, key principles, and fundamentals that are applicable to both point and nonpoint sources.

Following issuance of the Phase I policy, the Maryland Department of Agriculture (MDA) took the lead in the development of the Phase II nonpoint source trading policy. In April 2008, MDA issued Phase II-A Guidelines for the Generation of Agricultural Nonpoint Source Nutrient Credits (Maryland Department of the Environment 2008) and Phase II-B Guidelines for the Exchange of Agricultural Nonpoint Credits and Maryland's Trading Market Place (Maryland Department of Agriculture 2008). Maryland's strategy for accommodating growth under the TMDL relies heavily on nonpoint source trading (Maryland Department of the Environment 2008).

Maryland has started to develop an Accounting for Growth (AfG) policy that would address the increase in pollution from population growth and new development through trading (Accounting for Growth Workgroup 2013).<sup>3</sup> In addition, Maryland has released draft guidance on cross-sector trading, which could offer additional flexibility in meeting load reduction targets for nonpoint source sectors.

## **PART I. A COMPARISON OF STATE WATER QUALITY TRADING PROGRAMS**

As the state programs continue to evolve and see more activity, consistency both among the programs and with the TMDL becomes increasingly important. Creating consistency could help to reduce transaction costs, increase certainty for participants who may operate in more than one state program, hedge against litigation, ensure consistent accounting towards TMDL progress, and help accommodate interstate and inter-basin trading (Branosky et al. 2011; Selman et al. 2009). Table 1 displays the main elements of a nutrient trading program examined in this paper. (See Appendix A for a list of acronyms.)

**Table 1. Main Elements of a Nutrient Trading Program**

| Element                                      | Definition  |
|--|---|
| Eligible Pollutants                          | The pollutants that are allowed to be exchanged.  |
| Trading Area                                 | The geographic area (e.g., a watershed) within which both buyers and sellers must be located for a trade to occur.  |
| Definition of a Credit/Offset                | A credit is defined as a measured or estimated unit of delivered pollution reduction per unit of time to the mainstem of the Chesapeake Bay. Reductions used to achieve a cap or to prevent year-to-year operational violations are usually referred to as credits; whereas, reductions used to offset discharges caused by new growth are frequently referred to as offset credits, or offsets.  |
| Life of a Credit/Offset                      | The length of time for which a certified credit must be guaranteed.   |
| Market Structure and Price-Setting Mechanism | The arrangement in place for transacting and pricing credits. Exchange, bilateral, clearinghouse, and fee in lieu (FIL) are four types of market mechanisms that the Chesapeake Bay states use to transact credits.<br><i>Exchange:</i> An exchange market is characterized by open information and fluid transactions between buyers and sellers. Prices may be fixed or variable.<br><i>Bilateral:</i> Bilateral trades are one-on-one negotiations between the buyers and sellers, and the price is decided through negotiations. Participants interested in bilateral trades can use an exchange market to find buyers or sellers. Prices are determined by the free market.<br><i>Clearinghouse:</i> A clearinghouse is a market where a single intermediary links buyers and sellers of credits. Prices are typically determined by an auction process.<br><i>Fee in lieu:</i> Through a fee in lieu system, a developer or permitted entity can pay a pre-determined fee into a centralized fund in order to offset their obligation. Prices are typically fixed by the regulatory agency. |
| Agricultural Credit Estimation Method        | The method used to estimate nonpoint source nutrient reductions and eligible credits.   |
| Trading Ratios                               | Trading ratios discount each pound of nutrient eligible for exchange in the market. State programs develop these ratios to protect the market participants and meet water quality goals. Types of trading ratios are:<br><i>Reserve ratio:</i> Allocates a portion of each credit into a credit insurance pool to be used in case of credit default.<br><i>Retirement ratio:</i> Discounts each credit to ensure that a trade results in a net improvement in water quality.<br><i>Uncertainty ratio:</i> Discounts each credit to account for variability in nutrient removal efficiencies for agricultural conservation practices that may be based on scientific uncertainty or random weather fluctuations.   |
| Scenarios for Purchases                      | The overarching policy goal or requirement that drives demand for the trading program. These allowable scenarios dictate the circumstances under which a trade can be conducted (e.g., to meet a permit limit or to offset new loads).  |
| Eligibility Standard to Purchase             | The minimum standards or regulations that must be met before a buyer may purchase credits.  |
| Minimum Term for Credits/Offsets             | The amount of time for which credits/offsets must be secured.   |
| Eligibility Standard to Generate             | The regulatory pollutant control requirements that apply to sellers in the absence of trading. Sellers must first achieve their applicable practice- or performance-based baselines, or eligibility requirements, before they can enter the trading market and  |

|   |   |
|---|---|
|   | sell credits.   |
| Eligible Practices                              | Nutrient-reducing conservation practices, activities, and treatments that can be implemented to generate credits.   |
| Restrictions on Credit/Offset Generation        | Restrictions put in place on the use of cost share payments to fund practices used to generate credits or offsets and on the conversion of agricultural land to generate credits or offsets.  |
| Project Approval/Certification and Verification | The multi-step process for ensuring practice standards are met, from approving documentation of a proposed credit-generating project (i.e., certification) to ensuring practices have been implemented and are operated effectively (i.e., verification). |
| Registration and Tracking                       | The process of tracking and accounting for certified credits and trades.  |

## GENERAL TRADING RULES

A water quality trading program must establish what pollutants can be traded, where trades may occur, standards for exchanging commodities, and the valuation of credits. In addition to standard market guidelines, states may place additional restrictions on trades if certain situations could undermine other policy goals. Since policy goals vary from state to state, these restrictions differ as well. For example, state programs contain trading ratios that discount each pound of nutrient eligible for exchange in the market. Table 2 provides an overview of the general trading rules for the three state programs.

**Table 2. General Trading Rules**

| Feature                          | Maryland  | Pennsylvania   | Virginia  |
|----------------------------------|---|--|---|
| Eligible pollutants <sup>a</sup> | <ul style="list-style-type: none"> <li>Nitrogen</li> <li>Phosphorus</li> <li>Sediment</li> </ul>  | <ul style="list-style-type: none"> <li>Nitrogen</li> <li>Phosphorus</li> <li>Sediment</li> </ul> | <ul style="list-style-type: none"> <li>Nitrogen</li> <li>Phosphorus</li> </ul>  |
| Trading areas                    | <ul style="list-style-type: none"> <li>Patuxent</li> <li>Potomac</li> <li>“Everywhere else” (Includes Eastern shore, Western shore and Susquehanna)</li> </ul> <p><i>Draft Accounting for Growth Policy:</i></p> <ul style="list-style-type: none"> <li><i>Within local TMDL watershed (if present); major basin; statewide (if credits not otherwise available)</i></li> </ul> | <ul style="list-style-type: none"> <li>Potomac</li> <li>Susquehanna</li> </ul>                   | <ul style="list-style-type: none"> <li>For the Exchange program the credits can be traded within the following basins: <ul style="list-style-type: none"> <li>Eastern Shore<sup>b</sup></li> <li>James</li> <li>Rappahannock</li> <li>Potomac-Shenandoah</li> <li>York River</li> </ul> </li> <li>Stormwater credits are to be generated within the same or adjacent eight-digit HUC</li> </ul> |

| Feature   | Maryland   | Pennsylvania   | Virginia   |
|---|--|--|--|
|   | <p><u>Draft Cross-Sector Trading Guidance:</u></p> <ul style="list-style-type: none"> <li>• Patuxent</li> <li>• Potomac</li> <li>• Susquehanna</li> <li>• Eastern Shore</li> <li>• Western Shore</li> </ul> <p>Or if there is a local TMDL, within the TMDL watershed.</p>   |  |  |
| <b>Definition of a credit/offset</b>                | <ul style="list-style-type: none"> <li>• One pound per year delivered to the Chesapeake Bay</li> </ul>   |  |  |
| <b>Life of credit and/or offset</b>                 | <ul style="list-style-type: none"> <li>• Credits and offsets last one calendar year</li> <li>• BMPs generate credits or offsets for the full year after they are installed<sup>c</sup></li> </ul> <p><u>Draft Accounting for Growth Policy:</u></p> <ul style="list-style-type: none"> <li>• Post-development offsets must be definably permanent<sup>d</sup></li> </ul> | <ul style="list-style-type: none"> <li>• Credits last one compliance year (October 1 to September 30)</li> <li>• PADEP provides a 60-day true-up period to finalize credit purchases after the end of the compliance year</li> </ul> <p><u>Proposed:</u></p> <ul style="list-style-type: none"> <li>• PADEP may increase its true-up period to 180 days</li> </ul> | <ul style="list-style-type: none"> <li>• Term credits and offsets last one calendar year (January 1 to December 31)</li> <li>• Permanent credits must be guaranteed for perpetuity and are required for trades to meet the Virginia Stormwater Management Program requirements</li> </ul>  |
| <b>Market structure</b>                             | <ul style="list-style-type: none"> <li>• Bilateral</li> </ul> <p><u>Draft Accounting for Growth Policy:</u></p> <ul style="list-style-type: none"> <li>• Bilateral</li> <li>• FIL</li> </ul>   | <ul style="list-style-type: none"> <li>• Bilateral</li> <li>• PENNVEST Clearinghouse</li> </ul>  | <ul style="list-style-type: none"> <li>• Bilateral for exchange of nonpoint source credits</li> <li>• Fee-in-lieu system through the Water Quality Improvement Fund, as a last resort if the buyer is unable to locate nonpoint offsets on his own</li> <li>• Clearinghouse for compliance credits generated by point sources and exchanged through the Virginia Nutrient Credit Exchange Association</li> </ul> |
| <b>Credit and/or offset price setting mechanism</b> | <ul style="list-style-type: none"> <li>• The market sets the credit and offset price</li> </ul> <p><u>Draft Accounting for Growth Policy:</u></p>  | <ul style="list-style-type: none"> <li>• The market sets the credit price for bilateral trades</li> <li>• Trades conducted through the Pennsylvania Infrastructure</li> </ul>  | <ul style="list-style-type: none"> <li>• The market sets the price for offsets generated by nonpoint sources and wasteload allocations exchanged between point sources</li> </ul>  |

| Feature                               | Maryland   | Pennsylvania   | Virginia   |
|---------------------------------------|--|--|--|
|                                       | <ul style="list-style-type: none"> <li>Establishment of a FIL system where developers can pay a set fee per pound of nutrient to be offset, and the administrator of the fund will be responsible for securing the offsets. The fee will be adjusted on a tri-annual review</li> </ul> | Investment Authority, a clearinghouse for nutrient credit transactions in the state, use bilateral negotiations and forward and spot auctions to set the price                         | outside the VA Water Quality Improvement Fund <ul style="list-style-type: none"> <li>VA Nutrient Credit Exchange Association sets the price of compliance credits generated by point sources and exchanged within it</li> <li>VA Water Quality Improvement Fund was established via legislation to provide an option of last-resort to secure nonpoint source credits. If an entity is unable to secure nonpoint source credits they may pay a fee into the Water Quality Improvement Fund (administered by VADEQ). VADEQ sets the fee amount and is responsible for securing offsets<sup>e</sup></li> </ul> |
| <b>Agricultural credit estimation</b> | <ul style="list-style-type: none"> <li>Chesapeake Bay Nutrient Trading Tool<sup>f</sup></li> </ul>   | <ul style="list-style-type: none"> <li>Spreadsheet tool<sup>g</sup></li> </ul> <p><u>Proposed:</u></p> <ul style="list-style-type: none"> <li>The calculation tools are TBD</li> </ul> | <ul style="list-style-type: none"> <li>Lookup tables based on Chesapeake Bay Watershed Model runs for various levels of BMP implementation</li> </ul> <p><u>Proposed:</u></p> <ul style="list-style-type: none"> <li>Reduction values assigned to BMPs must be consistent with CBP nutrient reduction and efficiency values, unless better information is available and presented for approval by VADEQ</li> </ul>   |
| <b>Delivery ratio</b>                 | <ul style="list-style-type: none"> <li>The Chesapeake Bay Watershed Model provides each trading program's delivery ratio.</li> </ul>   |  |  |
| <b>Reserve ratio</b>                  | <ul style="list-style-type: none"> <li>None</li> </ul>   | <ul style="list-style-type: none"> <li>10 percent for all certified credits</li> <li>Ratio is applied at time of generation</li> </ul>   | <ul style="list-style-type: none"> <li>None</li> </ul>   |

| Feature                  | Maryland  | Pennsylvania  | Virginia   |
|--------------------------|---|---|--|
| <b>Retirement ratio</b>  | <ul style="list-style-type: none"> <li>5 percent for credits generated by point sources</li> <li>10 percent for credits generated by nonpoint sources</li> <li>Ratio is applied at time of sale</li> </ul> <p><i>Draft Accounting for Growth Policy:</i></p> <ul style="list-style-type: none"> <li><i>Retirement ratio for development is TBD</i></li> </ul> | <ul style="list-style-type: none"> <li>None</li> </ul>  | <ul style="list-style-type: none"> <li>None</li> </ul> <p><i>Proposed:</i></p> <ul style="list-style-type: none"> <li><i>5 percent for credits generated by nonpoint sources</i></li> </ul>  |
| <b>Uncertainty ratio</b> | <ul style="list-style-type: none"> <li>≥ 10 percent for credits generated by nonpoint sources using BMPs not approved by the CBP</li> <li>Ratio is applied at time of generation</li> </ul>   | <ul style="list-style-type: none"> <li>PADEP can apply an uncertainty ratio if necessary</li> </ul> <p><i>Proposed:</i></p> <ul style="list-style-type: none"> <li><i>PADEP is considering introducing an uncertainty ratio for point source to nonpoint source trades based on USEPA’s technical memorandum</i></li> </ul> | <ul style="list-style-type: none"> <li>2:1 uncertainty ratio applied to nonpoint source credits used to offset new and expanding WWTPs</li> <li>Ratio is applied at time of sale</li> <li>No ratio applied to stormwater trades</li> <li>No ratio applied to point source-generated credits</li> </ul> |

