



Beck Creek Watershed Assessment Report



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List of Abbreviations

AFO	Animal Feeding Operation
ACA	Animal Concentration Area
AHUA	Animal Heavy Use Area
BMP	Best Management Practices
CAO	Concentrated Animal Operation
CAFO	Concentrated Animal Feeding Operation
CWA	Clean Water Act
E&S	Erosion and Sediment Control
EPA	United States Environmental Protection Agency, Region III
LA	Load Allocation
LCCD	Lebanon County Conservation District
MMP	Manure Management Plan
NMP	Nutrient Management Plan
NPDES	National Pollutant Discharge Elimination System
PADEP	Pennsylvania Department of Environmental Protection
QAPP	Quality Assurance Project Plan
SAP	Sampling and Analysis Plan
TMDL	Total Maximum Daily Load
VAO	Voluntary Agricultural Operation
WIP	Watershed Implementation Plan
WLA	Waste Load Allocation

I. Executive Summary

In 2016, the United States Environmental Protection Agency, Region III (EPA) assessed 13 farms in Pennsylvania's Beck Creek watershed in an effort to review how effective Pennsylvania's agricultural programs are in protecting local waterways from runoff from animal feeding operations (AFOs). This watershed-based AFO assessment reviewed: 1) on the ground effectiveness of, and compliance with state or federal requirements for reducing nitrogen, phosphorus, and sediment; and, 2) the implementation of various agricultural conservation practices commonly referred to as best management practices (BMPs) relevant to improving water quality at the farm level.

Beck Creek is in Lebanon County, Pennsylvania and is in the Susquehanna River Basin which drains to the Chesapeake Bay. Beck Creek is a headwater tributary of Quittapahilla Creek. Pennsylvania identified the entire Quittapahilla Creek watershed as impaired by sediment and phosphorus based on chemical sampling and biological surveys of the aquatic life. The Pennsylvania Department of Environmental Protection (PADEP) identified agriculture as one of the primary sources of excessive sediment in the basin, and the source of nutrient loads in Beck Creek. PADEP developed a Total Maximum Daily Load (TMDL) for sediment that applies to the entire Quittapahilla Creek basin and individual phosphorus TMDLs for its named tributaries including one for Beck Creek. Based on a reference-watershed approach, the Quittapahilla TMDL set an annual loading of sediment of 8.8 million pounds for the entire basin and called for a 73 percent reduction. The Beck Creek TMDL set a maximum phosphorus annual loading of 3,067 pounds and called for a 58 percent reduction to achieve that loading. EPA approved the Quittapahilla Creek watershed TMDL for nutrients, siltation and sediment and the Beck Creek watershed TMDL for phosphorus on April 9, 2001. The Chesapeake Bay TMDL also calls for nutrient and sediment reductions from sources in Pennsylvania's portion of the Chesapeake Bay watershed, which includes Beck Creek.

In this assessment, EPA pursued a watershed-based approach in a water impaired by nutrients and sediment in order to assess the impact of multiple AFOs on that water, and to what extent the many Pennsylvania programs intersect to drive and support BMP implementation on those farms. In October and November 2015, EPA visited and assessed 13 farms, which included dairy, cattle, and swine operations. This approach allowed EPA to evaluate how the state regulatory programs, policies, and compliance resources translate to implementation of on-the-ground practices to protect both local and regional water quality. Water quality improvements are not solely the result of state actions and/or requirements, but improvements also rely on the day-to-day decisions of individual farmers to ultimately implement these practices, with or without technical and financial assistance.

For the agriculture sector, protection of local waterways depends on local farmers implementing suitable BMPs, whether required or voluntary. Pennsylvania has four regulatory programs that are applicable to farms: the National Pollutant Discharge Elimination System (NPDES) Concentrated Animal Feeding Operation (CAFO) permit program, the Pennsylvania Nutrient Management (NM) Program, the Manure Management Program, and the Agriculture Erosion and Sediment Control (Ag E&S) Program. For the NM program and the Ag E&S program, PADEP has delegated authority to conduct farm inspections to the Lebanon County

Conservation District (LCCD). However, PADEP is responsible for enforcing the Ag E&S program and State Conservation Commission (SCC) is responsible for enforcing the NM program in Lebanon County. Pennsylvania also has various programs to provide technical and financial assistance to farmers to enhance environmental stewardship, such as the Growing Greener Program and Pennsylvania Resources Enhancement and Protection Program (REAP). In addition, farmers can participate in federal conservation programs funded and administered by the United States Department of Agriculture and EPA, such as the Clean Water Act (CWA) Section 319 Grant Program. These programs, along with others, are vital to the success of protecting and restoring local waterways and ultimately the Chesapeake Bay.

All farms in Pennsylvania that land apply manure are required to have a written Manure Management Plan (MMP). Pennsylvania's Act 38 Nutrient Management Program requires the implementation of a Nutrient Management Plan (NMP) for farms with greater than two animal equivalent units per acre available for manure application. In addition, all farms that plow or till more than 5,000 square feet of land or have animal heavy use areas are required to have an Agriculture Erosion and Sediment Control Plan (Ag E&S Plan) or a comparable U.S. Department of Agriculture Natural Resource Conservation Service (NRCS) Conservation Plan meeting the requirements of 25 Pa. Code § 102.4(a).

This report aggregates the findings at the 13 assessed farms and does not identify any of the farms by name. Specific observations made during the assessment include the following:

- At the time of the inspections, there were no active pollution events and no observed discharges from any of the farms.

