

2009 Beta Test Report: Process Development & Description of Findings

Updated June, 2010



WSI Mission Statement

A science-based nonprofit working to strengthen private and public sector efforts to reduce nutrient pollution of rivers, lakes and coastal waters.

About Water Stewardship, Inc (WSI)

- A private, independent nonprofit corporation
- Science- and Ag sustainability- based
- Conduct third party assessments of conservation implementation, operation and maintenance
- Focused on nutrient impacts on water quality
- Assess, verify and quantify impacts of conservation implementation
- Identify and quantify additional cost-effective BMP opportunities
- WSI's staff has more than 100 years experience in agricultural and environmental management

Water Stewardship Projects and Services

- Conduct whole farm assessment, verification and continuous improvement of conservation performance to help farmers meet government, supply chain and consumer water quality expectations.
- Ecosystem service/trading credit estimation and verification
- Eco-labeling locally sourced products from farms meeting WSI certification standards
- Estimate nutrient reductions for management scenarios using WSI software (NLE, © WSI 2009) for federal, state and local government, industries and organizations

WHY THE UPDATED VERSION OF THE REPORT?

WSI uses localized "No BMP" land use loads from the Chesapeake Bay Watershed Model (WSM) as a starting point in our calculations. An updated version of the WSM was released during the spring of 2010. After review, WSI decided both the quantitative reduction estimates and the interpretation of results changed sufficiently to warrant an updated report. In general, nutrient and sediment reductions were higher.

Introduction to WSI Process Development and Protocols

In 2009, Water Stewardship, Inc. launched a test of a third-party assessment, verification and continuous improvement program for 37 animal agriculture operations in the Shenandoah Valley of Virginia. The purpose of this beta test was to develop and refine our process and protocols with the input of participating farms, state, federal and local conservation agencies, and agricultural advisors.

The process started by recruiting a diverse group of farmers to participate in the program. WSI found that two aspects of our approach resonated well during these initial on-farm conversations. First the fact that WSI is a private organization that signed a confidentiality agreement before beginning discussions with the farmer was extremely important to most farmers. Regardless of whether they would participate or not, WSI made it clear that all farm specific information received during the process would be kept confidential. Second, farmers were receptive to an independent, third party, quantitative assessment of their conservation and water quality protection efforts relative to the goals and expectations established by Virginia to protect the Chesapeake Bay. The WSI program is an opportunity for farms to realize what the implications of regional water quality goals are on the management of their specific production systems. This was evident by their willingness to share nutrient management plans and other conservation and management information and documents.

The WSI whole-farm process consists of three phases:

Phase 1 - WSI Conservation Baseline (CBL) assessment is designed to assure that the farmer is currently functioning according to state and/or federal policies and expectations regarding nutrient and manure management and erosion control (e.g. state, NRCS, and EPA). Any CBL deficiencies are expected to be corrected within the first two years of CIP implementation. The CBL is a minimum requirement to be a program participant.

Phase 2 - Verification of practice implementation, operation and maintenance for conservation measures implemented above the CBL. During the visit with the farmer, WSI reviews farm records and conducts a farm walk over or assessment to document practices that have been implemented beyond the CBL. This allows estimation of the reduction in nutrient load from implemented practices so they can be credited towards what is needed to meet state and federal expectations.

Phase 3 – The Continuous Improvement Program (CIP) is designed to progressively move farmers toward water quality goals along a sustained, reviewed and reinforced path. The CIP is drafted after record assessment and farm walkover are completed and recommends water quality protection measures tailored to the farm's production system. WSI may also include recommendations that represent significant changes to current management systems where economically feasible opportunities for substantial water quality improvements will occur. An initial CIP is negotiated with the farmer that is expected to be implemented over the next 2-6 year period. During the progress assessment, the CIP is updated and a commitment is made for the next cycle. In some cases, this may reach long-term state or federal expectations for water quality protection but in most it is not operationally or economically viable to implement to that level in the first CIP agreement so a second, or perhaps third, CIP cycle may be needed.

Coincident with the CIP, WSI provides each farm with a quantitative estimate of their nutrient loss load using our Nutrient Load Estimator (NLE © WSI 2009). The NLE was created by Water Stewardship, Inc. to calculate estimated nutrient and sediment loads for agricultural and urban tracts and the impact that a BMP or combination of BMPs will have on those loads. The land use loads and BMP application protocols used in NLE are adapted from the Chesapeake Bay Program Phase 5 Watershed Model. When used in WSI's farm assessment process, NLE estimates each farm's nutrient load before any BMPs were applied, that farm's current load with existing BMPs, and what reductions could occur on the farm if additional BMPs were implemented. Appendix 1 contains copies of a typical farmer CIP agreement and whole-farm NLE load calculations.

Being quantitative in nature, the WSI protocol requires documented information regarding a farm's nutrient management practices as well as the physical dimensions of any conservation measures they have already implemented. This proved to be an obstacle to some participants that could not provide the information needed for the WSI analysis. Consequently, WSI conducted assessments and developed CIP agreements for 33 of the original 37 farms recruited for the program. The remaining farms are expected to participate in the WSI program in 2010.

Refinements to Approach Based on Beta Test Experience

A primary goal of the beta test was to determine the cost of the WSI program on a per farm basis and how to minimize these costs. Reducing staff time per farm analysis is critical to making the WSI program a cost efficient investment for the farm business. The beta test proved that gathering the information needed for our analysis and visiting with the farmer required the greatest time. Setting clear expectations with participating farmers is necessary for an efficient assessment. For the WSI program to truly be of value to a farm business, the farmer must invest some time up front documenting practices and providing this information to WSI before site visits occur. This allows for WSI to come prepared with a preliminary assessment when visiting the farm and spend the farmer's valuable time discussing future plans and possible CIP practices.