<sup>a</sup> Pollutants must be traded individually

<sup>b</sup> Act of February 26, 2010, § 62.1-44.19:18, 2010 Va. Acts (nutrient allocation compliance and reporting) allows Eastern Shore point sources to purchase point source compliance credits from the Potomac and Rappahannock river basins.

<sup>c</sup> Depending on the BMP, generated credits could expire either after one full year or at the end of a calendar year (i.e., December 31).

<sup>d</sup> In Maryland, the definition for a permanent credit has not yet been decided.

<sup>e</sup> The prices for last-resort compliance credits are equal to the cost of reducing the equivalent load from municipal WWTPs in Virginia. The prices for last-resort offsets are equal to the greater of (1) the cost of reducing the equivalent load from the facility securing the allocation or an equivalent facility or (2) two times the cost of reducing the equivalent load from nonpoint sources.

<sup>f</sup> Through a USDA Conservation Innovation Grant, the World Resources Institute has developed the CBNTT. This is an interstate platform that links existing NutrientNet platforms and is integrated with both the NRCS nutrient tracking tool and the Chesapeake Bay Watershed Model best management practice efficiencies (Maryland Department of Agriculture 2014).

<sup>g</sup> The spreadsheet tool was developed at the inception of Pennsylvania’s nutrient trading program. It uses the nutrient balance approach to estimate nitrogen and a simplified revised universal soil loss equation (RUSLE) approach to estimate phosphorus (Pennsylvania Department of Environmental Protection 2014).

### Eligible Pollutants

Total nitrogen and total phosphorus are the two actively traded pollutants in the Chesapeake Bay watershed, with Maryland and Pennsylvania also allowing for the trading of sediment although there is currently no demand. There are some variations among the states regarding what pollutants can be traded and under what conditions.

- In Maryland, the draft Accounting for Growth policy has proposed that post-construction stormwater be subject to nutrient and sediment limits. WWTPs have nitrogen and phosphorus compliance requirements.
- In Pennsylvania, WWTPs have nitrogen and phosphorus requirements.

- In Virginia, the post-construction phosphorus loading requirement also serves as a proxy for post-construction nitrogen control. The nitrogen reductions associated with each nonpoint source phosphorus offset acquired under this program are therefore retired at the time of purchase. WWTPs, MS4s, and industrial stormwater permits have individual nitrogen and phosphorus compliance requirements.

### **Trading Areas**

In Maryland and Pennsylvania, trades are allowed to occur within their states' portions of major river basins, operating within watersheds of equivalent scales. However, Maryland has combined three of its smallest basins (i.e., Eastern Shore, Western Shore, and the Susquehanna) into a single trading basin called "Everywhere Else." And if the credit buyer is located in a watershed that has a local TMDL, he would need to purchase credits from within that local TMDL watershed. The Accounting for Growth workgroup has not reached consensus on the trading geographies for the development stormwater offset program. The cross-sector trading guidance would use the five major basins, eliminating the aggregated Everywhere Else basin. Maryland is considering revising its policy for point sources and agricultural sources to use the five major basins.

Pennsylvania has established two trading basins, the Potomac and the Susquehanna. However, Pennsylvania is allowing interbasin trades between the Susquehanna and Potomac basins. One example is through a grant-funded pilot project implemented by the Borough of Chambersburg. In this project, the Borough of Chambersburg's wastewater utility, located in the Potomac River basin, financed the implementation of agricultural best management practices in both the Susquehanna River and Potomac River basins (The Pennsylvania Bulletin 2013). Chambersburg and a couple of other WWTPs located in the Potomac River basin have also bought credits generated in the Susquehanna River basin from other WWTPs to meet their nutrient reduction requirements for the Chesapeake Bay. Results from the Chambersburg pilot project may help to inform the feasibility of conducting interbasin trading across the Bay watershed.

Virginia's program operates at two different scales. The watershed general permit is designed to protect the Chesapeake Bay and its tidal tributaries. Credits are traded within major river basins (i.e., Potomac, Rappahannock, York, James, and Eastern Shore). Eastern Shore facilities are also allowed to acquire compliance credits from the Potomac and Rappahannock basins. There is also a trading restriction in the James basin to address a "hot spot" in the upper estuary. Permanent offsets acquired to meet post-construction phosphorus requirements must be acquired from the same or adjacent 8-digit HUC unless none are available, and then they may be acquired anywhere in the river basin. A proposed regulation governing the certification of nonpoint source credits also includes provisions to address local water quality concerns. Under the proposed regulation, when a new source is limited by a local TMDL, nonpoint source credits only could be obtained upstream of where loads from a new source reach impaired waters. When a new source discharges to impaired waters without a TMDL, credits must be obtained upstream of the discharge or as close to the discharge as possible if not available upstream.

### **Definition and Life of Credits and Offsets**

Credits and offsets are defined as a delivered pound of nitrogen, phosphorus, or sediment (the latter in the case of Maryland and Pennsylvania) to the Chesapeake Bay. There are two types of credits: term and permanent. Term credits are annual credits, though the projects used to

generate these credits may be installed or implemented for multiple years. For example, a farmer may agree to implement cover crops for five consecutive years. His project would generate a given number of term credits each year over the five-year period. Permanent credits are generated from practices that can be guaranteed for perpetuity.

All states use at least term credits. Virginia uses term credits and permanent credits. Term credits in Virginia are for practices that while not permanent, will generate reductions for at least one year due to their lifespans, for example. Virginia has developed a definition for permanent credits or offsets which are required to offset permanent loads from development. In Virginia, a permanent credit is linked to a project with a permanent easement or similar legal instrument that will ensure it is in place and maintained in perpetuity.<sup>4</sup> Maryland is also defining a permanent offset for the purposes of its AfG policy.

### **Market Structure and Price-Setting Mechanism**

All of the states use bilateral exchanges as at least one of their market structures. This market structure generally allows the free market to determine the price of bilateral trades. The credit price is negotiated between the buyer and seller until a number is agreed upon that generates a profit for the credit generator and results in a savings for the credit buyer. An exchange market is also commonly used. Like bilateral exchanges, it may involve negotiations, but buyers and sellers connect on a public forum where credits for sale are posted along with offered prices.

A clearinghouse is type of market structure that is used by both Pennsylvania and Virginia. Under a clearinghouse structure, a single intermediary convenes multiple buyers and sellers and may convert a variable commodity into a uniform commodity. The Pennsylvania Infrastructure Investment Authority (PENNVEST) serves as a clearinghouse for a portion of the nutrient credit transactions in the Pennsylvania program where credits are awarded to the highest bidder through a competitive auction process. In Virginia, the VNCEA is a clearinghouse used in the exchange of point source compliance credits, but rather than using an auction, the VNCEA establishes a fixed price for credits. Clearinghouses may be more cost effective due to their ability to bring together all interested participants, thereby reducing time spent locating buyers and sellers and negotiating prices; however, in early markets where trading volume is still minimal, bilateral exchanges may be more appropriate.

To date, Virginia is the only state that has created a fee-in-lieu (FIL) system, though Maryland is considering a FIL system as part of its Accounting for Growth policy. Virginia established the Water Quality Improvement Fund (VAWQIF) to serve as a last resort FIL system for its water quality trading program. In effect, this fund is only to be used by permitted entities that could not otherwise locate point source or nonpoint source offsets. The permitted entity could pay money into the VAWQIF, which in turn will implement offset projects in order to offset the permit obligation. To date there has been no purchase of credits through the VAWQIF. Maryland's draft AfG policy currently describes a FIL system that would allow developers to pay a fee per pound of pollutant to a county- or state-sponsored FIL fund. In turn, the county or state would be responsible for locating nutrient offsets and/or installing offset projects. The amount of the fee would be adjusted triennially to reflect market prices.

Credit prices in the state markets have differed significantly, especially between term credits and permanent credits. In Pennsylvania, term credits are generated by WWTPs operating below design capacity or by implementing agricultural pollutant-reduction activities such as poultry manure gasification and exporting poultry litter out of the Chesapeake Bay watershed. Virginia has had an active compliance market of WWTP-generated term credits through the Exchange. Term, or annual, phosphorus credits in this market have been selling for under \$5/lb (Virginia Nutrient Credit Exchange Association 2014). Virginia's permanent offset market, however, has involved land use conversion to ensure the resulting credits last for perpetuity, as opposed to just for one year. Because of the challenging nature of guaranteeing credits for perpetuity, these permanent phosphorus offsets have been selling for up to \$18,000/lb.<sup>5</sup>

### **Agricultural Credit Estimation**

Because agricultural pollution is diffuse and difficult to directly measure, estimation tools and models are used. Currently, states use three different methods for estimating credits. Maryland uses the Chesapeake Bay Nutrient Trading Tool which has coupled the Nutrient Tracking Tool with the Chesapeake Bay Watershed Model best management practice efficiencies (Maryland Department of Agriculture 2014). The tool estimates current nutrient loads and potential nutrient reductions from proposed implementation of conservation practices for crop, pasture, and animal confinement operations. Pennsylvania currently uses a spreadsheet tool developed at the inception of its nutrient trading program that uses a nutrient balance approach to estimate nitrogen and a simplified revised universal soil loss equation (RUSLE) approach to estimate phosphorus (Pennsylvania Department of Environmental Protection 2014). Finally, Virginia currently uses a lookup table developed based on an earlier version of the Chesapeake Bay Watershed Model for agricultural practices and is proposing to require that reduction values be in line with Chesapeake Bay Program efficiencies and reduction values.

The Chesapeake Nutrient Trading Tool (CBNTT), which was developed not only for Maryland but for the entire Chesapeake Bay watershed, is currently being evaluated in Pennsylvania and Virginia.

### **Trading Ratios**

Trading ratios exist to protect market participants and improve water quality. Ratios are expressed as percentages when they indicate less than one full credit or offset value. Alternatively, numeric ratios (e.g., 2:1) are used when trading partners must buy or sell more than one full credit or offset value. Aside from delivery ratios, which all states use in accordance with USEPA policy, each state also applies additional trade ratios to address uncertainty and/or to generate net environmental benefits.

- Pennsylvania has a ten percent reserve ratio that discounts all certified credits. Pennsylvania's current legislation enables PADEP to apply an uncertainty ratio if it is deemed necessary, and PADEP is currently contemplating the addition of an uncertainty ratio for all nonpoint source trades per recommendations made by USEPA Region III's technical memorandum on uncertainty.
- Maryland applies a five percent retirement ratio to credits generated by point sources and a ten percent retirement ratio to credits generated by nonpoint sources at the time of the trade. These credits are retired to the state and are meant to generate net water

quality improvements. Maryland also reserves the right to apply an uncertainty ratio for credits generated by conservation practices that have not been approved by the Chesapeake Bay Program.