CAFO/CAOs – Generally meeting requirements and improvements can be made

- The CAFO regulated under the federal NPDES program had permit coverage and had developed an NMP with a certified nutrient management specialist. However, the NMP did not account for all the manure nutrients or inorganic fertilizer used on the operation (i.e., one manure pit, manure from one animal group located on the CAFO, and all inorganic fertilizer). In addition, the CAFO's recordkeeping needs improvement. The CAFO had developed NRCS conservation plans.
- The two CAOs regulated under PA's Act 38 Nutrient Management Program had developed and were implementing current NMPs developed by certified nutrient management specialists.
- One CAO had developed an NRCS conservation plan and the other was not required to since it did not till cropland.
- PADEP and LCCD had inspected the CAFO and CAOs in the past two years.
- The Beck Creek phosphorus TMDL set a zero WLA (for point sources) and a LA of 3,067 pounds/year (covering all nonpoint sources) in the Beck Creek watershed in 2001 (as apparently there were no CAFOs or other point sources at that time); in 2013, upon application by one of the AFOs increasing the numbers of animals in its operation, PADEP issued an NPDES permit for a large CAFO point source.

AFOs (that are not CAFOs/CAOs) – Not All AFOs Met Regulatory Requirements

- Six of the ten non-CAFO/non-CAO farms had developed MMPs or an NMP, but only two of those were implementing current MMPs including maintaining crop yield records and manure application records documenting manure is land applied at appropriate times of the year for crop nutrient uptake.
- Of the two farms implementing current MMPs, one was written by a certified nutrient management specialist and this farm was implementing precision agriculture using global positioning system and telemetry guidance for planting, spraying, and manure spreading on all owned and rented cropland.
- Two of the ten non-CAFOs/non-CAO farms had developed an E&S Plan, three had developed NRCS conservation plans, and five had no plans.
- Of the eight farms that had not developed and/or implemented a current MMP or E&S Plan, PADEP had visited zero and LCCD had visited four of the farms.

BMPs – Many operations are implementing priority practices and there's room for growth

- Stream fencing and buffers were being implemented to some extent on 88 percent of the farms with an average buffer width of 25 feet.
- 75 percent of the farms had more than six months manure storage; 50 percent of these farms were applying manure on cropland during the winter¹.
- Field practices such as cover crops and conservation tillage were implemented to some extent at 83 percent and 92 percent of the farms, respectively.
- On the 10 farms implementing cover crops, 70 percent were applying manure on the cover crop.

Ambient Water Quality Monitoring

- Ambient watershed sampling results showed Total Nitrogen levels ranging from 3.3 – 10.5 mg/L. Concentrations increased by 6.9 mg/L from the upstream to downstream sampling locations in Beck Creek.
- Ambient watershed sampling results showed Total Phosphorus levels ranging from 0.19 to 0.23 mg/L and Total Suspended Solids ranging from 5.0 to 9.0 mg/L. Total Phosphorus and Total Suspended Solids concentrations decreased slightly from the upstream to downstream sampling locations in Beck Creek.
- E. Coli and Fecal Coliform also decreased slightly from the upstream to downstream sampling locations in Beck Creek.

II. Background

This watershed assessment is part of the U.S. Environmental Protection Agency's (EPA's) broader activities working with states to strengthen their animal agriculture programs to improve local water quality and advance the restoration and protection efforts of the Chesapeake Bay watershed. EPA has oversight authority of the National Pollutant Discharge Elimination System (NPDES) Program, which regulates concentrated animal feeding operations (CAFOs). EPA also has oversight of the Chesapeake Bay TMDL, which addresses tidal Bay impairments caused by

¹ In Pennsylvania, winter is defined as meeting any one of the following: a. the date includes or is between December 15 to February 28, or b. the ground is frozen more than 4 inches, or c. the ground is snow covered.

excess nitrogen, phosphorus and sediment. The TMDL is supported by state Watershed Implementation Plans (WIPs) that set forth the pollution control measures needed to fully restore the Chesapeake Bay and its tidal rivers for various sectors including agriculture.

Pennsylvania's Phase I and Phase II WIPs promote implementation of both regulatory and voluntary programs that implement a broad suite of agricultural conservation practices to reduce nutrient and sediment loads from agricultural cropland and animal production operations. Key practices include animal waste storage facilities, stream buffers, stream fencing, cover crops, nutrient management, land retirement, and conservation tillage.

According to the Chesapeake Bay Program Partnership Watershed Model 2015 Progress scenario, agricultural lands account for 22 percent of the Bay watershed, making agriculture one of the largest land uses in the area, and second only to forested and open wooded areas (64 percent). The 64,000 square mile Chesapeake Bay watershed has more than 87,000 farm operations and 6.8 million acres of cropland. Agriculture is the largest single source of nitrogen, phosphorus, and sediment loading to the Bay through applying fertilizers, tilling croplands, and applying animal manure. Out of the total amount or loading of pollutants delivered to the Bay, agricultural activities are responsible for approximately 45 percent of nitrogen loads, about 55 percent of phosphorus loads, and 60 percent of sediment loads. (Chesapeake Bay Program Watershed Model 2015 Progress scenario).