WSI accomplished this efficiency by developing and providing farms with a checklist of needed documentation as well as developing an annual reporting system for farms so WSI is kept abreast of changes in the operation in regards to conservation and cropping practices. Our current estimate of time and resources spent per farm is about \$3,000 for an average sized farm in the Shenandoah Valley (300-400 acres and about 200 cows). This estimate will vary based on operations of different scales and complexity. Biennial verification on CIP implementation and occasional assistance on implementation is expected to cost under \$600 per farm. WSI anticipates further reductions in per farm costs with additional refinement of our program protocols.

It became apparent that WSI had to prepare for scaling up the assessment and continuous improvement program beyond our current organizational capacity. The beta test allowed WSI to develop a training program for Conservation Assessment Professionals (CAP) that enables us to adapt to fluctuations in seasonal and geographical demand for our services. The first training session was successfully held in January of 2010, with several more scheduled during the remainder of the year. The CAPs will serve as independent sub-contractors to WSI which should further reduce per farm costs.

Beta Test Findings

Existing farm status: The Commonwealth of Virginia's Tributary Strategy has a goal to reduce nutrient losses from farms by about 55% from the "no BMP" load scenario. Thus farms need to implement a suite of practices that reduce the nutrients lost from farms by 55% over the long term. The NLE calculator estimates how close a given farm is to achieving this goal. Over all farms, the average size was 442 acres, ranging from 91 to 1,438 acres. A number of different animal agriculture types were represented, including dairy, poultry and beef. To better examine the data, four types of farm operations were broken out: beef/poultry, dairy/poultry, conventional dairy, and grass-based dairies ("grazers") (Table 1). Although there were only three grazers in the beta test, the data indicated substantial differences between them and other animal operations.

The existing (CBL plus other practices already implemented) percent N and P reduction data are shown in Table 1 for the four farm groups. All but one of the 33 beta farmers received nutrient reduction credit for Nutrient Management, Conservation Tillage, and Animal Waste Management. The farmer who did not receive credit was practicing intensive tillage at the time of the farm visit so the farm did not achieve Conservation Tillage credit (in this case it became a CIP recommendation). Several other farms required adjustments in order to meet NRCS or state expectations for certain practices, e.g., accounting for litter in NMP. Farms, however, varied in the type and extent of implementation of additional practices that impacted their existing load reductions. Only one of the farm

operations reached or exceeded the 55% reduction level for N and four operations reached or exceeded 55% reduction level for P.

Table 1. Mean, median, and range for percent N and P reduction levels by farm type as calculated by NLE*. These reductions reflect the current farm status which includes practices implemented above the CBL.

Farm Type	No. Farms	% N Reduction	% P Reduction
Poultry/Beef	10	Mean = 23 Median = 23 Range = 7-38	Mean = 35 Median = 32 Range = 15-62
Dairy/Poultry	8	Mean = 25 Median = 25 Range = 17-32	Mean = 34 Median = 35 Range = 18-51
Dairy	12	Mean = 24 Median = 24 Range = 10-42	Mean = 31 Median = 30 Range = 7-55
Grazers	3	Mean = 51 Median = 50 Range = 43-59	Mean = 54 Median = 52 Range = 52-58
All Farms	33	Mean = 26 Median = 25 Range = 7-59	Mean = 35 Median = 34 Range = 7-62

*NLE calculations are based on Chesapeake Bay Watershed Model land use loads and Bay Program BMP effectiveness estimates and application protocols.

What was the difference between a high and a low percent nutrient reduction farm? Ranking the ‘top’ four farms in each of four reduction categories (highest and lowest percent N and P reductions) provided some trends. For the highest N reductions (59-42%), three are grazers and one is a dairy. For the highest P reductions (62-55%), two are poultry and beef, one a grazer, and one a dairy. There was no single factor that resulted in higher nutrient reductions but rather a combination of practices. This would include grazing versus confinement, cover crops not receiving manure or fertilizer, brokering litter, continuous no-till, and buffers. It should be noted that the Chesapeake Bay Program’s BMP efficiencies assume a high P reduction with continuous no-till but on very high P soils or where manure continues to be applied this P reduction may be overestimated.

The lowest N reductions (10-16%) were found on two dairy operations, and two beef (partially confined) plus poultry operations. For P (7-18%), there were two dairy operations, one beef plus poultry operation, and a dairy and dairy plus poultry tied for the fourth lowest reduction. All three farm types, except the grazers, had similar N and P reductions. Operations with both beef and poultry, however, had substantially lower initial loads because they rely more on pastures and less on row crops. It is more difficult to achieve the full 55% reduction on these farms due to their inherently low nutrient loads and it may be more practical to focus on the more intensive row crop operations to achieve water quality goals. The high nutrient reductions achieved by grazers indicate an opportunity for some dairies to transition to a seasonal grazing system, thereby reducing their reliance on intensive double cropping systems for feed.

Currently implemented practices: The above CBL practices that had been implemented are shown in Table 2 as frequency of occurrence by farm type. It should be noted that nutrient management, conservation tillage, and animal waste management were not included in this list since they are considered CBL practices.