- Virginia currently applies a 2:1 trading ratio to agricultural credits generated to offset new and expanding WWTPs but applies no uncertainty ratio for stormwater trades. Virginia is also proposing a five percent retirement ratio for nonpoint source trades.

## PURCHASING CREDITS

Point sources such as WWTPs and MS4s are major regulated sources of nutrient pollution impairing the Chesapeake Bay. At the same time, these entities, particularly MS4s, face some of the source sectors' highest costs of reducing their nutrient discharge (Jones et al. 2010). The purpose of nutrient trading programs is to provide these regulated sectors with less expensive and more flexible options for complying with discharge requirements. Table 3 summarizes the scenarios under which these sectors would be able to purchase credits, eligibility conditions set by the trading program that must be met before being able to acquire credits or offsets, and any requirements regarding terms for the credits.

**Table 3. Purchasing Credits**

| Feature                |  | Maryland  | Pennsylvania   | Virginia  |
|------------------------|--|---|--|---|
| WASTEWATER             | <b>Scenarios for Purchases</b>                       | <ul style="list-style-type: none"> <li>New or expanding point sources must offset increased loading</li> </ul>  | <ul style="list-style-type: none"> <li>Existing point sources may purchase credits generated by point or nonpoint sources to meet annual load limits subject to additional conditions of NPDES permits</li> <li>New or expanding point sources of any design flow must offset increased loading</li> </ul> | <ul style="list-style-type: none"> <li>Existing point sources may purchase credits generated by other point sources to meet annual load limits subject to additional conditions of NPDES permits</li> <li>New municipal point sources initiating a discharge after December 31, 2010, of design flow <math>\geq 0.0001</math> MGD must offset increased loading</li> <li>Expanding municipal point sources of design flow <math>\geq 0.04</math> MGD and new or expanding industrial point sources with an equivalent load must offset increased loading</li> </ul> |
|                        | <b>Eligibility Standard to Purchase</b>              | <ul style="list-style-type: none"> <li>Existing significant point sources must have enhanced nutrient removal in operation before purchasing offsets</li> </ul>   | <ul style="list-style-type: none"> <li>WWTPs must be in compliance with permit and other regulatory requirements</li> </ul>  | <ul style="list-style-type: none"> <li>None</li> </ul>  |
|                        | <b>Minimum Term for Acquired Credits and Offsets</b> | <ul style="list-style-type: none"> <li>New or expanding point sources must secure offsets for at least 10 years and submit a plan for an additional 10 years</li> </ul>   | <ul style="list-style-type: none"> <li>N/A</li> </ul>  | <ul style="list-style-type: none"> <li>New or expanding point sources must secure credits for at least 5 years</li> </ul>   |
| DEVELOPMENT STORMWATER | <b>Scenarios for Purchases</b>                       | <p><u>Draft Accounting for Growth Policy:</u></p> <ul style="list-style-type: none"> <li>The alteration of land that creates a disturbed area of at least 5,000 ft<sup>2</sup> and results in increased nutrient loads</li> </ul> | <p><u>Proposed:</u></p> <ul style="list-style-type: none"> <li>Offset options for development stormwater are currently being defined</li> </ul>  | <ul style="list-style-type: none"> <li>Offsets can be purchased when:                             <ul style="list-style-type: none"> <li>less than 5 acres of land is disturbed,</li> <li>the post-construction TP load requirement is less than 10 lbs, or</li> <li>at least 75% of required TP reductions have been met onsite</li> </ul> </li> </ul>   |

| Feature              |  | Maryland   | Pennsylvania   | Virginia   |
|----------------------|--|--|--|--|
|                      | <b>Eligibility Standard to Purchase</b>              | <ul style="list-style-type: none"> <li>TBD</li> </ul>  | <ul style="list-style-type: none"> <li>TBD</li> </ul>  | <ul style="list-style-type: none"> <li>Construction activities greater than 5 acres or with more than 10 lbs in post-construction TP loads must first demonstrate that at least 75% of the required TP reduction has been achieved onsite</li> </ul> |
|                      | <b>Minimum Term for Acquired Credits and Offsets</b> | <u>Draft Accounting for Growth Policy:</u> <ul style="list-style-type: none"> <li>Stormwater offsets must be permanent</li> </ul>  | <ul style="list-style-type: none"> <li>TBD</li> </ul>  | <ul style="list-style-type: none"> <li>Stormwater offsets under the VA Stormwater Management Program must be permanent</li> </ul>  |
| MUNICIPAL STORMWATER | <b>Scenarios for Purchases</b>                       | <u>Draft Cross-Sector Trading Guidance:</u> <ul style="list-style-type: none"> <li>50% of the nitrogen load reduction target for non-MS4 stormwater may be achieved via trading between sectors</li> <li>Phase II MS4 municipalities may trade to comply with a maximum of 50% of their impervious cover treatment requirements</li> </ul> | <u>Proposed:</u> <ul style="list-style-type: none"> <li>Offset options for MS4s are currently being evaluated</li> </ul> | <ul style="list-style-type: none"> <li>Phase I and phase II MS4 permittees can acquire, use, and transfer nutrient credits for purposes of compliance with any WLAs established as effluent limitations in MS4 permit</li> </ul>                     |
|                      | <b>Eligibility Standard to Purchase</b>              | <u>Draft Cross-Sector Trading Guidance:</u> <ul style="list-style-type: none"> <li>Entities interested in trading must provide an urban watershed implementation plan</li> </ul>   | <ul style="list-style-type: none"> <li>TBD</li> </ul>  | <ul style="list-style-type: none"> <li>MS4s must have a VADEQ-approved TMDL action plan</li> </ul>   |
|                      | <b>Minimum Term for Acquired Credits and Offsets</b> | <ul style="list-style-type: none"> <li>TBD</li> </ul>  | <ul style="list-style-type: none"> <li>TBD</li> </ul>  | <ul style="list-style-type: none"> <li>Varies based on need</li> </ul>   |
| CAFO                 | <b>Scenarios for Purchases</b>                       | <ul style="list-style-type: none"> <li>N/A</li> </ul>  | <ul style="list-style-type: none"> <li>N/A</li> </ul>  | <ul style="list-style-type: none"> <li>CAFOs can acquire, use, and transfer credits for compliance with any wasteload allocations contained in the provisions of a VPDES permit</li> </ul>   |
|                      | <b>Eligibility Standard to Purchase</b>              | <ul style="list-style-type: none"> <li>N/A</li> </ul>  | <ul style="list-style-type: none"> <li>N/A</li> </ul>  | <ul style="list-style-type: none"> <li>CAFOs must have a VADEQ-approved WLA compliance plan</li> </ul>   |

| Feature |   | Maryland   | Pennsylvania  | Virginia  |
|---------|---|--|---|---|
|         | Minimum Term for Acquired Credits and Offsets | <ul style="list-style-type: none"> <li>N/A</li> </ul>  | <ul style="list-style-type: none"> <li>N/A</li> </ul> | <ul style="list-style-type: none"> <li>TBD</li> </ul> |
| SEPTIC  | Scenarios for Purchases                       | <u>Draft Cross-Sector Trading Guidance:</u> <ul style="list-style-type: none"> <li>Septic system nitrogen load reduction targets may be met through trading between sectors</li> </ul> | <ul style="list-style-type: none"> <li>N/A</li> </ul> | <ul style="list-style-type: none"> <li>N/A</li> </ul> |

### Wastewater

In general, the state obligations under the Tributary Strategies and later under the TMDL drove wasteload allocation requirements in NPDES permits which have served as the main policy drivers for trading nitrogen and phosphorus. However, the ways in which these permit limits are used to define allowable trading scenarios vary among the states.

Most of the demand to trade in Maryland is coming from new and expanding WWTPs that are required to offset their additional loads. Maryland requires that WWTPs be operating at ENR levels before they are eligible to trade. When credits are purchased, Maryland imposes a requirement that WWTPs must acquire at least ten years of credits and provide a plan for how credits will be acquired for an additional ten years.

Maryland’s eligibility standard differs from Pennsylvania’s and Virginia’s which allow plants to trade to meet their permit limits. To purchase credits in Pennsylvania, WWTPs must simply be in compliance with regulations. In addition, WWTPs can purchase credits from other point sources or nonpoint sources and face no requirement on securing credits for any length of time.

Virginia has no minimum requirements for point sources to be able to acquire credits. Compliance credits are acquired on a year-to-year basis; however, new or expanded dischargers must provide offsets for a minimum of five years of operation when registering under the watershed general permit.

### Development Stormwater

In Virginia, developers are subject to a phosphorus limit which may be partially or fully met by purchasing permanent phosphorus offsets, depending on the size of the development. Maryland’s draft Accounting for Growth strategy, if passed, would impose nutrient limits on post-construction stormwater and allow for purchase of offsets as well.

### Municipal Stormwater

Currently only Virginia allows MS4 stormwater trading. Virginia has been the only state to incorporate TMDL-based nutrient reductions into MS4 permits, and municipalities can trade to achieve the required nutrient reductions. The municipalities can acquire credits for any timeframe that

suits their needs in order to meet required reductions. Pennsylvania is currently evaluating whether to expand its trading program to include MS4s.

In Maryland’s draft cross-sector trading guidance, the state proposes that non-MS4 jurisdictions may achieve up to half of their nitrogen load reduction targets via trading. Likewise, Phase II MS4s may be able to achieve up to half of their impervious cover treatment requirements via trading.

**CAFO**

CAFOs are also given the option of trading in Virginia; however, the rules around CAFO trading have not been fully formed.

**Septic**

Maryland’s draft cross-sector trading guidance allows for the entire nitrogen load reduction target for septic to be met via trading. No other states have this option.

Table 3a below summarizes the sectors that are included in each of the state trading programs, when trading can occur, and from whom credits may be purchased.

**Table 3a. Comparison of Allowable Trading Scenarios in Virginia, Maryland, and Pennsylvania**

|                         |                  | Who can buy? |                      |                        |      |        |
|-------------------------|------------------|--------------|----------------------|------------------------|------|--------|
|                         |                  | Wastewater   | Municipal Stormwater | Development Stormwater | CAFO | Septic |
| When can trading occur? | Who can sell?    |              |                      |                        |      |        |
| To Comply               | Point sources    | VA, PA       | VA                   |                        | VA   |        |
|                         | Nonpoint sources | PA           | VA                   |                        | VA   | MD*    |
| To Maintain/Offset      | Point sources    | VA, MD, PA*  | VA                   | VA, MD*                | VA   |        |
|                         | Nonpoint sources | VA, MD, PA*  | VA                   | VA, MD*                | VA   |        |

\* Draft or proposed policy or regulation

## GENERATING CREDITS

State programs vary in regard to the eligibility standards, or baselines, that interested credit generators must meet before they may generate credits. Largely, states allow the same practices to generate credits though some states place greater restrictions on credit generation opportunities than others. Table 4 summarizes these key components for eligibility in each sector.