Of the agricultural nutrient and sediment loadings to the Bay from all Bay jurisdictions, Pennsylvania's agricultural sector accounts for an estimated 58 percent of the total nitrogen, 30 percent of the total phosphorus, and 33 percent of the total sediment delivered to the Bay (Chesapeake Bay Program Watershed Model 2015 Progress scenario). Among all the jurisdictions' agricultural sectors, Pennsylvania's agricultural sector ranks first in nitrogen loadings and second in phosphorus and sediment loadings to the Bay. Agriculture is the largest sector in Pennsylvania of nitrogen, phosphorus and sediment loading to the Bay.

EPA has authority to oversee and evaluate state NPDES permit programs to ensure compliance with the CWA, including whether CAFO regulations are implemented appropriately in the state. CAFOs are a subset of animal feeding operations (AFOs). Both AFOs and CAFOs fall within the agricultural sector. EPA's oversight may include assessments of animal agriculture operations to see whether those facilities meet the federal regulatory thresholds to qualify as CAFOs. In addition, EPA has authority to determine if AFOs should be designated as CAFOs due to their impact on receiving waters. These AFO reviews are part of EPA's ongoing regulatory oversight activities to ensure compliance with the CWA and to assess the effectiveness of state programs in addressing agricultural impacts upon receiving waters. The scope of this assessment focused on animal agriculture and did not evaluate the contribution of non-animal agricultural activities (e.g., row crops, orchards, etc.).

This subwatershed assessment is being conducted as part of EPA's oversight responsibilities under the Chesapeake Bay TMDL to ensure Pennsylvania's progress towards achieving its agriculture WIP commitments to reduce nitrogen, phosphorus, and sediment consistent with the Chesapeake Bay TMDL allocations. Consistent with those regulatory oversight activities, in a May 29, 2013 modification to the EPA and Chesapeake Bay Foundation Settlement Agreement, EPA agreed to undertake AFO reviews in four subwatersheds throughout the Chesapeake Bay

basin over four years, starting in 2013. The Beck Creek watershed is the third of the four subwatershed assessments conducted under the settlement agreement.

a. Purpose of the AFO Watershed Assessments

The purpose of this AFO watershed assessment is to assess compliance of farms with applicable state and federal requirements for reducing nitrogen, phosphorus, and sediment runoff to surface waters; document the implementation of agricultural conservation practices by farmers; assess the effectiveness of state programs in addressing water quality impacts; and evaluate how well the Pennsylvania Department of Environmental Protection (PADEP), the State Conservation Commission (SCC), and the Lebanon County Conservation District (LCCD) are ensuring compliance at these farms through their respective roles and authorities. The farm visits provided EPA with insight into what types of programs Pennsylvania is implementing and the farm community's understanding of the regulatory requirements.

PADEP's mission is "to protect Pennsylvania's air, land and water from pollution and to provide for the health and safety of its citizens through a cleaner environment." PADEP is delegated the authority to administer the federal NPDES CAFO program, and also administers its own state programs to regulate agricultural animal production operations under the Pennsylvania Clean Streams Law. Pennsylvania's agriculture programs include, but are not limited to, the Agriculture Erosion and Sediment Control (Ag E&S) program, the Manure Management Program, the Nutrient Management Program, and the Pennsylvania National Pollutant Discharge Elimination System (NPDES) CAFO permit program. The effective implementation of these programs is the main focus of this assessment.

CCDs are essential to the oversight of Pennsylvania's agriculture-related regulatory programs and implementation of agricultural conservation practices by farmers. Specifically, delegated CCDs review nutrient management plans (NMPs) for compliance with Act 38, assist PADEP's implementation of the Manure Management Program, and conduct annual on-farm status reviews of all concentrated animal operations (CAOs) with approved NMPs. CCDs conduct status review of voluntary agricultural operations (VAOs) once every three years. The CCDs also investigate complaints and instances of nutrient management non-compliance under a delegation agreement with the SCC.

PADEP is responsible for administration of the E&S program under 25 Pa. Code § 102. It requires the implementation and maintenance of E&S BMPs to minimize the potential for accelerated erosion and sedimentation. Written E&S Plans are required for agricultural plowing or tilling activities and animal heavy use areas that disturb more than 5,000 square feet (approximately 1/10 an acre). When an agricultural operation does not have an E&S Plan available for review at the time of the on-site inspection, PADEP is the agency responsible for E&S compliance and enforcement activities in Lebanon County.

PADEP is responsible for the administration of the Manure Management Program under 25 Pa. Code §91.36(b). PADEP oversees the implementation of the Manure Management Program by providing technical, administrative, and programmatic guidance to farm operators, program participants, CCD staff and boards, and other interested parties. The Manure Management Program requires every farm in Pennsylvania that land applies manure or agricultural process

wastewater, regardless of size, to develop and implement a written Manure Management Plan (MMP). PADEP is the agency responsible for manure management program compliance and enforcement activities. LCCD, through their NM and Manure Management delegation agreement assumes a role in education, outreach, and complaint investigations.

The SCC is responsible for the administration of the Nutrient Management Program under Act 38 (SCC, 2006), which sets forth minimum thresholds for animal agriculture operations required to develop and implement an NMP. A CAO is defined as an operation with a high animal density compared to acres available for manure application and must have at least 8,000 pounds (lbs.) of animals on the farm. High density farms are those that have more than 2,000 lbs. of live animal weight per acre of land where manure can be applied. Land includes owned and rented land where manure is or will be applied: cropland, hayland, or pasture. The density calculation includes all livestock, whether they are for production or recreation. VAOs are operations that voluntarily submit an NMP, but are not required to do so by law.