This list of practice implementation could be viewed both as a reflection of practices already available and as a “needs” list of practices needing to be emphasized in the future. While about half of the farmers had some stream fencing or buffers, most needed to implement additional fencing, few had 35’ buffers and none had the preferred 50-100’ buffers. Of the farms with buffers, very few had buffers on all of their streams. Usually, it consisted of one CREP project while the rest of the streams were either fenced top of stream bank or not fenced.

Table 2. The frequency of occurrences for best management practices that were assessed, verified, and included in the calculation for the existing farm N and P reduction status for each farm operation type. These practices are considered as being above the CBL.

Above Baseline Practices Credited	Poultry and Beef (n=10)	Dairy and Poultry (n=8)	Dairy (n=12)	Grazers (n=3)	Totals (n=33)
Dry pack barn or covered loafing area	3	4	6	2	15
Stream fencing	6	1	6	2	15
Buffers (grass or forest)	3	2	6	2	13
Land conversions	5	2	1	2	10
CREP	6	1	2	0	9
Mortality composting	5	3	1	0	9
No-till	3	1	4	1	9
Prescribed grazing*	1	0	0	3	4
Cover crops w/o manure	0	3	2	1	5
PSNT	2	1	1	0	4
Export litter	3	1	0	0	4
Confinement area water mgmt.	0	0	1	1	2
Phytase	10	8	0	0	18

Currently the Bay Model does not contain an efficiency estimate for intensive rotational grazing. Farmers doing intensive rotational grazing were told that an efficiency estimate was under development.

About a third of farmers have performed some land conversion. This was usually cropland to pasture or pasture to buffers. We credited nine farms as performing continuous no-till on at least some of their acreage. During the beta test we found that many farmers would no-till for 3-5 years and then need to perform a rip operation to breakup shallow hard pans. Although five farms received reduction credit for cover crops not receiving manure this was generally not for all cover crops on a particular farm. Distance to fields was the primary reason for farmers not putting manure on cover crops, rather than to obtain a cover crop benefit. Lastly, four of 18 farm operations that had poultry, brokered a portion of the litter produced off-farm.

Recommended CIP practices: The recommended CIP practices by farm type are listed in Table 3. Specifics on most of these recommendations are described below. Two recommendations in Table 3, however, do not directly impact nutrient reductions: a better accounting of poultry litter in the existing NMP, and mining down soil P on high P fields. They are detailed below.

We developed a general recommendation on Rental Lands / Purchasing Lands that was included in all 33 CIP documents (see Appendix 1). The Rental Lands / Purchasing Lands recommendation was followed by the following impact statement:

Impact: Will be property dependent. In decision process for new rental lands or purchasing of new lands, consider the existence of *verifiable* conservation practices that will reduce nutrient and sediment losses. Also, check P status of any lands; aim to have soils <120 ppm (240 lbs/A) P.

Table 3. The frequency of occurrence for recommended CIP practices by farm type*

CIP Practices Recommended	Poultry/Beef (n=10)	Dairy/Poultry (n=8)	Dairy (n=12)	Grazers (n=3)	Total (n=33)
-----Manure Related Practices-----					
Discontinue manure on cover crops	4	6	11	1	22
Discontinue manure on alfalfa	0	0	5	0	5
Discontinue manure on pasture	1	0	3	0	4
Dry pack barn / covered loafing area	0	5	0	0	5
Manure mgt – e.g., solids separation	1	1	3	0	5
Broker litter/manure	2	3	0	0	5
Feed management – dairy**	0	1	0	0	1
-----Agronomic Practices-----					
Discontinue starter P fertilizer on corn	0	1	2	0	3
Refine N management on corn	4	3	9	0	16
Continuous no-till	2	2	2	2	8

-----Water Management-----					
Confinement area water management	6	3	3	0	12
Agricultural retention basins	2	2	3	0	7
High traffic area management	5	1	3	2	11
-----System Change Practices-----					
Prescribed or rotational grazing	6	3	0	0	5
Land conversions	4	2	2	0	8
Stream fencing	2	4	3	0	9
Buffers***	1	1	1	0	3
Establish warm season grasses	5	0	1	0	6
-----Non-Nutrient Reduction Practices-----					
Account for litter in NMP	0	1	2	0	3
Mine down high soil P	8	5	6	2	21

*The frequency of practice recommendation increased as we gained experience during the beta test. When the CIP agreements are revisited we will make the recommendations more consistent across all farms. However, this is an adaptive process so we always expect to be adding new practices and enhancing existing practices. For the upcoming pilot test we will implement an expanded “checklist” of practices to enhance consistency among farms.

**Incorporation of low cost distiller’s grains and brewers waste into rations makes getting reductions in P levels in feed a challenge.

*** The number of times buffers were recommended is low due to the low level of acceptance of buffer implementation. WSI recommends buffers along streams wherever possible.

CIP recommendations generally accepted by farmers: Each CIP was developed in collaboration with participating farmers to reflect their future plans, past experiences, and management preferences. There were, however, instances when WSI recommended practices that we knew would be challenging and may have to be implemented slowly or when the economic situation for small farms in the Valley improve. Over the course of the beta test it became apparent that many farms had similar issues that required similar practices to correct. This allowed WSI to develop a compilation of CIP practices that could be applied to different farms and retain consistency in expectations among farmers. Some of the recommended practices are listed below along with observations garnered by WSI.