Table 4. Generating Credits

| Feature   | Maryland   | Pennsylvania   | Virginia   |
|---|--|--|--|
| <p style="text-align: center;">AGRICULTURE</p> <p><b>Eligibility Standard to Generate</b></p> | <ul style="list-style-type: none"> <li>• Generator must meet his portion of the state nutrient reduction goal for nonpoint agriculture as defined as               <ul style="list-style-type: none"> <li>○ A per-acre annual loading rate (lbs TN/acre, lbs TP/acre, lbs S/acre) calculated from the applicable Bay or local TMDL allocations, whichever is more restrictive<sup>a</sup></li> </ul> </li> <li>• In addition, agricultural operations must               <ul style="list-style-type: none"> <li>○ Comply with all applicable nutrient management regulations</li> <li>○ Develop and implement a soil and water conservation plan including, if applicable, a waste management system plan</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• Generator must be in compliance with all applicable regulations for nutrient management, manure management, and erosion control<sup>b</sup></li> <li>• In addition, agricultural operations must meet a threshold requirement beyond the state baseline<sup>c</sup> by (1) implementing a 100-foot manure setback, (2) implementing a 35-foot vegetative buffer, or (3) reducing the farm’s total nutrient balance by 20 percent below the reductions achieved through regulations</li> </ul> <p><u>Proposed:</u></p> <ul style="list-style-type: none"> <li>• <i>Agricultural baselines will no longer have a practice threshold. It will be performance-based, defined by a modeling tool calibrated to be in compliance with expectations of the TMDL</i></li> </ul> | <ul style="list-style-type: none"> <li>• Generator must fulfill his portion of the state nutrient reduction goal for nonpoint agriculture defined as implementing the following BMPs (as applicable):               <ul style="list-style-type: none"> <li>○ Soil conservation plan</li> <li>○ Nutrient management plan</li> <li>○ Cereal cover crops</li> <li>○ Exclusionary livestock fencing</li> <li>○ Vegetative riparian buffers</li> </ul> </li> </ul> <p><u>Proposed:</u></p> <ul style="list-style-type: none"> <li>• <i>Crop and pasture: implemented Resource Management Plan OR the following practices, as applicable:</i> <ul style="list-style-type: none"> <li>○ <i>Soil conservation (achieve maximum soil rate that cannot exceed “T” and addresses gross erosion)</i></li> <li>○ <i>Nutrient management plan</i></li> <li>○ <i>35’ Riparian buffer</i></li> <li>○ <i>Cover crop following summer annual crop receiving more than 50 lbs of nitrogen</i></li> <li>○ <i>35’ livestock water body exclusion</i></li> <li>○ <i>Nutrient management practices</i></li> </ul> </li> <li>• <i>Animal feeding operations:</i> <ul style="list-style-type: none"> <li>○ <i>Manure storage facility</i></li> </ul> </li> <li>• <i>Confined poultry operations:</i> <ul style="list-style-type: none"> <li>○ <i>Manure stored appropriately in accordance with the nutrient management plan</i></li> </ul> </li> </ul> |

| Feature                       |   | Maryland  | Pennsylvania   | Virginia   |
|-------------------------------|---|---|--|--|
|                               | <b>Eligible Practices</b>                       | <ul style="list-style-type: none"> <li>Chesapeake Bay Program BMPs</li> <li>Additional BMPs considered with use of an uncertainty ratio</li> </ul>  | <ul style="list-style-type: none"> <li>Chesapeake Bay Program BMPs</li> <li>Poultry litter export</li> <li>Manure gasification</li> </ul> <p><i>Proposed:</i></p> <ul style="list-style-type: none"> <li><i>Poultry litter export will not be eligible in the future</i></li> </ul>  | <ul style="list-style-type: none"> <li>Chesapeake Bay Program BMPs</li> </ul>  |
|                               | <b>Restrictions on Credit/Offset Generation</b> | <ul style="list-style-type: none"> <li>Cost-shared BMPs are not eligible to generate credits or offsets</li> <li>Credits or offsets will not be approved for idling whole or substantial portions of farms</li> <li>Credits or offsets cannot be generated when farmland is converted to new development</li> </ul> | <ul style="list-style-type: none"> <li>Cost-shared BMPs are eligible to generate credits unless the cost-share agency places restrictions on the funds</li> <li>Credits will not be approved for idling whole or substantial portions of farms</li> </ul>  | <ul style="list-style-type: none"> <li>Cost-shared BMPs are not eligible to generate credits</li> </ul>  |
| <b>OTHER NONPOINT SOURCES</b> | <b>Eligibility Standard to Generate</b>         | <ul style="list-style-type: none"> <li>Currently not defined</li> </ul>   | <ul style="list-style-type: none"> <li>Need to comply with all applicable regulations</li> </ul> <p><i>Proposed:</i></p> <ul style="list-style-type: none"> <li><i>Baseline for nonpoint sources will be performance based, defined by a modeling tool calibrated to be in compliance with expectations of the TMDL</i></li> </ul> | <ul style="list-style-type: none"> <li>Land conversion projects must meet loading level equal to the pre-conversion land use and the level of reductions assigned in the Virginia Watershed Implementation Plan or approved TMDLs applicable to that land use</li> </ul> |

| Feature    |   | Maryland  | Pennsylvania   | Virginia   |
|------------|---|---|--|--|
| WASTEWATER | <b>Eligibility Standard to Generate</b> | <ul style="list-style-type: none"> <li>• Significant point sources must have enhanced nutrient removal in operation</li> <li>• Wasteload allocation cannot be sold until it has been adopted in a NPDES permit through the public review process</li> <li>• Nonsignificant point sources must upgrade and meet annual load limits for nutrients of 6100 lbs or less TN and 457 lbs or less TP</li> <li>• Facilities trading excess credits based on excess capacity must demonstrate consistency with water and sewerage plans</li> </ul> | <ul style="list-style-type: none"> <li>• Point sources must meet pollutant effluent load associated with effluent limitations contained in the NPDES permit based on the applicable technology based requirements, or the load in a TMDL or similar allocation, whichever is more stringent</li> </ul> | <ul style="list-style-type: none"> <li>• Concentrations for annual wasteload allocations for significant facilities vary by river basin. All are at 2010 design flow: <ul style="list-style-type: none"> <li>○ Eastern Shore is 4 mg/L TN and 0.3 mg/L TP</li> <li>○ Potomac River above the fall line is 4 mg/L TN and 0.3 mg/L TP</li> <li>○ Potomac River below the fall line is 3 mg/L TN and 0.1 to 0.3 mg/L TP</li> <li>○ James River is 6 mg/L TN and 0.5 mg/L TP</li> <li>○ Rappahannock River is 4 mg/L TN and 0.3 mg/L TP</li> <li>○ York River is 6 mg/L TN and 0.4 mg/L TP</li> </ul> </li> <li>• Wasteload allocations or compliance credits and offsets cannot be sold unless the facility for which the wasteload allocation was granted has been constructed and is operating</li> </ul> |
|            | <b>Eligible Practices</b>               | <ul style="list-style-type: none"> <li>• Operating below nutrient concentration limits of 4 mg/L nitrogen and 0.3 mg/L phosphorus</li> </ul>  | <ul style="list-style-type: none"> <li>• Operating below nutrient load allocations</li> </ul> <p><u>Proposed:</u></p> <ul style="list-style-type: none"> <li>• <i>Point sources can only generate credits by treating nutrients to levels below specified concentration limits</i></li> </ul>          | <ul style="list-style-type: none"> <li>• Operating below nutrient load allocations</li> </ul>  |

| Feature                |                                  | Maryland   | Pennsylvania  | Virginia  |
|------------------------|----------------------------------|--|---|---|
| MUNICIPAL STORMWATER   | Eligibility Standard to Generate | <ul style="list-style-type: none"> <li>N/A</li> </ul>  | <u>Proposed:</u> <ul style="list-style-type: none"> <li>Options for eligibility standards for MS4s are currently being evaluated</li> </ul>                   | <ul style="list-style-type: none"> <li>Phase 1 MS4s must meet their wasteload allocations under the TMDL as defined in their permits</li> </ul>   |
|                        | Eligible Practices               | <ul style="list-style-type: none"> <li>N/A</li> </ul>  | <ul style="list-style-type: none"> <li>N/A</li> </ul>   | <ul style="list-style-type: none"> <li>Any practices that reduce loads beyond the wasteload allocation</li> </ul>   |
| DEVELOPMENT STORMWATER | Eligibility Standard to Generate | <u>Draft Accounting for Growth Policy:</u> <ul style="list-style-type: none"> <li>2025 watershed implementation plan allocation for pre-development land use or forest load</li> </ul> | <u>Proposed:</u> <ul style="list-style-type: none"> <li>Options for eligibility standards for development stormwater are currently being evaluated</li> </ul> | <ul style="list-style-type: none"> <li>Baselines for urban practices from new development and redevelopment shall be in compliance with post-construction water quality design criteria requirements of the VA Stormwater Management Program which are reflected as maximum loading rates of TP</li> <li>Baselines for all other existing development shall be at a level necessary to achieve the reductions assigned in the urban sector in the VA Chesapeake Bay TMDL Watershed Implementation Plan or approved local TMDLs</li> </ul> |

| Feature |   | Maryland  | Pennsylvania   | Virginia   |
|---------|---|---|--|--|
| SEPTIC  | <b>Eligible Practices</b>               | <u>Draft Accounting for Growth Policy:</u> <ul style="list-style-type: none"> <li>Any on-site practice that generates reductions below the baseline</li> <li>Forestry practices beyond Forest Conservation Act or local riparian buffer requirements</li> <li>Capture offsite drainage and providing treatment</li> <li>Expand and convert an adjacent stormwater management facility</li> <li>Convert a stormwater management facility for greater nutrient treatment</li> <li>Install denitrifying OSDS systems</li> <li>Exceed stormwater management requirements for redevelopment</li> </ul> | <u>Proposed:</u> <ul style="list-style-type: none"> <li>TBD</li> </ul> | <ul style="list-style-type: none"> <li>Any practices that reduce loads beyond the wasteload allocation</li> </ul>              |
|         | <b>Eligibility Standard to Generate</b> | <ul style="list-style-type: none"> <li>WWTPs must be operating at enhanced nutrient removal or have plans to upgrade to enhanced nutrient removal in order to be eligible for credits from hook up of septic systems</li> <li>Commercial onsite sewer disposal systems are considered on a case-by-case basis</li> </ul><br><u>Draft Accounting for Growth Policy:</u> <ul style="list-style-type: none"> <li>New OSDS would be subject to a load allocation equal to the load from any pre-existing OSDS, adjusted as if they have been upgraded to best available technology</li> </ul>         | <ul style="list-style-type: none"> <li>N/A</li> </ul>                  | <ul style="list-style-type: none"> <li>Nitrogen credits for septic hookups can be generated on a case-by-case basis</li> </ul> |

| Feature            | Maryland   | Pennsylvania  | Virginia  |
|--------------------|--|---|---|
| Eligible Practices | <ul style="list-style-type: none"> <li>• Connections of septic systems generate TN credits to varying degrees depending on location</li> </ul> | <ul style="list-style-type: none"> <li>• N/A</li> </ul> | <ul style="list-style-type: none"> <li>• Hooking up septic systems that are outside of originally planned service area<sup>d</sup></li> </ul> |

<sup>a</sup> Baseline requirements are calculated as a per-acre annual loading rate based on the TMDL goals for agriculture in the watershed where the credits are generated.

<sup>b</sup> The applicable regulations could include 25 Pa. Code §§ 83.201 through 83.491 regarding nutrient management plans, manure storage facilities, and financial assistance and incentives to develop nutrient management plans; 25 Pa. Code § 91.36 establishing pollution control and prevention requirements for animal manure storage facilities, liquid manure application, and pollutant discharge; 25 Pa. Code § 92a.29 establishing the permitting process for CAFOs, including having a nutrient management plan; or 25 Pa. Code §§ 102.1 through 102.8 regarding erosion and sediment control.

<sup>c</sup> Pennsylvania defines the baseline as the applicable regulations. After an agricultural operation meets the baseline, it must meet the threshold requirements before it can implement BMPs to generate credits.

<sup>d</sup> Unofficial policy

### Agriculture

In all three states, agriculture has been the focus for credit supply. Agricultural baselines vary in each of the states. In the case of Virginia and Maryland, the agricultural baselines represent the agricultural load allocations under the TMDL though they are expressed differently with Virginia having a practice-based baseline and Maryland having a performance-based baseline. Pennsylvania’s agricultural baseline was developed prior to the implementation of the TMDL and is currently under review by PADEP and USEPA to align it with the TMDL. In addition each state requires producers to be in compliance with all applicable agricultural regulations. Practices that constitute regulatory compliance are not eligible to generate credits. For example, Maryland’s revised nutrient management regulations require exclusion of livestock from streams which means that streambank fencing would not be eligible to generate credits because it is required by law.

Generally, the agricultural practices that can generate credits are based on the approved list of Chesapeake Bay best management practices. This rule is consistent with USEPA’s technical memorandum guidance. However, differences between state regulatory requirements as well differences in how baseline is defined and expressed mean that there are differences among the states regarding which Bay-approved BMPs are eligible to generate credits versus those required to meet baseline. Because Virginia has a practice-based baseline, some practices required to meet baseline in Virginia are ones that can generate credits in other states. For example, in Virginia riparian buffers are required on all crop fields that are adjacent to a perennial stream, thus implementation of a 35 foot buffer along the stream corridor would be required to meet baseline and could not generate credits. In Maryland, the baseline is performance-based and does not specify specific activities, yet compliance with the Maryland nutrient management regulations will require some farms to adopt certain practices (i.e., incorporation of manure, fertilizer setbacks, streambank fencing) in order to be eligible to generate credits. In Maryland and Virginia, practices that can generate credits are also restricted to non-cost-shared BMPs while Pennsylvania does not have this restriction.