Under the Act 38 program, an NMP includes: the amount of manure generated on the operation; manure nutrient content according to manure test results; field specific nitrogen-and phosphorus-based manure application rates; mechanical manure application setbacks including 100 foot setback from streams, lakes, ponds, and sinkholes; or 35 foot permanent vegetated buffer; and 100 feet from active water wells; manure handling procedures including properly constructed and maintained manure storage areas; barnyard and paddock management to minimize contaminated runoff to streams; 120-day limit on uncovered in-field manure stacking; and documentation pertaining to exported manure, if the operation exports more than five tons poultry litter or 25 tons non-poultry litter per year.

Through Delegation Agreements with the SCC, delegated CCDs are responsible for conducting an annual NMP inspection (also referred to as an annual site status review) at each CAO to evaluate compliance with Act 38 nutrient management requirements. The SCC handles all Act 38 enforcement and initiates enforcement actions on all referrals received from CCDs. LCCD has been delegated the authority to conduct annual NMP inspections, provide education, and seek voluntary compliance.

In Pennsylvania, a CAFO is defined as a CAO with greater than 300 animal equivalent units (AEUs)², any agricultural operation with greater than 1,000 AEUs, or any agricultural operation defined as a large CAFO under 40 CFR 122.23(b)(4). Regulations at 25 Pa. Code § 92a require CAFOs to obtain an NPDES permit from PADEP and comply with the NPDES permit requirements. Under an NPDES CAFO permit, an AFO is required among other things to implement an NMP that addresses appropriate application of nutrients to crops while minimizing nitrogen and phosphorus loss to ground and surface waters, as well as submit an Annual Report to PADEP by February 15th of each year. The NMPs that are required for CAOs and CAFOs must be developed Under Act 38, and all NMPs must be prepared by a PDA-certified nutrient management specialist using the current version of SCC's standardized plan format. PADEP is responsible for permit compliance-related activities at CAFOs in Lebanon County. The LCCD conducts NMP implementation reviews at CAFOs.

² 1 animal equivalent unit (AEU) = 1,000 lbs. of live weight of livestock or poultry animals, on an annualized basis

As Pennsylvania's designated lead for point and nonpoint source pollution, PADEP acquires and disburses various federal, state and nonprofit grant funds. Nonpoint source grant programs include EPA Clean Water Act (CWA) Section 319 grants, EPA CWA Section 117 Chesapeake Bay Implementation Grant (CBIG) program, EPA CWA Section 117 Chesapeake Bay Regulatory and Accountability Program (CBRAP), and Pennsylvania's Growing Greener program.

Other programs available to Pennsylvania farmers that provide financial assistance for BMP implementation include, but not limited to:

- The Pennsylvania Resources Enhancement and Protection Program (REAP), which has provided nearly \$20 million in state tax credits to farmers that have agreed to implement certain conservation best management practices (BMPs) and/or implement no-till systems through the purchase of no-till equipment.
- The Pennsylvania Infrastructure Investment Authority PennVest funding, which has offered \$46 million for agriculture-related non-point source projects since July 2010. Of the \$46 million, \$22.8 million went to two large manure technology projects.

In addition, there are several federal programs administered through USDA to help provide financial assistance for BMP implementation such as: Environmental Quality Incentives Program (EQIP); Regional Conservation Partnership Program (RCPP); Conservation Reserve Program (CRP); Conservation Reserve Enhancement Program (CREP); and, Conservation Stewardship Program (CSP).

b. Watershed and AFO Selection Process

In the Chesapeake Bay watershed, there are several geographic areas that have large numbers of livestock operations. EPA decided to focus primarily on dairies and cattle for the four AFO reviews. Dairy and cattle operations were selected since most dairy and cattle operations in the Chesapeake Bay watershed are not subject to permitting under the federal NPDES CAFO program due to size and design. The geographic areas with the largest numbers of dairy cattle are southern New York, south-central Pennsylvania, western Maryland, and the Shenandoah Valley.

In 2015, EPA chose to conduct an AFO watershed review in south-central Pennsylvania where there is a significant concentration of dairy cows (see Figure 1) and farms produce more manure nutrients (primarily nitrogen and phosphorus) than can be applied to the land without accumulating nutrients in the soil.³ South-central Pennsylvania has an imbalance in the assimilative capacity and the quantity of manure nutrients produced on farms.

EPA identified all 12-digit HUC watersheds in Pennsylvania within the Chesapeake Bay watershed. Starting with this list of 791 watersheds, EPA identified those watersheds that had at least four AFOs in watersheds whose surface waters were identified as impaired on Pennsylvania's 303(d) list, were a headwater stream, and located entirely in Pennsylvania. After using these criteria to narrow down the number of watersheds, EPA assessed stream flow,

³ Kellogg, Lander, Moffitt, and Gollehon
<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.387.9742&rep=rep1&type=pdf>

drainage patterns, presence of livestock at farms, presence of BMPs such as stream fencing, and distance from farms to streams in 12 of the watersheds.

The Beck Creek watershed was chosen for this review because it is an impaired water body for nutrients and sediment due to agricultural sources, and it has a significant number of potential AFOs (and therefore significant manure generation) located close to surface waters with the potential for having a water quality-related impact. The potential AFOs in the watershed are mostly dairies, although there are also poultry, swine, and beef cattle operations as well. EPA's goal was to visit and assess all individual, non-poultry AFOs in the Beck Creek watershed. Poultry AFOs were not included in this assessment due to biosecurity issues related to an outbreak of avian influenza across the United States. EPA visited and assessed 13 individual potential AFOs throughout the Beck Creek watershed.