- *Discontinue the use of starter P fertilizer on fields with high soil test P*
 - There is a perception that a cold spring necessitates starter P application even if a field has extremely high soil test P levels. Although a cold spring may initially inhibit P uptake in corn, many studies have shown that the corn will take up enough P when the soil warms up so as not to affect yield. WSI has found that sharing the results of scientific studies is helpful (<http://www.waterstewardshipinc.org>)

and click on Farmer News) but the farmers were also interested in testing the effectiveness of starter P on their own fields before making a management change. WSI has partnered with the BMP Challenge, a program that protects against net economic losses while farmers attempt to reduce their nutrient application to optimal levels. Trials to test the effectiveness of starter P will begin on 3-5 beta test farms in the 2010 growing season.

- *Covered loafing barn to correct sacrifice area and produce a dry manure product that could be transported off-farm*
 - Many operations in the Valley already have at least one of these structures on the farm. These prevent or lessen the bare soil “loafing areas” adjacent to milking parlors. Loafing barns have a direct nutrient reduction benefit since they displace these “sacrifice” areas that are prone to nutrient and sediment runoff. They also help manage animal waste by serving as a means of collecting much of the dairy manure in a dry state that makes it easier to transport to distant fields or to export off-farm (For this reason, these structures are sometimes referred to as “dry pack” barns). The animal health benefits help to sell this practice because keeping the cows out of the mud decreases bacteria counts in the milk and helps to prevent mastitis.
- *Construct stream fencing with off-stream watering*
 - Although most farmers were amenable to this recommendation, very few agreed to implement a minimum 35ft buffer, preferring top of the stream bank fencing to minimize the loss of productive land. It should also be noted that 35 ft has become the standard buffer width and 50-100 ft buffers, on which assumed nutrient reductions were based, are rarely seen and not generally recommended.
- *Use deep rooted Asian radish with a cereal grain cover crop to break up hardpan and avoid deep tillage every couple of years*
 - Many farmers who identify themselves as “no-till” continue to till every few years to address hardpan issues. Several beta test farms have already been experimenting with a radish cover crop and were pleased with the results. This allows them to practice something that meets the definition of continuous no-till.
- *Reduce soil test P levels on fields with P measuring above 120 ppm¹.*
 - For the 29 farms in Rockingham and northern Augusta counties, 41% of all fields, including pasture, had P-Saturation above 30% (soil test P >120 ppm). At this level, the risk of P loss to water in contact with the soil is greatly increased. WSI recommends that farmers reduce or at least hold these soil test P levels constant at or below 30% P-Saturation to position them for more conservative P-based management expected in the future. A WSI Information Sheet, Managing P Based on Soil P Saturation, was developed and provided to the farmer (<http://www.waterstewardshipinc.org> and click on Farmer News). Participating farmers took this information as an opportunity to devise a long term strategy that will retain available land for manure application.²

BMPs that farmers are resistant to implement:

- *Reduce manure application to cover crops*
 - Virginia cost share does not distinguish between cover crops that receive up to 40 pounds of manure and those that do not, but the Chesapeake Bay Program BMP definition for cover crops only gives nutrient reduction credit for cover crops that do not receive manure (or other nutrient sources). Most

¹ An issue arose on the reporting of P in nutrient management plans in Virginia using the NutMan program. The printout for the soil test results sheet in NutMan says values are in ppm P₂O₅. In reality the numbers reported are in ppm P. Apparently no one has changed the NutMan program to reflect this difference in reporting. Nutrient recommendations in NutMan are still made in amounts of P₂O₅ which adds to the confusion.

² WSI would recommend that future Nutrient Management Plans include the prior soil test results in addition to the new soil test results. This would provide a ready comparison on trends in soil P levels.

farms do not have the storage capacity (particularly for dairies) to hold manure from fall to spring and expanding storage capacity is expensive. The discrepancy between state cost share rules and nutrient reduction credit within the Chesapeake Bay Model is confusing to most farmers and probably causes accounting errors in model estimates of cover crop nutrient reduction efficiency.

- *Account for all nutrient sources within the NMP*
 - Several farmers take advantage of local nutrient sources on an opportunistic fashion; taking advantage of available poultry litter every few years or whenever they get can get some for a good price. For this reason, some NMPs do not reflect every nutrient source and pose a challenge to calculating an accurate estimate of nutrient losses. WSI recommended that farms amend their NMPs to reflect these sources, but some farms seemed reluctant given the unpredictable nature of the practice.
- *Expand use of perennials in longer rotations relative to corn/small grain production*
 - Although farmers readily see the conservation benefits of expanding their acreage of perennial grasses, most were resistant due to the fact that an increase of grass in the forage ration has a negative effect on milk production. With the rising cost of growing corn, however, WSI believes that there is an opportunity to work with farmers to take advantage of the cost savings associated with grass forage if proper assistance can be made available.
- *Transition to seasonal grazing.*
 - WSI tested the interest of farms in seasonal grazing as a strategy to lower costs during the spring and fall and be able to rely more on perennial grasses relative to corn and small grain rotations. One farm that participated in the beta test operates with a seasonal grazing system that allows for growing less corn, but also collects less manure that would otherwise have to be applied to small grains in the fall. This particular farm is one of the highest performing operations in regards to water quality protection. There was some initial interest in the concept, but no one committed to implementation until there was some assistance available to buffer against the risk of learning how to manage a new system. A WSI Information Sheet, [Transition to Grazing](http://www.waterstewardshipinc.org), was developed and provided to the farmer (<http://www.waterstewardshipinc.org> and click on Farmer News).
- *Apply Potash only to alfalfa fields instead of manure*
 - The cost of potash fertilizer is high and considering that dairy manure is a “free” source that needs to be spread on a field anyway, there is little incentive to end this practice. However, this can result in substantial N application to a crop that does not need it and adds P to soils that usually have surplus P thus diminishing the ability of alfalfa to serve as an important crop in a rotation that can help reduce excess soil P.