In some instances, states have disagreed on the types of agricultural practices beyond the approved Chesapeake Bay list that can generate credits. To date, only Pennsylvania has allowed poultry litter export to generate credits, although Pennsylvania has recently proposed that this practice no longer be eligible. In addition, Pennsylvania is currently the only state certifying credits from manure gasification technologies. However, each state has a process for consideration of new or innovative practices (see Box 1).

**Box 1. Approving New Practices for Credit Generation**

The states have processes in place by which new practices to generate credits can be proposed and reviewed. In Maryland, credit generators who are proposing to use new, innovative practices without previously accepted nutrient reduction effectiveness estimates can submit their proposal to MDA for review and consideration by a technical review committee. This committee will determine installation, maintenance, and monitoring requirements on a case-by-case basis and may assign an uncertainty ratio (MDA 2008). Pennsylvania is also open to new practices but requires the generator to provide calculations that demonstrate how the nutrient reductions will be generated and use methodologies deemed acceptable by PADEP. PADEP may rely on various modeling tools, data sources, peer-reviewed literature, and other methods to approve a proposed credit-generating activity (The Pennsylvania Bulletin 2010). Virginia is proposing a similar path for new conservation practices. VADEQ will review proposed credit-generating activities and nutrient removal effectiveness estimates on a case-by-case basis (Virginia State Water Control Board 2013).

In addition to individual state efforts to approve new conservation practices for credit generation, the Chesapeake Bay Program has a process in place for reviewing proposed nutrient- and sediment-reducing BMPs for inclusion in the Watershed Model. Jurisdictions or a Chesapeake Bay Program workgroup can submit a proposal for a new conservation practice. A review panel of experts is then formed to create a definition of the proposed practice, recommend nutrient and sediment reduction efficiencies, and determine how the practice should be applied in the Bay model, among other things. The panel's suggestions are then reviewed by a series of workgroups and committees before the proposed practice and its effectiveness estimates are finally adopted. As new conservation practices are approved for use in the Watershed Model, the accounting tool for the Bay TMDL, states should be able to add these conservation practices to their list of accepted practices (U.S. EPA 2010).

**Other Nonpoint Sources**

The largest nonpoint source credit generating activity outside of agriculture is land conversion (though land conversion activities may occur on agricultural land). Land conversion is currently only eligible in Virginia, as the Maryland and Pennsylvania programs include provisions against conversion of whole or substantial portions of a farm in order to generate credits. In Virginia, all of the permanent phosphorus offsets generated to offset stormwater loads have been generated through land use conversion projects or permanently protected stormwater practices. Generally, these projects involve converting a portion of a farm into forest with easements in place to ensure permanence.

## **Wastewater**

Wastewater is one of the primary suppliers of offsets. To date, Virginia has had an active trading program among its point sources through the VNCEA which has facilitated and organized the exchange of nutrient credits among WWTPs. In 2013, 184,752 nitrogen credits and 33,992 phosphorus credits were traded through the VNCEA (Virginia Department of Environmental Quality 2014b).

Similarly in Pennsylvania, most of the traded credits in 2013 were generated by point sources. Of the 115,570 nitrogen credits that were traded in 2013, less than 20 percent were generated by agricultural sources. And of the 10,833 phosphorus credits that were traded, less than 30 percent were generated by agricultural sources (Pennsylvania Department of Environmental Protection 2013).

In order to generate credits, WWTPs in Virginia and Pennsylvania must be operating below their permitted load limits. However, in Maryland, WWTPs wishing to generate credits must be operating below their concentration limit. The difference in these states' policies is subtle but important. A WWTP's load allocation is based on a concentration limit at some given rate of flow. In the case of Pennsylvania and Virginia, load allocations are based on design flows. When a WWTP is not operating at design capacity it may be possible to operate below its load allocation without having upgraded to meet the concentration limit. In Maryland, however, WWTPs may only generate credits if they have upgraded to ENR and are operating below concentration limits of 4 mg/l TN and 0.3 mg/l TP. Pennsylvania is currently proposing a revision of its policy that would require WWTPs to meet concentration limits for nitrogen and phosphorus before being able to generate credits.

## **Municipal Stormwater**

With the municipal stormwater sector facing the highest costs of reducing nutrients out of all of the sectors, it is unlikely that MS4s will be significant in terms of credit generation. However, Virginia allows MS4s to generate credits for nutrient-reducing activities that generate reductions beyond their nutrient load allocations in their permits. Currently, the Phase I MS4 permit for Arlington County and the general permit for all of Virginia's Phase II MS4 facilities include numeric nutrient reduction requirements for the Chesapeake Bay TMDL. It is anticipated that these reduction requirements will be present in all new Phase I MS4 permits. Maryland and Pennsylvania do not currently have policies for trading in the MS4 sector.

## **Development Stormwater**

Virginia is the only state with legislation in place for generating credits from practices that reduce post-construction phosphorus loads. New and redevelopment sites must first meet their water quality site design criteria before they are eligible to sell excess reductions from any practices that go beyond the design criteria. Maryland is drafting an Accounting for Growth policy that addresses development stormwater, though the baseline requirements have not been finalized as the policy workgroup did not reach consensus. However, the draft options include the pre-development land use load's 2025 WIP allocation or the forest land use load. Maryland's draft policy includes several onsite and offsite mitigation options that can be used to meet permit obligations and/or generate credits if reductions from these activities go beyond permit requirements.

### Septic

Maryland is the only state with an official policy on generating credits from septic systems. Wastewater treatment plants are eligible to generate nitrogen credits by hooking up failing septic systems. Although Virginia does not have an official policy, VADEQ has allowed wastewater treatment plants to generate nitrogen credits for hooking up septic systems outside of their originally designated sewerage area. Credits can be generated by hooking up septic systems that are either failing or operating properly, though credits are calculated based upon a properly operating system. In both states, only nitrogen credits can be generated from septic retirement projects because the Chesapeake Bay Watershed Model only simulates nitrogen pollution from septic systems.

## CERTIFICATION, VERIFICATION, AND REGISTRATION PROCESSES

The authorizing documents (i.e., statutes, regulations) for each state program detail the processes of certifying credits and offsets and verifying the BMPs and actions used to produce them. State programs promote market activity by posting eligible credits and offsets to a registry to which buyers may refer when seeking credits or offsets. Registries provide a transparent platform for the exchange of credits. This enables state programs to keep a track of the credits. Table 6 summarizes the certification, verification and registration processes for credits and offsets generated under each state program and the methods used to verify the program’s success.

**Table 5. Certification, Verification, and Registration Processes**

| Feature   | Maryland  | Pennsylvania  | Virginia  |
|---|---|---|---|
| Agency responsible for credit and/or offset certification | <ul style="list-style-type: none"><li>• MDA<sup>a</sup></li><li>• MDE<sup>b</sup></li></ul> | <ul style="list-style-type: none"><li>• PADEP</li></ul> | <ul style="list-style-type: none"><li>• VADEQ</li></ul> |

| Feature   | Maryland   | Pennsylvania   | Virginia   |
|---|--|--|--|
| <b>General project approval and certification process</b> | <ul style="list-style-type: none"> <li>Applicants prepare and submit a Maryland Agricultural Nutrient Credit Certification form explaining how their project meets the trading policy's requirements</li> <li>MDA reviews the project for compliance with the trading policy and baseline requirements</li> <li>Projects may be certified pending implementation</li> <li>MDA can require additional documentation, an on-site inspection, and/or other information before certifying a project and issuing credits</li> </ul> | <ul style="list-style-type: none"> <li>Applicants prepare and submit certification requests for projects</li> <li>PADEP staff members and other experts review certification requests</li> <li>PADEP certifies projects that comply with the nutrient trading regulation and do not need further clarification</li> <li>Projects may be certified prior to implementation</li> </ul> | <ul style="list-style-type: none"> <li>Applicants plan and implement projects based on VADEQ project standards and specifications</li> <li>VADEQ staff members review project proposals<sup>c</sup></li> <li>Projects may be certified after VADEQ conducts an administrative and technical review followed by public notification of the proposed project</li> <li>Point sources report to VADEQ on trades before February 1 of the year following the calendar year in which offsets were generated</li> </ul> |
| <b>Credit Issuance</b>                                    | <ul style="list-style-type: none"> <li>Once the project is certified, credits may be issued ex-ante (prior to implementation) for projects pending implementation or ex-post (after implementation) for projects that are already implemented</li> </ul>   | <ul style="list-style-type: none"> <li>Credits are issued after the project is implemented and verified</li> </ul>   | <ul style="list-style-type: none"> <li>Project must be implemented and certified before credits are issued</li> </ul> <p><i>Proposed:</i></p> <ul style="list-style-type: none"> <li><i>For land use conversion projects, VADEQ will only issue 25% of the total credits at the time of certification; the remaining 75% will be issued when the participant demonstrates he his generating credits in accordance with a pre-determined implementation plan</i></li> </ul>                                       |
| <b>General project verification</b>                       | <ul style="list-style-type: none"> <li>Project proposals require provisions for annual verification and reporting</li> <li>Annual projects require third-party<sup>d</sup> inspections twice per year, and structural projects require third party inspections once per year</li> </ul>  | <ul style="list-style-type: none"> <li>Project proposals must include a plan to verify nutrient and/or sediment reductions annually</li> <li>Third-party verification is preferred</li> <li>Method and frequency of verification depend on the project type</li> </ul>   | <ul style="list-style-type: none"> <li>Nutrient reduction certificate and point source reports describe how project complies with trading regulations</li> <li>VADEQ conducts the inspections for verifications and validation</li> <li>Nonpoint sources are verified annually and protocols vary by</li> </ul>  |

| Feature                             | Maryland  | Pennsylvania   | Virginia  |
|-------------------------------------|---|--|---|
|                                     | <ul style="list-style-type: none"> <li>MDA performs annual spot checks on a minimum of 10 percent of all agricultural projects</li> <li>Baseline, operation, and maintenance requirements must be verified annually</li> </ul> <p><u>Draft Accounting for Growth Policy:</u></p> <ul style="list-style-type: none"> <li>Establish independent reviewers to certify and verify credits; verifiers receive and are up-to-date with state certification for market trading programs; additional checks and balances to avoid conflict of interest</li> </ul> | <ul style="list-style-type: none"> <li>Verification may occur at any time during the life of the project</li> <li>Verification must demonstrate that the project has been implemented and that other requirements, such as baseline and threshold, have been met</li> <li>PADEP may conduct other verification activities, such as monitoring, inspections, and compliance audits</li> </ul> | <p>sector</p> <ul style="list-style-type: none"> <li>Point source practices are validated through the exchange's annual compliance report and VADEQ's annual report</li> <li>VADEQ has the authority to inspect facilities and practices as a condition of VA Watershed General Permit</li> </ul> |
| <b>Registry</b>                     | <ul style="list-style-type: none"> <li>Maryland Nutrient Tracking Tool</li> </ul> <p><u>Proposed:</u></p> <ul style="list-style-type: none"> <li>Chesapeake Bay Nutrient Trading Registry</li> </ul> <p><u>Draft Accounting for Growth Policy:</u></p> <ul style="list-style-type: none"> <li>All trades to be in a publicly accessible, on-line database established by state (MDE OR MDA) and used to track progress</li> </ul>   | <ul style="list-style-type: none"> <li>Registry Spreadsheet Tool</li> </ul> <p><u>Proposed:</u></p> <ul style="list-style-type: none"> <li>The type of registry is TBD</li> </ul>  | <ul style="list-style-type: none"> <li>Virginia Pollutant Discharge Elimination System permits</li> <li>VADEQ records</li> </ul> <p><u>Proposed:</u></p> <ul style="list-style-type: none"> <li>The type of registry is TBD</li> </ul>  |
| <b>Agency in charge of registry</b> | <ul style="list-style-type: none"> <li>MDA/MDE</li> </ul>   | <ul style="list-style-type: none"> <li>PADEP</li> </ul>  | <ul style="list-style-type: none"> <li>VADEQ</li> </ul>   |

<sup>a</sup> MDA certifies credits generated by agricultural nonpoint sources.

<sup>b</sup> MDE certifies credits generated through septic hookups.