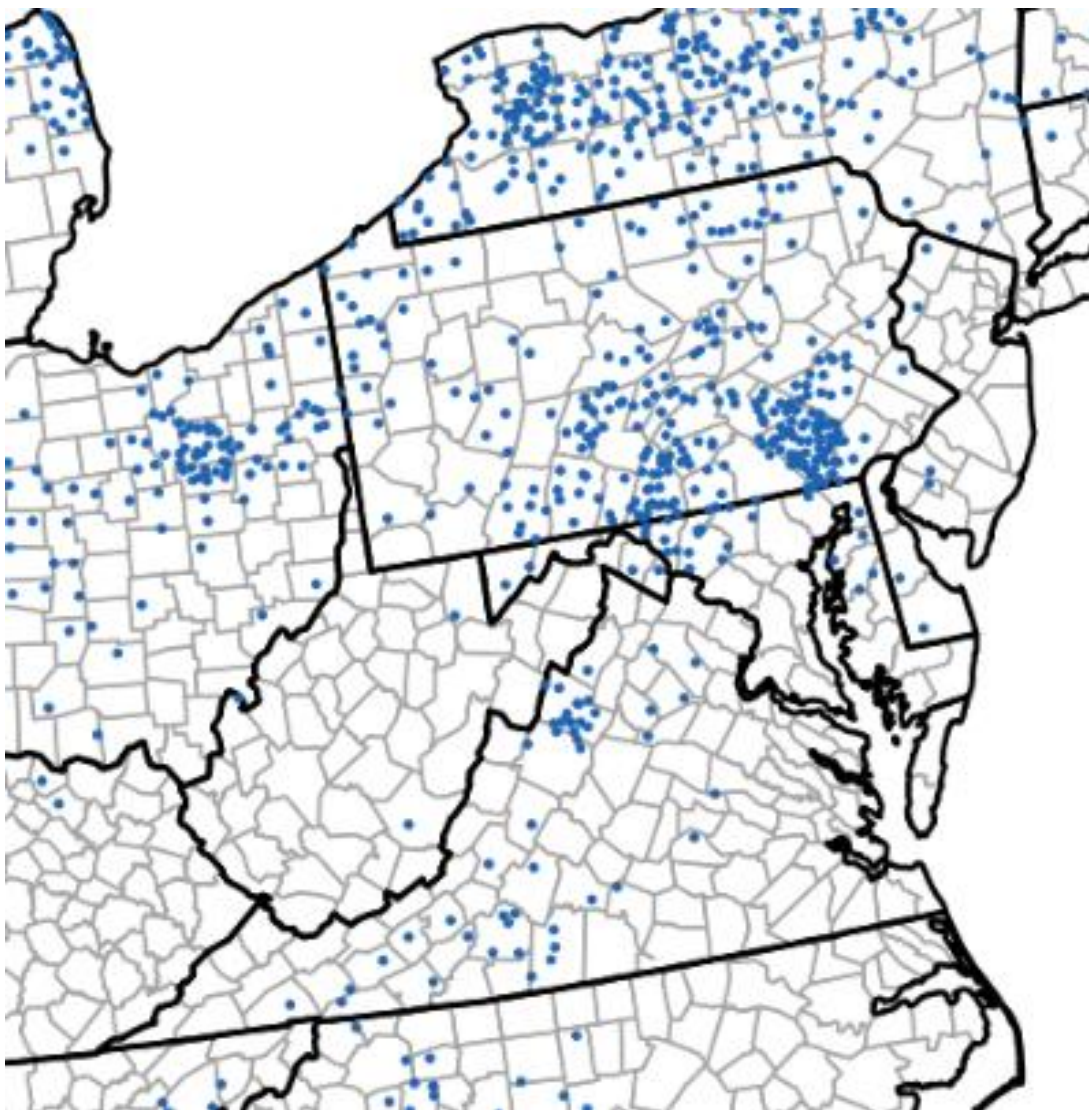


Figure 1: Milk cow inventories, 2012 (1 dot = 2,000 cows). Source: USDA 2012 Ag Census

III. Beck Creek Watershed

The Beck Creek watershed is part of the Snitz Creek-Quittapahilla Creek watershed (Hydrologic Unit Code [HUC]-12: 020503050802). The Beck Creek watershed is located entirely in Pennsylvania, south of Lebanon, Pennsylvania in Lebanon County, Pennsylvania near its border with Lancaster County, Pennsylvania. Beck Creek is approximately 7.14 miles long, with the Beck Creek watershed covering approximately 5,200 acres. Beck Creek is a headwater tributary of Quittapahilla Creek and generally flows from south to north, starting southwest of Lebanon in North Cornwall Township, Pennsylvania through the Royal Oaks Golf Club and Lebanon Country Club to where it enters Quittapahilla Creek. Quittapahilla Creek is a tributary of Swatara Creek, a tributary of the Susquehanna River (HUC-6: 02050305). The Susquehanna River empties into the northern end of the Chesapeake Bay at Havre de Grace, Maryland, providing half of the Bay's freshwater inflow. Land use in the Beck Creek watershed is dominated by agriculture with approximately 67% of land in the watershed in cropland, hayland and pasture. Approximately 16% of land area is urban/suburban (e.g., residential, mixed and turfgrass), and 17% of the watershed remains forested.⁴