Lessons Learned

WSI consistently received positive feedback regarding our quantitative approach to estimating farm nutrient loads. The Virginia goals for reducing nutrient losses on farms to restore the Chesapeake Bay were viewed as an abstract political goal that meant little to an individual farmer. The WSI program, however, provided the translation for the farmers to understand how their operations would have to change to meet state level goals. Providing current loads and a target for farms to manage towards brings a relatively abstract discussion to the ground level. Decisions on planting, fertilization, expansion, etc. should be viewed through the lens of water quality protection in addition to the traditional considerations like farm economics and animal health.

Most farmers rely on several “advisors” to develop and refine their management systems. Programs like WSI are a familiar form of consultation that can be integrated with the plans they make with their crop and animal health advisor. WSI fits into this management approach by functioning as a “conservation advisor”. The difference is that

WSI is not selling a product to the farm, so our analysis is delivered as an objective consultation, careful to avoid even a perception of a conflict of interest.

WSI achieved great traction in CIP discussions by quantifying the impact on nutrient losses to ground and surface water with each BMP recommendation. The farmers tended to view conservation practices as relatively equal in importance in regards to water quality. Some of the greatest interest was generated in discussions of the difference among practices in regards to reducing N and P losses.

WSI found it difficult to establish a consistent expectation of progress among farmers for implementing their CIPs. Some recommendations are costly and significant investment in conservation will depend on market improvement for animal products from recession level prices and/or additional supply chain or government incentives or expectations. There is, however, a need to set a minimum expectation for progress on CIPs to avoid stagnation. Therefore, WSI will work in 2010 to establish minimum thresholds that must be achieved for continued participation based on what is economically feasible.

Although not legally binding, WSI found that having a final CIP agreement signed by both the farmer and WSI staff was extremely important. First of all, it gives the farmer a chance to seriously think about the cost and management implications of each recommendation. WSI received invaluable feedback on cost and time considerations that are specific to each operation. In 2010, WSI will attempt to institutionalize farmer input on cost considerations and provide policy makers with reports that should shed light on some of the barriers to BMP adoption. Alternative uses of manure, additional equipment needed, and added fuel costs were just some of the considerations that would be lost if we only considered the required cost share or capital costs.

WSI has heard from local conservation agencies that participating farms have used their CIPs as a framework to communicate their interests in BMP implementation. For example, one requirement of the newly structured Conservation Stewardship Program (CSP) is a commitment to continuous improvement. Several farmers have used their WSI CIP during the CSP application process to demonstrate this commitment. Several farmers obtained NMPs just so they could participate in the WSI program and we have been informed of several cases where farmers have already requested assistance in implementing CIP practices. In addition, some farmers have already implemented practices or made operational changes based on discussions with WSI and/or CIP recommendations.

Throughout the beta test we maintained a close relationship with in-field agency personnel and we have received feedback that our program has some farmers thinking differently, some asking for new things and some asking for assistance for the first time. Similarly, WSI has established a working relationship with the Mennonite community.

Policy Recommendations

- Based on our observations during the beta test and our recommendation to base P applications on P-saturation, we found that surplus P is the major animal production issue in regions of the Bay Watershed. There is a tremendous amount of surplus P on farms in the beta test and in the Shenandoah Valley. The current Phosphorous Site Index approach to NMP allows continued application and build-up of P levels on most fields. State, federal and private investment in alternative uses of manure (particularly for energy) with enough return to the farmer to cover the cost of purchasing N and K that must be replaced is essential to addressing the surplus manure issue. WSI published a manuscript on surplus manure and manure-P in the Chesapeake Bay Watershed. The manuscript and a two-page executive summary can be downloaded at the WSI website (see <http://www.waterstewardshipinc.org>).
- Solids separation and loafing barns produce dryer manures that are better suited for transport off-farm than liquid dairy slurry. Having drier manure may also be advantageous for new technologies like pyrolysis and gasification. Given the increase in dairy manure solids through separation and bed pack, is it possible for a dairy manure transport subsidy similar to the poultry litter program?

- WSI is working with VA DEQ and DCR to clarify the rules regarding the transport of dry manure solids off-farm, particularly on permitted dairies. Several farmers cited concerns that this practice would violate their VPA permits.
- Transport of nutrients off-farm has high inorganic nutrient replacement costs. However, cost share for replacement N and K fertilizers when manure is transported off farm could help achieve balanced nutrient applications, would prevent P build-up and greatly accelerate water quality improvements.
- Cost share and outreach is needed to implement seasonal grazing on dairies. There is a water quality and conservation benefit to the expansion of grazing on dairy farms, but the only assistance available is for operations looking to transition to organic. A transition program is needed to help conventional farms increase their percentage of grazing and hay land to meet water quality protection goals.
- Funding needs to be available through existing programs like Conservation Activity Plans (CAPs) or other new programs to pay the cost of independent third party assessment and continuous improvement program development until it becomes an accepted part of production cost or a supply chain expectation. This is a key missing element in the conservation delivery system that was welcomed and supported by public sector conservation agency personnel.
- Based on observations and discussions with farmers, WSI recommends that appropriate agencies consider the following cost share practices that could provide significant additional reduction opportunities:
 - ✓ Potash for alfalfa to replace manure
 - ✓ Replace N and potash in corn and small grain silage production if transport of manure/litter off-farm is instituted
 - ✓ Dewatering of dairy solids
 - ✓ Inter-seeding small grains in alfalfa receiving manure
- There is considerable opportunity and farmer interest in implementing numerous practices which do not have CBP approved efficiencies, or are outside the current definition for the practice. WSI recommends development or refinement of efficiency estimates for these practices and review of how state/NRCS practice cost share requirements are consistent with CBP BMP definitions. This is particularly needed for the following practices:
 - ✓ Continuous no-till
 - ✓ Rotational grazing
 - ✓ Agricultural retention basins
 - ✓ Cover crop receiving up to 40 lbs N
 - ✓ Inter-seeding small grain in alfalfa receiving manure
 - ✓ Liquid manure injection
 - ✓ Stream fencing at 10-15' from top of bank