<sup>c</sup> Nonpoint source offsets must be acquired through a public or private entity acting on behalf of the landowner.

<sup>d</sup> Third parties may include Certified Crop Advisers, Maryland Professional Engineers, USDA-NRCS Technical Service Providers, or Soil Conservation Districts.

### Project Approval/Certification and Verification

Although each trading program has detailed information on the certification and verification processes that a participant must follow in order to enter the trading market, the processes and terminology vary among the states.

### *Maryland*

MDA is responsible for reviewing and approving applications for nonpoint source projects. Every project receives an administrative review and onsite visit to verify baseline conditions. Upon successful review, the project is provisionally approved and certified (prior to implementation), and the credits are issued ex-ante. Once a project is implemented and verified, credits issued to the project are considered ex post and can be used towards permit compliance.

Nonpoint source trade contracts must contain provisions for annual verification and reporting. Baseline, operation, and maintenance requirements are verified annually via onsite visits. Structural conservation practices must be inspected once per year and annual conservation practices twice per year. Maryland allows approved third parties to perform the inspections on their behalf. In addition to regular inspections, MDA or a designated third party will annually conduct random inspections on at least ten percent of sold agricultural credits.

### *Pennsylvania*

PADEP is the authority that reviews and certifies projects and issues credits. Both point and nonpoint source applicants are required to submit their requests to PADEP. Applications receive an administrative review but typically receive no onsite inspection prior to certification. PADEP certifies, or approves, proposed credit-generating projects when interested sellers submit materials for review. Approved projects are then implemented by the landowner, and verification occurs after implementation.

Annual nutrient and/or sediment verification plans must be included as part of the project application. The method and frequency of project verification will depend on the project type. Third parties typically conduct verification, and PADEP may conduct additional activities, such as monitoring, inspections, and compliance audits. Once the project is installed and verified, credits are issued.

PADEP authorizes the use of credits by WWTPs through NPDES permit provisions. Following the use of credits, the WWTPs must also report this use in Discharge Monitoring Reports at the end of the compliance year.

### *Virginia*

Credit generators must submit project proposals to VADEQ. Proposals should include information and evidence to document that baseline practices are in place. VADEQ performs an administrative review and a technical review of all proposed projects. The technical review requires an onsite visit to verify that baseline conditions are met and that the project is installed properly. If the project is approved and certified, VADEQ issues credit to the project following the calendar year in which the practice was installed. VADEQ may inspect the practices at any time to verify they are implemented and properly operated and/or maintained. The frequency and method of verification depends on the individual project proposal and may occur at any time. Projects must be implemented before credits are released for use.

Virginia’s proposed regulations call for a similar certification and verification processes with some additional requirements, including: a topographic map with the location of the credit-generating practices, financial assurance cost estimates for structural conservation practices, and the HUC in which the credit-generating entity is located. For perpetual, land use conversion credits, additional requirements include documentation of the land use, evidence of site protection for perpetuity, and notarized documentation that the land is free of liens. VADEQ will conduct an administrative and technical review in addition to a public notification of the proposed credit-generating activities before the project can be certified. For land use conversion projects, VADEQ will issue 25 percent of the total credits at the time the project takes land out of agricultural production and is protected by a deed restriction; the remaining 75 percent will be issued when the participant demonstrates that the land conversion has been successfully completed.

### **Registration and Tracking**

All states register projects and track credits and trades, but the method for registration and tracking varies. Once trades begin to occur in Maryland, the state may use the Chesapeake Bay Nutrient Trading Registry which offers an online, searchable database of credit and trade information. WRI recently developed this watershed-wide registry that can be used not just by Maryland but by all of the states. The site is currently in beta testing and it remains to be seen whether it will be adopted by Pennsylvania and Virginia as well.

Currently, Pennsylvania maintains a registry database that captures basic information such as credit buyers and sellers, number of nitrogen or phosphorus credits registered, and an identifying number associated with the credit-generating project. It publishes the registry on PADEP’s website. Virginia currently publishes a basic registry which includes the total transactions for each nutrient water but not the individual sales. Virginia has plans to use a more comprehensive online registry.

## **PART II: OPPORTUNITIES FOR IMPROVING CONSISTENCY AND EFFECTIVENESS ACROSS STATE WATER QUALITY TRADING PROGRAMS**

When comparing the state programs, we identified several opportunities for creating and improving consistency among the programs and increasing their effectiveness as cost-effective mechanisms for meeting TMDL allocations. As part of our methods, we solicited feedback from state administrators and other professionals engaged in trading in order to identify additional opportunities based on their expertise and experience. The findings from these interviews as well as our literature review are discussed in this section.

### **Create Consistency in Definitions and Terms**

The state trading programs use similar terms but define them differently in some cases. For example, the terms “certification” and “verification” have various meanings among the states. In Virginia, certification means “the approval of nutrient credits issued by the department” and occurs after implementation (Virginia Water Control Board 2013). In Pennsylvania, certification refers to reviewing and approving a proposed credit-generating activity, but credits are not issued until after implementation and verification. In Maryland, certification of nonpoint source

agricultural conservation practices also refers to approving the proposed credit-generating activity, but MDA will issue credits ex-ante, or before the practice has been implemented. Verification also has different meanings among and within states. It could refer to reviewing evidence of implementation or conducting on-site inspections. And the type of verification can vary within states based on the project activity.

Creating alignment in how programs define trading program elements is a simple way to create clarity and consistency. For example, having a common definition for a credit provides a good foundation for achieving consistency in other program elements. Using consistent terms and processes among each of the Chesapeake Bay states would help the trading programs earn the understanding and trust of the general public, increase access for third parties such as aggregators to work across state lines, and pave the way for interstate trading. USEPA's forthcoming technical memorandum on certification and verification may provide common language that the states can agree to adopt.

### **Create Consistent, Minimum Standards for Critical Program Elements**

Having some minimum standards that are adhered to by all the states on certain critical trading program elements could improve consistency and create greater transparency and public trust in the trading programs. Common standards for critical program elements can help to ensure that a credit has the same pollution reduction value in all of the states, has similar project assurances, and represents additional nutrient reductions than would not have otherwise been achieved in the absence of trading. This section suggests some of these trading program elements that could benefit from consistent standards in the Bay watershed.

#### *Credit Estimation Method*

As it stands with every state using a different methodology, the same practices on the same types of farms could be generating different amounts of credits in different states. A 2011 study by Latane and Stephenson demonstrated that implementing the same practice to generate credits results in different reductions on similar farms as a result of variability in credit estimation methods, among other factors. For example, the study found that enhanced nutrient management would reduce nitrogen by 40 pounds more in Pennsylvania than in Virginia. These differences create accounting problems and demonstrate inequity in how state programs credit nutrient-reducing activities that offset loads in order to meet the TMDL goals.

If states move toward using one common platform, the increased consistency in how credits are calculated and awarded can help to ensure trading programs are equitable among states and can provide certainty for participants who trade in various states. A common tool that's rooted in the methodology of the Chesapeake Bay Watershed Model, the accounting tool for the Bay TMDL, would also help to ensure that baseline activities and credit-generating activities are in alignment with the TMDL accounting processes.

#### *Cost Share Restrictions*

Inconsistent policies on whether cost share can be used to implement credit-generating practices could result in issues with additionality and equity. States that allow cost share to be used to generate credits lack assurances that the projects are financially additional<sup>1</sup>, creating

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<sup>1</sup> Financial additionality in projects occurs when the revenue potential from selling the nutrient credits is a decisive reason for implementing the project.

inconsistency in the value of credits that are all being applied equally to meet or maintain Bay TMDL allocations. In addition, producers in states that allow cost share to be used would be at an advantage by being able to price credits lower than producers in states that do not allow cost-shared practices. If interstate trading occurs in the future, states would benefit from developing common policies around restricting the use of cost share to generate credits in order to ensure additionality of credits and to eliminate the potential for competitive advantage.

#### *Seller Eligibility Requirements*

Each state has a different seller eligibility requirement for agriculture. In order to ensure that water quality goals of the TMDL are met, it is critical that credits are additional to the requirements necessary to meet load allocations. Therefore, each state's baseline should be equivalent to the TMDL load allocations. Currently, both Maryland's and Virginia's baselines, although set differently (i.e., Maryland uses a performance-based and Virginia uses a practice-based baseline), are in line with each of their state's TMDL load allocations for agriculture. Pennsylvania's baseline, on the other hand, falls short of meeting necessary TMDL targets, according to USEPA (2012).

In addition, variations in baseline requirements mean that agricultural producers will have different levels of effort that are required to become eligible to trade. Under interstate trading, this discrepancy could create unfair advantages. For example, under the current baselines, agricultural producers in Pennsylvania would have a much lower baseline to reach than agricultural producers in Maryland or Virginia, and therefore may be able to offer lower credit prices.

As states revise their policies, care should be taken to ensure that however the agricultural baselines are expressed, the end results must be consistent in that they reflect TMDL targets.

#### *Trading Ratios*

States employ various types of trading ratios in order to ensure water quality is not compromised even if credits default due to uncontrollable circumstances or credit estimates differ from reality. However, the variation in what ratios are applied results in credits holding different values among the states. Trade ratios ultimately affect the amount of offsets that a credit-generating activity can generate. When credits are being used across the watershed to achieve required reductions under the TMDL allocations, it's crucial that a common currency is used.

In addition, when the type and magnitude of ratios applied and the time that they are applied vary among states, it could create challenges for interstate trading. For example, if credits generated in Virginia are sold to a buyer in Pennsylvania, there would be no trade ratios applied, apart from the delivery factor. However, if this deal is reversed and a buyer in Virginia purchases from a credit generator in Pennsylvania, the credits would be subject to Pennsylvania's 10 percent reserve ratio when they're generated and to Virginia's 2:1 uncertainty ratio when they're applied in Virginia. The latter scenario would have much higher costs overall than the former scenario in which no discounts are applied, reducing the overall cost effectiveness without adequate scientific rationale supporting the need for both ratios. These kinds of discrepancies due to variations in trade ratios could also create inequities under interstate trading and confusion for participants navigating multiple programs.

Developing minimum standards and rules for how and when to apply trade ratios would help create a level playing field, create consistency for trading program participants operating across states, and eliminate the possibility of excessively discounting credits traded across states.

#### *Project Approval Process*

In Maryland and Pennsylvania, nonpoint source projects can be certified prior to implementation. In Maryland, the credits from certified nonpoint source projects can also be issued ex-ante (i.e. prior to being implemented), but in Pennsylvania, projects must be implemented and verified before credits are issued. In Virginia, proposed projects are approved but credits are only issued after the project has been implemented. Likewise, project verification standards differ among states in terms of when verification happens, who is qualified to verify projects, frequency of verification, whether verification requires a site visit, and whether pre-implementation verification is required.

With the states having varying levels of stringency for project approval and verification, some programs may face higher degrees of scrutiny than others which could jeopardize public trust in trading in general. If states agree to some consistent, minimum standards for critical requirements, trading programs may earn more trust from the public, USEPA, and potential credit buyers. Some critical elements that should share consistent, minimum standards include: project approval requirements (e.g., a minimum level of information that must be included in project applications, a minimum site visit requirement for certification), a minimum project certification length, minimum assurances that are needed to issue permanent offset credits, and minimum ongoing verification standards.

#### **Create Better Documentation and Greater Transparency on Credits and Trades**

Currently, with states registering their credits using various mechanisms and with various degrees of public availability, it is not easy to track the amount and kinds of credits that are certified and have been sold in the Bay watershed. States should consider adopting minimum standards for registering and tracking certified credits that include the public display of critical information related to the credits. Having this transparency of common information among the states would help to build public trust in trading and ensure accountability.

Likewise, a centralized marketplace to catalyze the exchange of credits between buyers and sellers would be a very useful tool to connect potential market participants and facilitate entry into the trading market.

A common registry and marketplace would establish a common “currency” through which all trades in the Bay watershed would operate, building public trust and preparing the region for possible future trades across state lines.

#### **Engage Additional Sectors in Trading**

Most of the Bay states limit the degree to which different sectors participate in their trading programs which in turn may prevent programs from maximizing the cost effectiveness of achieving the Bay TMDL. To ensure programs are cost effective, multiple source sectors with various mitigation costs should be included so that the greatest cost differentials can be achieved and trading volume can be maximized (Fisher-Vanden and Olmstead 2013; STAC 2013).