Beck Creek was identified as impaired and not meeting water quality standards set by Pennsylvania. The protected uses of the Beck Creek watershed are water supply, recreation and aquatic life. The aquatic use for Beck Creek is trout stocking fishes. Beck Creek was listed as impaired on Pennsylvania's 1996 303(d) list due to violations of Pennsylvania's water quality standards for nutrients, specifically Phosphorus. Although both nutrients (phosphorus and nitrogen) are listed as the causes of impairment and are subsequently modeled, only a TMDL for phosphorus was established to help restore the designated uses of the Quittapahilla Creek basin. This is due to PADEP's finding that phosphorus is the limiting nutrient in all waters of the Quittapahilla Creek basin. Phosphorus is often the major nutrient in shortest supply and is frequently a prime determinant of the total biomass. Beck Creek was included in the sediment TMDL for the Quittapahilla Creek. EPA approved the Quittapahilla Creek watershed TMDL for nutrients, siltation and sediment and the Beck Creek watershed TMDL for phosphorus on April 9, 2001. The Quittapahilla Watershed Association developed a draft TMDL implementation plan for the Quittapahilla Creek entitled "Watershed Implementation Plan Quittapahilla Watershed" dated May 2013. However, to date, the plan has not been approved by PADEP.

IV. Collaboration with State and Local Partners

Both PADEP and LCCD provided valuable support for EPA's watershed assessment. PADEP reviewed this report for accuracy, to evaluate how Pennsylvania's state requirements applied to a particular farm, and to ensure compliance with applicable regulations. LCCD provided EPA with information to assist with contacting farmers to set up the farm visits.

V. Water Quality Sampling

Tetra Tech, Inc. (Tetra Tech), contractor to the EPA, collected environmental samples as part of this effort to assess the impact of small animal feeding operations (AFOs) on the water quality of a Chesapeake Bay subwatershed in the Beck Creek watershed. EPA selected six ambient

⁴ Land use data is from PADEP's ArcView Generalized Watershed Loading Functions model

sampling locations in the Beck Creek watershed. Ambient sampling occurred on October 9, 2015. Ambient sampling locations were selected to provide samples from publicly-accessible locations that would support characterization of the overall water quality within the watershed. Tetra Tech collected grab samples of surface water and sediment from each of the six ambient sampling locations shown in Figure 2. Table 1 lists the location and sampling time for each of the ambient sites.

a. Sample Locations

Ambient sampling locations were selected by EPA Region 3, and locations were selected to provide samples that were representative of background conditions within the watershed. Some ambient sampling locations are located at or near an AFO involved in this assessment. Samples were collected at all ambient locations on the same day to ensure comparability of environmental and weather conditions among the ambient samples. The sampling team photographed each ambient sampling location. Photographs were taken to document the sample location, and to document indicators of bed, bank, and ordinary high water mark (OHWM) at each location.



Figure 2: Beck Creek Watershed Ambient Water Quality Sampling Locations

Table 1. Ambient Sampling Locations in the Beck Creek Watershed

Ambient Site ^a	Latitude ^b	Longitude ^b	Location Name	Date and Time
1	40.323674	-76.483352	Bricker Lane	10/9/2015, 10:30 AM
2	40.319668	-76.477739	Reist Road	10/9/2015, 11:30 AM
3	40.313707	-76.471314	Oak Street	10/9/2015, 12:02 PM
4	40.308898	-76.46631	Royal Road	10/9/2015, 12:32 PM
5	40.298712	-76.459469	Colebrook Road	10/9/2015, 01:00 PM
6	40.277847	-76.457466	Starner Road	10/9/2015, 01:30 PM

a. Sites listed in downstream to upstream order

b. Latitude and longitude coordinates based on North American Datum from 1983 (NAD83)

b. Sampling Results

Sampling results show an increase in Total Nitrogen of 6.9 mg/L from upstream (Starner Road) to downstream sampling (Bricker Lane) locations in Beck Creek. Total Phosphorus and Total Suspended Solids concentrations decreased slightly from upstream to downstream sampling locations. E. Coli and Fecal Coliform also decreased slightly from upstream to downstream sampling locations. Table 2 provides results for Total Nitrogen, Total Phosphorus, Total Suspended Solids, E. Coli, and Fecal Coliform for the ambient sampling locations. It should be noted that although the Beck Creek watershed's land use is predominantly in agriculture (67%), there are other potential sources, such as on-lot septic systems, that may be contributing pollutants.

Table 2. Ambient Sampling Results in the Beck Creek Watershed

Location Name	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Total Suspended Solids (mg/L)	E. Coli (#/100 mL)	Fecal Coliform (#/100 mL)
Bricker Lane	10.2	0.19	5.0	225	240
Reist Road	10.5	0.19	5.0	126	65
Oak Street	1.9	0.22	5.0	308	370
Royal Road	6.2	0.21	8.0	308	NA ^a
Colebrook Road	7	0.23	9.0	NA ^a	720
Starner Road	3.3	0.20	5.0	461	310

a - (not measured, lab error)

VI. Observations Related to Agriculture-related Regulatory Programs

For this AFO assessment, EPA collected information on 13 farms through farm visits and public documents pertaining to the impairments and TMDL for Beck Creek. Between October 8, 2015 and November 20, 2015, EPA visited and assessed 13 farms in the Beck Creek watershed. The farm visits were scheduled with the owners in advance. A check list was utilized to ensure that similar information was collected at each of the farms. This information was used to evaluate the effectiveness of, and compliance with state or federal requirements for reducing nitrogen, phosphorus, and sediment as well as the implementation of best management practices (BMPs) relevant to improving water quality at the farm level. A sample AFO farm visit checklist is included in **Appendix A**.