Virginia's Five Priority Practice "Baseline" for Trading

Virginia has identified five priority practices that farmers must have implemented to be eligible to generate nutrient trading credits that can be marketed through the Commonwealth's trading program. These practices (identified below) were expected to achieve about two thirds of the average reduction from agricultural operations in Virginia's Tributary Strategies (60% of the 55% average agricultural load). Agency, environmental and others expressed interest in performance of beta test farmers relative to the five priority practices. While the beta test was not designed to specifically evaluate the priority practices, a discussion of our observations regarding knowledge about, and implementation of, the priority practices follows.

Virginia's 5 Priority Practices – Beta Test Observations

The five practices are to be implemented according to the Virginia Agricultural BMP Manual for 2010(see <http://webdat.dcr.virginia.gov/agbmpman/toc.pdf>).

Observations:

General – Most of the 33 farmers were not aware of the 5 Virginia priority practices. If they were aware they did not know what the expectations were for implementation.

Practice Specific:

(1) Cover crops – most of the beta test farmers who incorporate cover crops in their farm operation follow the cover crop cost share guidance on limiting manure-N applications to <40 lbs. However, there is no existing nutrient reduction efficiency in the Chesapeake Bay Model for cover crops that receive manure-N. WSI realizes this practice is often necessary to empty manure storage before winter, but WSI does not assign a reduction credit when implemented as described. *WSI would encourage the assessment of whether applying 40 pounds of applied N should have a N reduction efficiency and if so, a new, lower, efficiency for cover crops that receive <40 lbs of fall applied N should be developed.* .

(2) Nutrient management – all of the beta test farmers had nutrient management plans (NMP). However, there were instances of unaccounted poultry litter utilization and P application to O-P fields. Animal numbers are at times confusing especially if the NMP is written for a future higher animal number or percent confinement is not included. In general, NMPs are written to fit existing conditions. There is a need to move towards NMPs that assist the farmer in mining down soil P levels, longer rotations with perennial grasses, and increase continuous no-till.

(3) Stream exclusion of livestock – a majority of farms have implemented some stream fencing for exclusion of livestock, however, this has been mostly just to the top of the stream bank. While this is to be commended, it appears the fenced areas along streams are assumed to be 35 feet wide by the Bay Program. Efforts should be made to get fencing at least 10-15 feet from top of bank and Bay program accounting should be addressed accordingly.

(4) Riparian buffers (grass or forest) – Riparian buffers are supposed to be a minimum 35 feet wide but the recommended width is 75-100 feet for the reduction efficiencies assumed. Thus, 35 feet has become the norm for buffer width and wider buffers are rarely recommended. If all buffers are the minimum width, the efficiency should be adjusted to reflect that. While it is understood that farmers are reluctant to take 75-100 feet along streams out of production, it must be recognized that efficiencies were based on something approaching this and buffers of at least 50 feet should be promoted if current efficiencies are maintained.

(5) Conservation tillage – This priority practice requires that farmers have implemented conservation tillage on all row crop land. This means that the land must have a minimum of 30% vegetative cover at all times (this can include the canopy of a growing crop). Farmers need to better understand what level of tillage and harvest practices maintain adequate residue. In many cases, soil was disked enough to reduce residue levels below 30% prior to planting or inadequate residue was left following silage harvest to meet the minimum residue requirement.

Appendix 1 Nutrient Load Calculations and Continuous Improvement Plan Developed for a Representative Farmer

Project: Dairy Operation Example
Scenario: CBL
Action: Scenario Summary

Post BMP Landuse	Acres
Post BMP Landuse	72
Alfalfa w/ Nutrient Mngmt	6
Hay w/ Nutrient Mngmt	231.4
Row Crops w/ Nutrient Mngmt- Low Till	99.6
Pasture	2.4
Degraded Stream Corridor	

Animals	Number	Time Confined
Animal	150	0.75
Dairy Cows		

Landuse Change and Efficiency BMPs				
BMP	Landuse	Amount Submitted	Amount Credited	Unit
Conservation Tillage	Row Crops	231.4	231.4	acres
Nutrient Management	Row Crops- Low Till	231.4	231.4	acres
Nutrient Management	Hay	6	6	acres
Nutrient Management	Alfalfa	72	72	acres

AFO BMPs		Animal	Amount	Unit
BMP				

No records to display.

Application Reduction BMPs

Landuse	Acres Submitted	Acres Credited	N lbs/acres Reduction	P lbs/acres Reduction
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No records to display.