The wastewater sector is a primary credit buyer across the watershed, and all states in the Chesapeake Bay watershed have nutrient permit limits for WWTPs. WWTPs are eligible to trade, under different scenarios, in Maryland, Pennsylvania, and Virginia. These point sources can trade amongst themselves, and as of recently, can all trade with nonpoint sources. By including nonpoint sources as a potential credit generator, it was estimated that point to nonpoint source trading within the same state and basin reduces costs by 36 percent compared to if only point to point source trading was allowed (Van Houtven et al. 2012).

Even greater savings could be achieved by including the MS4 stormwater sector in trading markets. With the exception of Virginia, the MS4 stormwater sector has not as of yet had the equivalent driver to reduce nutrient loads and to trade. If and when the stormwater sector is faced with quantified nutrient mitigation responsibilities, it stands to benefit greatly from trading, as the sector faces significantly high nutrient mitigation costs. Allowing this sector to trade with agricultural nonpoint sources can provide cost-savings of up to nearly 80 percent (Van Houtven et al. 2012). Right now, the biggest cost differential is between these two sectors, so including urban sources in state trading programs could greatly improve cost efficiency.<sup>6</sup>

Moreover, including MS4s will create long-term demand for credits. In Pennsylvania and Virginia, WWTP compliance trading is on the decline, as plants are upgrading to meet permit limits. Without involving MS4s in the trading program, the only demand in Pennsylvania will come from new and expanding WWTPs. Engaging MS4s in trading programs in Pennsylvania and Maryland could help to increase demand for credits, enabling the TMDL allocations to be achieved more quickly and cost effectively than would be possible without trading.

However, it is important to understand that traditional federal MS4 regulations strive to address local water quality issues caused by uncontrolled stormwater runoff from urban landscapes, and trading for nutrients would not be a permanent solution to meeting stormwater requirements. It is likely that trading in the MS4 sector would effectively serve to help extend the compliance period for municipalities to meet TDML obligations for nitrogen and phosphorus. For example, Arlington County (Virginia) is currently contemplating a trade with its county wastewater treatment plant in order to meet the nutrient reduction requirements under its second permit cycle. However, even though it may trade to meet its requirements, the county would continue to implement a robust stormwater management program. Arlington County expects that it will meet its TMDL nutrient reduction obligations in an additional two to three permit cycles as a result of progress in its stormwater program. Thus, trading would merely serve to extend its compliance period for meeting nitrogen and phosphorus reduction obligations and would not obviate its stormwater management obligations.

The market could be further expanded by creating and finalizing policies to include the development sector in the trading market, as is the case in Virginia and as has been initiated in Maryland. Virginia has imposed limits on post-development phosphorus loading through the construction stormwater permits. This program currently constitutes the majority of demand for nonpoint source credits in the state. Maryland is proposing similar offset requirements for development stormwater through its draft Accounting for Growth policy, but efforts have been delayed.

Because the Bay TMDL has limited allocations for new growth, nutrient caps on the development sector will be critical for most states to meet their targets.<sup>7</sup> Nutrient limits for construction stormwater permits would help to maintain the TMDL cap in the face of growth, and the water quality market can provide opportunities to generate offsets to help meet these limits. Development stormwater trading would create a healthy and long-term demand in the market and drive landowners towards more permanent offset projects.

By involving many players with varying costs for reducing pollution in the trading markets, demand for credits will increase and the cost of meeting the TMDL will decrease.

### **Streamline Programs within States**

Some states have what amounts to multiple trading programs. Virginia has a point to point source exchange program for compliance, a point to nonpoint source program for new and expanding WWTP offsets, and a permanent offset program for development. Likewise, Maryland has an offset program for wastewater treatment plants, requiring ten-year contracts, and is developing a separate program for new development that may call for permanent offsets. It is not yet clear whether Maryland's development offset program will trade the same pollutants or share the same trading areas as the existing Phase I and Phase II trading programs. Pennsylvania is also considering expanding trading opportunities to the MS4 stormwater and development sectors. These variations in programs and in turn, program elements, can hinder ease of participation and public understanding.

When trading programs are expanded to include additional eligible participants, some adjustments to the existing program may be necessary, but core trading program elements (e.g., allowable pollutants, trading areas, trading ratios, certification processes) could remain the same. However, when Maryland started developing its Accounting for Growth policy to handle offsets from new and redevelopment, rather than adopting general policies and frameworks from the existing wastewater offset program, the advisory group took a fresh look at program elements. Likewise, Virginia's stormwater program evolved differently from the point to nonpoint source trading program and contains differences on several key program elements.

Aligning trading programs for the various sectors within each state can cut down on the time and resources involved to develop and operate the programs, provide improved transparency, and streamline the trading program overall. In turn, a more transparent, streamlined, and cohesive trading program could catalyze participation of program participants who are active in more than one kind of market and increase public understanding and trust.

### **Clarify and Improve Legality of Trading**

In the Chesapeake Bay watershed, Pennsylvania's and Maryland's programs have both been subject to legal challenges. As a result, agencies may be wary of certifying credits and approving trades. Clear guidance and expectations from USEPA, clarification on critical state trading policy elements, and improved transparency in the state programs could help to inspire increased confidence and certainty in these programs.

USEPA is currently issuing a series of technical memoranda on trading which includes expectations for program elements such as baselines, trading ratios, and verification. These memoranda should help to provide legal certainty for trading programs in the Chesapeake Bay watershed. If states incorporate these minimum standards into their programs, administrators and participants may feel more confident that approved trades would be upheld in court should a lawsuit ensue.

Allowing for public comment earlier in the transaction process is another way that states could increase transparency and head off legal challenges.<sup>8</sup> Currently, trades are not challengeable until the credits are already applied to the permit. As a result, buyers may be uncertain if their investment in credits will pay off in light of the potential for a lawsuit against the trade. If trades have a public comment period before the transaction is complete, they could be legally challengeable before the buyer needs to commit to the purchase. While this additional step may be cumbersome, it could make potential participants more willing to explore the process.

### **Cultivate Relationships**

Improved communication amongst state departments and potential participants can be beneficial for determining the demand for trading, potential supply, and how the programs can be most efficiently administered. Building better relationships helps to ensure the efficacy of state programs.<sup>9</sup> In Delaware, the Department of Natural Resources and Environmental Control's engagement with stakeholders regarding trading over the past few years led to the agency's ultimate decision not to pursue a trading program at this time. Although the agency had planned to start a program, meetings with stakeholders illuminated the fact that there was limited interest.

In developing and revising their programs, Virginia, Pennsylvania, and Maryland did form stakeholder groups to help inform policies. This framework allows for all voices to be heard in the decision-making process and may be more likely to result in a program that is supported by all potential participants and policy makers.

In addition to state-specific stakeholder groups, the Chesapeake Bay Program uses a multistate model for advancing trading across the watershed through its Trading and Offsets Workgroup (TOWG). This workgroup is made up of members from all of the Chesapeake Bay watershed states in addition to representatives from federal and local governments, nongovernmental organizations, trade associations, universities, and the general public. The workgroup acts as a forum for sharing progress and lessons learned. It is also well-suited to take on cross-state issues regarding program consistency.

As states continue to revise their trading programs, and if additional states decide to create formal programs, these state-specific workgroups and the TOWG should continue to be leveraged to help advance trading within and across state boundaries.

### **Reduce Burdens on Participants**

Navigating the trading programs can be daunting for participants, particularly for landowners interested in selling credits. The steps involved for a landowner to enter the trading market involve determining eligibility, planning pollutant reduction activities, estimating credit generation potential, applying for credit certification, finding a buyer, and navigating and adhering to the resulting contractual agreement.

Streamlining programs within and among states, as discussed above, could help to make the programs more accessible to participants. Easing commonly faced burdens and transaction costs that are commonly faced by participants can also help to facilitate more activity in the market. For example, common templates can be used for verification activities and contractual agreements, and minimum standards and credit estimates can be published for allowable credit-generation activities (World Resources Institute 2014).

### **Allow More Practices**

To ensure programs are cost effective, the conditions for how one can trade should be flexible (Fisher-Vanden and Olmstead 2013; STAC 2013). In the Chesapeake Bay watershed, there are opportunities for additional structural and technological practices such as wetland and stream restoration, septic hook-ups, and septic retrofits to be used for permanent offset credit generation. In addition, the potential for using newer, innovative practices like oyster aquaculture and algae turf scrubbing in a permanent offset market should be explored.<sup>10</sup>

Maryland, on the other hand, prohibits whole or substantial land use conservation to generate credits from agriculture. Because Virginia has seen this practice as the only attractive option for permanent offsets, Maryland may find it beneficial or even necessary to revisit this farmland preservation policy. Standards for farmland preservation could be issued statewide (e.g., no more than ten percent of farmland may be converted to other land uses to generate credits) while still allowing some land use conversion in order to accommodate future population growth and development with viable, permanent offsets.

An expansive list of allowable practices can be crucial to the market functionality of trading programs. It could increase the number of participants who may be interested in generating credits and allow for more cost-effective practices.<sup>11</sup>

Because the states generally defer to USEPA regarding allowable practices, USEPA could also improve its conservation practice approval process in order to more efficiently review and approve practices for credit in the Chesapeake Bay Watershed Model and in trading programs.

### **Allow Interstate Trading**

Many of these recommendations which aim to achieve greater consistency among trading programs will naturally help to pave the way for interstate trading. Currently, trading in the Bay watershed occurs within states and within major basins within those states. While only formally allowing trades to occur within the state-basins may allow for more manageable and defensible geographic areas, bound by major basin watershed and political boundaries, the economic benefits of expanding trading programs to be able to operate with greater flexibility on a watershed-wide basis are significant (Fisher-Vanden and Olmstead 2013; STAC 2013). A study by RTI for the Chesapeake Bay Commission

estimated that for the wastewater sector's offset market (with credits coming from both point and nonpoint sources), opening up trading to the entire watershed could result in an 87 percent cost savings (2012).

The cost savings are generated for a number of reasons. First of all, expanding the geographic trading area also expands the number of potential participants. With a greater breadth in participation, more low-cost credits may be accessible. Secondly, by broadening the geographic area, buyers can seek out sellers who have high delivery ratios, as credits that are minimally or not at all discounted by delivery ratios may be priced competitively.

However, program administrators and other stakeholders have mixed opinions on whether interstate trading is necessary or desirable. Some believe that interstate trading is likely worth exploring, as it makes economic sense and may be necessary to meet the TMDL as the low-hanging fruit dwindles over the next ten years.<sup>12</sup> And because the TMDL, and therefore the trading programs, are driven by the health of the mainstem of the Chesapeake Bay, interstate trading would also make sense scientifically, assuming delivery ratios continue to be properly applied and local water quality is protected.<sup>13</sup>

On the other hand, there are concerns about interstate trading. Intrastate programs are complicated enough as they currently stand, and states are still trying to iron out their individual programs.<sup>14</sup> The potential cost savings may not make it worthwhile.<sup>15</sup> In addition, from a scientific perspective, the potential to create downstream "losers" with disproportionate pollution loads could make interstate trading problematic.<sup>16</sup>

The decision to pursue interstate trading should only be made after careful consideration. It is important that an interstate program does not create undue burdens<sup>17</sup> or cause political problems due to money leaving state boundaries.<sup>18</sup> When it is explored, a pilot program could be implemented in a small watershed, generate tangible results, and extend its lessons learned from that experience before expanding an interstate program to the entire Bay watershed.<sup>19</sup>

In designing how interstate trading would operate among three or more state programs with unique rules, there will have to be a decision on how to address differing policies. Box 2 provides three commonly suggested options for operationalizing interstate trading.

**Box 2. Operationalizing Interstate Trading**

If interstate trading is going to be an option for the Chesapeake Bay watershed, it would be more feasible if the programs were more cohesive. Without cohesiveness, it can be challenging to transfer information between states and determine which nutrient-reducing activities may be counted toward the WIPs.<sup>20</sup>

There are three main approaches for creating this necessary cohesiveness.