Of the 13 farms, there were 12 AFOs, including one large permitted CAFO within the Beck Creek watershed. One of the 13 farms raised animals on pasture, did not confine the animals for more than 45 days a year, and did not meet the definition of an AFO. The 13 farms included seven dairy operations, four cattle operations (steers and heifers), and two swine operations. Beck Creek flowed through the property of eight of the 13 farms. The following sections describe the applicability of Pennsylvania's various agriculture-related regulatory programs to those 13 farms.

a. Pennsylvania's NPDES CAFO Permit Program

Requirements: In Pennsylvania, a CAFO is defined as a CAO with greater than 300 animal equivalent units (AEUs)⁵, any agricultural operation with greater than 1,000 AEUs, or any agricultural operation defined as a large CAFO under 40 CFR 122.23(b)(4). An operation that meets the federal definition of a CAFO, as well as AFOs with more than 1,000 AEUs or a CAO with 301-1,000 AEUs, must obtain and comply with a CAFO NPDES permit. Pennsylvania's CAFO definition is broader in scope than the federal definition as it includes CAOs with as few as 300 AEUs. A Pennsylvania CAFO permit requires the implementation of an Act 38 NMP. Facilities covered by CAFO permits in Pennsylvania must meet the state baseline requirements for nutrient management, manure storage⁶, and erosion and sediment control as well as all federal NPDES CAFO regulatory requirements. CAFOs covered under a NPDES permit are required to be inspected once every five years.

Observations: At the time of EPA's farm visit, there was one dairy operation that had greater than 700 mature dairy cows or 1,000 AEUs⁷, and it applied for and received coverage under Pennsylvania's NPDES CAFO general permit (PAG12) in April 2013. PADEP inspected the CAFO on August 14, 2014 and LCCD visited on July 27, 2015. The CAFO had developed and was implementing a current NMP as required by the NPDES permit. However, the NMP did not account for all the manure nutrients or inorganic fertilizer being utilized on the farm (i.e., one manure pit, manure from one animal group located on the CAFO, and all inorganic fertilizer). The CAFO had a 35 foot wide grass buffer on cropland along the entire length of Beck Creek and animals did not have access to Beck Creek. The CAFO had more than six months of liquid manure storage; and, even though the NMP allowed winter manure spreading, the farm had not spread manure during the winter. In regards to recordkeeping, the CAFO was tracking manure application and weekly inspections are documenting leak detection systems. However, the CAFO was not documenting weekly housekeeping inspections of all manure storages, daily inspections of water lines, periodic inspections of land application equipment for leaks, or weather conditions at the time of application and for 24 hours prior to and following application.

⁵ 1 animal equivalent unit (AEU) = 1,000 lbs. of live weight of livestock or poultry animals, on an annualized basis

⁶ 25 Pa. Code Chapter 91.36(a) requires that a manure storage facility shall be designed, constructed, operated and maintained in accordance with current engineering and agronomic practices to ensure that the facility is structurally sound, water-tight, and located and sized properly, to prevent pollution of surface water and groundwater, including design to prevent discharges to surface waters during a storm up to and including a 25-year/24-hour storm.

⁷ AEUs were calculated using the Pennsylvania Agricultural Ombudsman Program Website at <http://www.paagombudsman.com/aeu-calculator/>

The other six dairy farms assessed had fewer than 200 mature dairy cows, which included one CAO with less than 301 AEUs that does not meet the size threshold for coverage under the NPDES CAFO permit program. The number of mature dairy cows at each farm ranged from 61 to 130 head, with an average of around 84 mature dairy cows. Average total herd size at each of the six dairy operations was around 150 head.

At the time of EPA's farm visits, each of the three heifer farms had fewer than 300 cattle⁸, were not CAOs, and did not require coverage under the NPDES CAFO permit program. The number of cattle (other than mature dairy cows) including heifers at the farms ranged from 10 to 66 head, with an average of around 41 head. One of these three heifer farms kept the animals on pasture, did not confine the animals for more than 45 days, and does not meet the definition of an AFO.

At the time of EPA's farm visits, the one beef cattle operation had fewer than 300 cattle, was not a CAO, and did not require coverage under the NPDES CAFO permit program. The total herd size at the beef cattle AFO was 36 head.

At the time of EPA's farm visits, the two swine operations were both owned/operated by the same company; however, the farms did not adjoin. One of the swine operations was a CAO, but had fewer than 301 AEUs (200 replacement gilts) and therefore did not require coverage under the NPDES CAFO permit program. The other swine operation had greater than 300 AEUs (750 breeding sows), was not a CAO and therefore did not require coverage under Pennsylvania's NPDES CAFO permit program. Although the swine operation with 750 breeding sows meets the federal size threshold for a medium AFO, at the time of the inspection, EPA observed no discharges into waters of the United States through a man-made ditch, flushing system, or other similar man-made device. Therefore, the operation did not require coverage under the federal NPDES CAFO permit program.

b. Pennsylvania's Nutrient Management Program

Requirements: The Commonwealth's 25 Pa. Code Chapter 83 regulations set forth the requirements for its Nutrient Management Program. In Pennsylvania, a concentrated animal operation (CAO) is defined as a livestock or poultry farming operation that has more than eight total animal equivalent units (AEUs) and exceeds 2,000 pounds of live animal weight per acre suitable for manure application. CAOs are required to implement an NMP written by a certified nutrient management specialist and approved by a CCD pursuant to Act 38. An operation not otherwise subject to Act 38 may volunteer to participate under Act 38 as a voluntary agricultural operation (VAO) and submit an NMP, but are not required to do so by law.