Pre BMP Loads

Landuse	N Load EOS (lbs)	N Load Delivered (lbs)	P Load EOS (lbs)	P Load Delivered (lbs)	Sediment Load EOS (tons)	Sediment Load Delivered (tons)
Animal Confinement Area	4182.1	270.1	83.9	39	0	0
Alfalfa	916.6	59.2	224.9	104.7	34.8	22.3
Row Crops	20722.8	1338.4	598.8	278.7	434.7	279
Hay	177.7	11.5	6	2.8	3	1.9
Pasture	1741.5	112.5	230.8	107.4	63.4	40.7
Degraded Stream Corridor	275	17.8	43	20	17.7	11.4
TOTAL	28015.7	1809.4	1187.2	552.6	553.7	355.3

CBL Loads

Landuse	N Load EOS (lbs)	N Load Delivered (lbs)	P Load EOS (lbs)	P Load Delivered (lbs)	Sediment Load EOS (tons)	Sediment Load Delivered (tons)
Animal Confinement Area	4182.1	270.1	83.9	39	0	0

Alfalfa w/ Nutrient Mngmt	914.9	59.1	224.9	104.7	34.7	22.3
Hay w/ Nutrient Mngmt	66.2	4.3	6	2.8	3	1.9
Row Crops w/ Nutrient Mngmt-Low Till	20048.4	1294.8	454.6	211.6	277.7	178.2
Pasture	1741.5	112.5	230.8	107.4	63.4	40.7
Degraded Stream Corridor	275	17.8	43	20	17.7	11.4
TOTAL	27228.2	1758.5	1043.1	485.5	396.6	254.5

Load Reduction from Pre-BMP Load

N Load EOS (lbs)	N Load Delivered (lbs)	P Load EOS (lbs)	P Load Delivered (lbs)	Sediment Load EOS (tons)	Sediment Load Delivered (tons)
787.5	50.9	144.1	67.1	157.1	100.8

Load Reduction Percentages from Pre-BMP Load

N Load EOS (%)	N Load Delivered (%)	P Load EOS (%)	P Load Delivered (%)	Sediment Load EOS (%)	Sediment Load Delivered (%)
2.8	2.8	12.1	12.1	28.4	28.4

Project: Dairy Operation Example
 Scenario: Existing
 Action: Scenario Summary

Post BMP Landuse	Acres
Post BMP Landuse	
Forest	9.4
Alfalfa w/ Nutrient Mngmt	72
Hay w/ Nutrient Mngmt	6
Row Crops w/ Nutrient Mngmt- Low Till	222
Pasture	99.6
Degraded Stream Corridor	2.4

Animals

Animal	Number	Time Confined
Dairy Cows	150	0.75

Landuse Change and Efficiency BMPs

BMP	Landuse	Amount Submitted	Amount Credited	Unit
Conservation Tillage	Row Crops	231.4	231.4	acres
Nutrient Management	Row Crops- Low Till	231.4	231.4	acres
Nutrient Management	Hay	6	6	acres
Nutrient Management	Alfalfa	72	72	acres
Forest Buffers	Row Crops w/ Nutrient Mgmt- Low Till	9.4	9.4	acres
Enhanced Nutrient Management- 1 Component	Row Crops w/ Nutrient Mngmt- Low Till	222	222	acres

Prescribed Grazing	Pasture	99.6	99.6	acres
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AFO BMPs

BMP	Animal	Amount	Unit
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No records to display.

Application Reduction BMPs

Landuse	Acres Submitted	Acres Credited	N lbs/acres Reduction	P lbs/acres Reduction
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No records to display.

Pre BMP Loads

Landuse	N Load EOS (lbs)	N Load Delivered (lbs)	P Load EOS (lbs)	P Load Delivered (lbs)	Sediment Load EOS (tons)	Sediment Load Delivered (tons)
Animal Confinement Area	4182.1	270.1	83.9	39	0	0
Alfalfa	916.6	59.2	224.9	104.7	34.8	22.3
Row Crops	20722.8	1338.4	598.8	278.7	434.7	279
Hay	177.7	11.5	6	2.8	3	1.9
Pasture	1741.5	112.5	230.8	107.4	63.4	40.7
Degraded Stream Corridor	275	17.8	43	20	17.7	11.4
TOTAL	28015.7	1809.4	1187.2	552.6	553.7	355.3

Existing Loads

Landuse	N Load EOS (lbs)	N Load Delivered (lbs)	P Load EOS (lbs)	P Load Delivered (lbs)	Sediment Load EOS (tons)	Sediment Load Delivered (tons)
Animal Confinement Area	4182.1	270.1	83.9	39	0	0
Forest	43.4	2.8	1.4	0.7	0.3	0.2
Alfalfa w/ Nutrient Mngmt	914.9	59.1	224.9	104.7	34.7	22.3
Hay w/ Nutrient Mngmt	66.2	4.3	6	2.8	3	1.9
Row Crops w/ Nutrient Mngmt-Low Till	17491.4	1129.7	425.1	197.8	257.4	165.2
Pasture	1393.2	90	184.6	85.9	38.1	24.4
Degraded Stream Corridor	275	17.8	43	20	17.7	11.4
TOTAL	24366.3	1573.7	968.8	450.9	351.2	225.4

Load Reduction from Pre-BMP Load

N Load EOS (lbs)	N Load Delivered (lbs)	P Load EOS (lbs)	P Load Delivered (lbs)	Sediment Load EOS (tons)	Sediment Load Delivered (tons)
3649.4	235.7	218.4	101.6	202.5	130

Load Reduction Percentages from Pre-BMP Load

N Load EOS (%)	N Load Delivered (%)	P Load EOS (%)	P Load Delivered (%)	Sediment Load EOS (%)	Sediment Load Delivered (%)
13	13	18.4	18.4	36.6	36.6

Continuous Improvement Plan Developed for Sample Dairy Operation

The load reductions listed in this document are estimates of the annual edge of stream load reduction that would occur when a practice was implemented on your farm compared to when only the Conservation Baseline (CBL) practices were implemented. When these practices are incorporated into the farm load calculations, the resulting reductions may vary slightly as a result of the other practices that are being implemented on the farm.