1. *Require uniformity among programs.* For interstate trading to work, programs may need (and USEPA may require) their baselines, credit estimation methodologies, allowable projects, and other policies and methodologies to be entirely uniform.<sup>21</sup>

2. *Employ set of minimum standards.* Alternatively, interstate trading could work if there was a set of fundamental minimal standards in place that would have to be met for trades that cross state lines. The base criteria could be built upon using the programs' existing commonalities. This option could also allow for states to require more strict rules based on their priorities.<sup>22</sup>

3. *Use crosswalk between programs.* Finally, a crosswalk could be developed that converts one program, and its credits, to another. By using a crosswalk, the individual state nuances could be accounted for, and participants would not be able to take advantage of the differences among the system that would create more advantageous opportunities in some states than in others.

## CONCLUSION

With the Bay TMDL now creating a common policy goal and demand driver for all sectors across all of the states and, and the release of several studies which demonstrate the potential cost effectiveness of the trading programs under various scenarios, the time is ripe for revisiting the consistency and effectiveness of the Chesapeake Bay watershed's trading programs. A mismatch of policy elements among the programs creates inconsistent and unclear pictures of how trading works in the Bay. In turn, threats of lawsuits, public misunderstanding, and participant uncertainty may threaten the success of trading being a useful mechanism for cost-effectively achieving the TMDL.

First and foremost, greater consistency in terms and program elements is necessary for public and participant understanding and trust. In addition, as steps are taken to bridge differences in program elements, care should be taken to ensure these changes will achieve cost efficiencies in meeting TMDL allocations. For example, including more sectors—particularly stormwater and development—can greatly increase the effectiveness of the trading programs at reducing costs and meeting the WIP allocations. Other major recommendations include increasing the number of eligible practices and allowing for interstate trading. These recommendations should be considered for their merits in increasing the consistency and effectiveness of trading policies in order to ensure that programs in the Chesapeake Bay are successfully designed to achieve maximum impact.

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## ENDNOTES

<sup>1</sup> Delaware handles trading on a case-by-case basis.

<sup>2</sup> In 2009, West Virginia drafted the West Virginia Water Quality Nutrient Credit Trading Program document. That document recognized the need for further considerations related to offsets and trading associated with the pending 2010 Chesapeake Bay TMDL. In the preparation of its WIP, West Virginia decided not to initially pursue a comprehensive trading program but instead to include within its WIP a basic framework for case-by-case offsetting of new or expanded loads.

<sup>3</sup> The information in this document regarding Maryland's proposed Accounting for Growth program represent the decisions made by the Accounting for Growth Workgroup as captured in the Workgroup's final August 2013 report. However, due to continued internal discussions within Maryland's Department of the Environment, these program rules may not reflect the most recent thinking on the Accounting for Growth program policies.

<sup>4</sup> Act of March 25, 2011, ch. 523, §§ 10.1-603.8:1, 2011 Va. Acts (an act to amend and reenact §§ 10.1-603.8:1 of the Code of Virginia relating to stormwater nonpoint nutrient offsets).

<sup>5</sup> Allan Brockenbrough, Virginia Department of Environmental Quality. Personal communication. September 23, 2014.

<sup>6</sup> Beth McGee, Chesapeake Bay Foundation. Personal communication. February 13, 2014.

<sup>7</sup> Glynn Rountree, National Association of Home Builders. Personal communication. February 14, 2014.

<sup>8</sup> Beth McGee, Chesapeake Bay Foundation. Personal communication. February 13, 2014.

<sup>9</sup> Jennifer Walls, Delaware, March 18, 2014.

<sup>10</sup> George Kelly, Environmental Banc and Exchange. Personal communication. April 30, 2014.

<sup>11</sup> George Kelly, Environmental Banc and Exchange. Personal communication. February 18, 2014.

<sup>12</sup> Susan Payne and John Rhoderick, Maryland Department of Agriculture. Personal communication. February 12, 2014. Peter Hughes, Red Barn Consulting. Personal communication. February 11, 2014. Glynn Rountree, National Homebuilders Association. Personal communication. February 14, 2014. Paul Marchetti, Brion Johnson, and Robert Boos, PENNVEST. Personal communication. February 20, 2014. Veronica Kasi, Jay Braund, and Brian Schlauderaff, Pennsylvania Department of Environmental Protection. Personal communication. February 12, 2014. George Kelly, Environmental Banc and Exchange. Personal communication. February 18, 2014. Dana York and Bob Ensor, Green Earth Connection LLC. Personal communication. February 12, 2014.

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<sup>14</sup> Beth McGee, Chesapeake Bay Foundation. Personal communication. February 13, 2014.

<sup>15</sup> Beth McGee, Chesapeake Bay Foundation. Personal communication. February 13, 2014.

<sup>16</sup> Jennifer Walls, DE Department of Natural Resources and Environmental Control. Personal communication. March 18, 2014.

<sup>17</sup> Veronica Kasi, Jay Braund, and Brian Schlauderaff, Pennsylvania Department of Environmental Protection. Personal communication. February 12, 2014.

<sup>18</sup> Russ Baxter, Allan Brockenbrough, and Diane Beyer, Virginia Department of Environmental Quality. Personal communication. February 20, 2014.

<sup>19</sup> Bob Ensor and Dana York, Green Earth Connection LLC. Personal communication. February 12, 2014.

<sup>20</sup> Peter Hughes, Red Barn Consulting. Personal communication. February 11, 2014.

<sup>21</sup> Susan Payne and John Rhoderick, Maryland Department of Agriculture. Personal communication. February 12, 2014. Russ Baxter, Allan Brockenbrough, and Diane Beyer, Virginia Department of Environmental Quality. Personal communication. February 20, 2014.

<sup>22</sup> Jennifer Walls, DE Department of Natural Resources and Environmental Control. Personal communication. March 18, 2014.

## APPENDIX A: ACRONYMS

|          |   |
|----------|---|
| AfG      | Accounting for Growth                               |
| BMP      | Best management practice                            |
| CAFO     | Confined animal feeding operation                   |
| CBNTT    | Chesapeake Bay Nutrient Trading Tool                |
| CBP      | Chesapeake Bay Program                              |
| ENR      | Enhanced nutrient removal                           |
| FIL      | Fee in lieu   |
| HUC      | Hydrologic unit code                                |
| MDA      | Maryland Department of Agriculture                  |
| MDE      | Maryland Department of the Environment              |
| MGD      | Million gallons per day                             |
| MS4      | Municipal separate storm sewer system               |
| NPDES    | National Pollutant Discharge Elimination System     |
| NRCS     | Natural Resources Conservation Service              |
| OSDS     | On-site sewage disposal system                      |
| PADEP    | Pennsylvania Department of Environmental Protection |
| PENNVEST | Pennsylvania Infrastructure Investment Authority    |
| RUSLE    | Revised universal soil loss equation                |
| TMDL     | Total maximum daily load                            |
| TN       | Total nitrogen                                      |
| TOWG     | Trading and Offsets Workgroup                       |
| TP       | Total phosphorus                                    |
| USDA     | US Department of Agriculture                        |
| USEPA    | US Environmental Protection Agency                  |
| VADEQ    | Virginia Department of Environmental Quality        |
| VAWQIF   | Water Quality Improvement Fund                      |
| VNCEA    | Virginia Nutrient Credit Exchange Association       |
| VPDES    | Virginia Pollutant Discharge Elimination System     |
| VSMP     | Virginia Stormwater Management Program              |
| WWTP     | Wastewater treatment plant                          |
| WIP      | Watershed Implementation Plan                       |
| WLA      | Wasteload allocation                                |
| WRI      | World Resources Institute                           |

## APPENDIX B. LEGAL AUTHORITIES AND GUIDANCE DOCUMENTS

| State               | Statute  |
|---------------------|--|
| <b>Maryland</b>     | <ul style="list-style-type: none"> <li>Laws of Maryland 2010, ch. 447, §§ 8–901 through 8–904, Md. Agriculture Code Ann. (regarding a voluntary agricultural nutrient credit certification program) ); Laws of Maryland 2012, ch. 25 §§ 8–901 through 8–904, Md. Agriculture Code Ann. (voluntary certification and registration of nutrient or sediment credits on agricultural land)</li> </ul>  |
| <b>Virginia</b>     | <ul style="list-style-type: none"> <li>Act of March 24, 2005, ch. 62.1, §§ 62.1-44.19:12 through 62.1-44.19:19, 2005 Va. Acts (establishing nutrient exchange or trading program).</li> <li>Act of March 27, 2009, ch. 364, § 10.1-603.8:1, 2009 Va. Acts (establishing stormwater nonpoint nutrient offsets).</li> <li>Act of April 18, 2012, § 10.1-603.15, et seq. (directing DEQ to develop regulations governing the certification of nutrient credits)</li> </ul>  |
| Regulation          |  |
| <b>Pennsylvania</b> | <ul style="list-style-type: none"> <li>Pennsylvania Nutrient Credit Trading Regulation, 25 Pa. Code § 96.8 (relating to use of offsets and tradable credits from pollution reduction activities in the Chesapeake Bay watershed). Available at <a href="http://www.pabulletin.com/secure/data/vol40/40-41/1927.html">http://www.pabulletin.com/secure/data/vol40/40-41/1927.html</a>.</li> </ul>   |
| <b>Virginia</b>     | <ul style="list-style-type: none"> <li>General VPDES Watershed Permit Regulation for TN and TP Discharges and Nutrient Trading in the Chesapeake Bay watershed in Virginia, 9 VAC 25-820-10 et seq. Available at <a href="http://leg1.state.va.us/cgi-bin/legp504.exe?000+reg+9VAC25-820">http://leg1.state.va.us/cgi-bin/legp504.exe?000+reg+9VAC25-820</a>.</li> </ul>   |
| Policy              |  |
| <b>Maryland</b>     | <ul style="list-style-type: none"> <li>MDE. 2008. Maryland Policy for Nutrient Cap Management and Trading in Maryland’s Chesapeake Bay Watershed. Available at <a href="http://www.mde.state.md.us/assets/document/NutrientCap_Trading_Policy.pdf">http://www.mde.state.md.us/assets/document/NutrientCap_Trading_Policy.pdf</a>.</li> <li>MDA. 2008. Maryland Policy for Nutrient Cap Management and Trading in Maryland’s Chesapeake Bay Watershed Phase II-A: Guidelines for the Generation of Agricultural Nonpoint Nutrient Credits. Draft, Annapolis. Available at <a href="http://www.mdnutrienttrading.com/docs/Phase%20II-A_Crdt%20Generation.pdf">http://www.mdnutrienttrading.com/docs/Phase%20II-A_Crdt%20Generation.pdf</a>.</li> <li>MDA. 2008. Maryland Policy for Nutrient Cap Management and Trading in Maryland’s Chesapeake Bay Watershed Phase II-B: Guidelines for the Exchange of Nonpoint Credits Maryland’s Trading Market Place. Draft, Annapolis. Available at <a href="http://www.mdnutrienttrading.com/docs/Phase%20II-B_Crdt%20Purchase.pdf">http://www.mdnutrienttrading.com/docs/Phase%20II-B_Crdt%20Purchase.pdf</a>.</li> </ul> |
| Guidance            |  |
| <b>Maryland</b>     | <ul style="list-style-type: none"> <li>MDA. 2011. <i>Producing and Selling Credits in Maryland’s Nutrient Trading Market: Guidance for Agricultural Producers and Landowners in the Chesapeake Bay Watershed</i>.</li> </ul>   |
| <b>Virginia</b>     | <ul style="list-style-type: none"> <li>VADEQ. 2008. <i>Trading Nutrient Reductions from Nonpoint Source Best Management Practices in the Chesapeake Bay Watershed: Guidance for Agricultural Landowners and Your Potential Trading Partners</i>. Available at <a href="http://www.deq.virginia.gov/Portals/0/DEQ/Water/PollutionDischargeElimination/VANPSTradingManual_2-5-08.pdf">http://www.deq.virginia.gov/Portals/0/DEQ/Water/PollutionDischargeElimination/VANPSTradingManual_2-5-08.pdf</a>.</li> <li>VADCR. 2009. <i>Virginia Soil and Water Conservation Board Guidance Document on Stormwater Nonpoint Nutrient Offsets</i>. Available at <a href="http://www.townhall.virginia.gov/L/GetFile.cfm?File=C:%5CTownHall%5Cdocroot%5CGuidanceDocs%5C440%5CGDoc_DEQ_5419_v1.pdf">http://www.townhall.virginia.gov/L/GetFile.cfm?File=C:%5CTownHall%5Cdocroot%5CGuidanceDocs%5C440%5CGDoc_DEQ_5419_v1.pdf</a>.</li> </ul>   |