No BMP farm load: N 28,016 lbs P 1,187 lbs

Current farm load: N 24,366 lbs P 969 lbs

(13% N reduction & 18% P reduction achieved from original)

Includes CBL practices (nutrient management, conservation tillage, waste management system), 5 acre CREP forest buffer, 4.4 acre riparian forest buffer, PSNT, Prescribed grazing

VA Tributary Strategy load needed to achieve a 55% load reduction:

N 12,607 lbs P 534 lbs

Practice #1 of this Plan is a Conservation Baseline Adjustment that needs to be agreed upon and implemented within one year.

#1 Practice to be implemented: Account for poultry litter imports in NMP and identify application rates and timing

Impact: Meets requirements of Nutrient Management Plan to get credit for the conservation baseline reduced nutrient load

Implementation date: Include in December/January reports to WSI – January 2010

Notes: _____

Practices #2-4 of this Plan are recommended to help move the farm operation towards nutrient reduction goals and/or to further assist in reducing soil P levels. Each activity needs to be agreed upon and implemented within a defined time period.

#2 Practice to be implemented: Fence out cows from stream in pastures and establish a buffer of 35' where possible

Impact: If 7,000 feet of stream fencing is installed with an average width of 35 feet between the fence and the stream, it will result in a reduction of approximately 391.9 lbs N and 57.7 lbs P. If 7,000 feet of stream fencing is installed with an average width of 15 feet between the fence and the stream, it will result in a reduction of approximately 260.9 lbs N and 42.8 lbs P.

Implementation date: Fall 2011

Notes: _____

#3 Practice to be implemented: Complete transition to continuous no-till if strip trials with radish can address hard pan issues

Impact: If continuous no till is implemented, it will result in a per acre reduction of approximately 13.0 lbs N and 0.8 lbs P.

Implementation date: Fall 2010

Notes: _____

#4 Practice to be Implemented: Discontinue fall application of manure to cover crops that are not harvested for silage in the spring. Use a strip trial in year one to see whether adequate establishment is achieved to protect against erosion.

Impact: Cover crops with manure do NOT receive N or P load reductions. If manure use is discontinued there would be an approximate per acre reduction of 25.1 lbs N for a drilled barley cover crop with an early planting date and 19.1 lbs N for a drilled barley cover crop with a standard planting date.

Implementation date: 2010

Notes: _____

#5 Practice to be implemented: Reduce soil P levels on high P fields

- 1. Discontinue manure application on these fields**
- 2. Go to longer rotations with perennial grass hay and grow corn no more than 2 years in 5 and preferably 2 in 6 on these fields.**
- 3. Switch to high P removal crops like switchgrass or alfalfa.**

Impact: This will accelerate the reduction in P levels and get the fields back to a level where they can receive manure, supplemented with inorganic fertilizer if needed, at rates that will not elevate P levels again.

If corn acreage is converted to alfalfa acreage, it will result in an approximate per acre reduction of x lbs N and x lbs P.

#6 Practice to be implemented: Rental Lands / Purchasing Lands

Impact: Will be property dependent. In decision process for new rental lands or purchasing of new lands, consider the existence of *verifiable* conservation practices that will reduce nutrient and sediment losses. Also, check P status of any lands; aim to have soils <120 ppm (240 lbs/A) P.

Implementation date: Ongoing

Notes: _____

For further information contact:

- Dale Gardner with Water Stewardship 540-246-2839
- Local NRCS Office for technical assistance 540-433
- Local VA DCR Office for technical assistance 540-433-2853

I agree to work toward the following practices # ____, # ____, # ____, # ____ and # ____ as presented in this Plan and will partner with Water Stewardship, Inc. to implement the Plan.

(Farmer) (Date)

(WSI Staff Member) (Date)

Water Stewardship Inc. Board of Directors

Richard Pritzlaff, President, Biophilia Foundation (Board Secretary)

Kevin Sellner, Executive Director, Chesapeake Research Consortium (Board Treasurer)

Andrew Sharpley, Distinguished Professor, University of Arkansas

Jim Toomey, Cartoonist and Marine Conservationist, Creator of Sherman's Lagoon Comic Strip

Tom Simpson, President and Executive Director, Water Stewardship, Inc (Board Chairman)

Beta Test funding support provided by:



Biophilia Foundation
Advancing Biodiversity Conservation on Private Land



222 Severn Avenue
Suite 11, Bldg 7
Annapolis, MD 21403

Web Site: <http://www.waterstewardshipinc.org>

The Water Stewardship Team

Tom Simpson

President and Executive Director

301-873-2268

toms@waterstewardshipinc.org

Ron Korcak

Program Coordinator & Co-Principal-Agriculture

410-353-7767

ronk@waterstewardshipinc.org

Daniel Kaiser

Director of Industry Programs

202-236-9828

dank@waterstewardshipinc.org

Sally Bradley

Technical and Policy Analyst

410-353-0329

sallyb@waterstewardshipinc.org

Dale Gardner (Harrisonburg Office)

Chesapeake Agricultural Program Coordinator

540-246-2839

daleg@waterstewardshipinc.org