Observations: At the time of EPA's farm visits, two farms exceeded 2,000 pounds of live animal weight per acre suitable for manure application and were defined as CAOs. One was a dairy farm and one was a swine farm. The swine CAO had developed and was implementing a current NMP. The dairy CAO had developed and was implementing a current NMP. Beck Creek did not flow across either of the CAOs. Both CAOs had six months' worth of storage capacity for liquid manure, allowing for manure to be land applied at appropriate times of the year for crop nutrient uptake. The dairy CAO had installed roof gutters on many of the barns to

⁸ Based on the federal definition of a medium CAFO

divert clean water, as well as curbing to direct runoff from barnyards to the manure storage. LCCD had visited both CAOs in the 2014 calendar year.

c. Pennsylvania's Manure Management Program

Requirements: Pennsylvania's 25 Pa. Code Chapter 91.36(b) regarding the land application of animal manure and agricultural process wastewater for non-CAFOs/non-CAOs states that the land application of animal manures and agricultural process wastewater requires a permit or approval from the Department unless the operator can demonstrate that the land application follows current standards for development and implementation of a plan to manage nutrients for water quality protection, including soil and manure testing and calculation of proper levels and methods of nitrogen and phosphorus application. The Manure Management Manual contains current standards for development and implementation of a plan to manage nutrients for water quality protection which can be used to comply with these requirements. A written manure management plan (MMP) includes requirements for how manure and agricultural process wastewater may be applied by various types of equipment and/or directly by animals on pastures and in animal concentration areas (ACAs). The MMP can be written by the farmer or a certified nutrient management specialist. If the MMP is written by a certified nutrient management specialist it is defined as Tier 1 Nutrient Management by the Chesapeake Bay Program and can receive nutrient reduction credit under the current version of the CBP Watershed Model.⁹ If the animal operation has an NMP written by a certified nutrient management specialist to meet Nutrient Management Act 38 standards and approved by a CCD (e.g., a voluntary agricultural operation, or a Natural Resource Conservation Service (NRCS) comprehensive nutrient management plan (CNMP)), such a plan would satisfy the Commonwealth's requirements for an MMP for that operation and meet the definition of Tier 2 Nutrient Management and can receive nutrient reduction credit under the current version of the CBP Watershed Model. There is currently no legal requirement for an MMP to be reviewed or approved by a regulatory authority. MMPs must be available on the farming operation at all times for review upon request.

Observations: Of the 13 farms assessed, ten applied manure or agricultural process wastewater to cropland, were not otherwise regulated as CAFOs or CAOs, and were required to have MMPs. At the time of EPA's farm visits, five of the ten farms had developed MMPs and one farm had developed an NMP. Of those five farms that developed MMPs, two farms were implementing current MMPs, including maintaining crop yield records and manure application records ensuring manure is land applied at appropriate times of the year for crop nutrient uptake; two farms were not maintaining manure application records; and, one farm's records were inconsistent with the application rates in the MMP. The farm that had developed an NMP to satisfy the MMP requirement, was not current and did not include crop years 2015 or 2016. Of the six farms that had developed MMPs, PADEP had visited none and LCCD had visited four. Three of the six farms reported spreading manure on cropland during the winter. One farm in particular reported it had less than four months of liquid manure storage and spread manure on cover crops during the winter due to lack of storage.

Of the two farms implementing current MMPs, one MMP was developed by a certified nutrient management specialist, and this farm was implementing precision agriculture using global

⁹ See the CBP's Nutrient Management Expert Panel's report at www.chesapeake.net/documents/Nutrient_Management_Interim_Phase_5_3_2_Final.pdf

positioning system and telemetry guidance for planting, spraying, and manure spreading on all owned and rented cropland.

Four of the ten farms did not have MMPs. Three of those four farm reported spreading manure on cropland during winter. Additionally, of those four, PADEP had visited none and LCCD had visited one.

d. Pennsylvania's Agricultural Erosion and Sediment Control Program

Requirements: All Pennsylvania farmers plowing or tilling are required to control erosion from their fields and animal heavy use areas with either an implemented conservation plan or an erosion and sedimentation control (E&S) plan meeting regulations at 25 Pa. Code Chapter 102. The implementation and maintenance of erosion and sediment control BMPs are required to minimize the potential for accelerated erosion and sedimentation, including for those activities which disturb less than 5,000 square feet. Amendments to 25 Pa. Code Chapter 102 were published as final rulemaking in the August 21, 2010 PA Bulletin. The revised regulation went into effect on November 19, 2010. Written E&S Plans are required for the following activities that disturb 5,000 square feet (464.5 square meters) or more of land: agricultural plowing or tilling activities and animal heavy use areas (AHUAs). Based upon PADEP regulations and guidelines, the farmer may use an NRCS Soil Conservation Plan to satisfy this requirement if certain areas such as soil loss and animal heavy use areas are addressed. In addition the E&S Plan must, at a minimum:

- limit soil loss from accelerated erosion to the soil loss tolerance (T) over the planned crop rotation
- implement additional BMPs to minimize accelerated erosion and sedimentation for agricultural plowing and tilling activities that will occur on fields with less than 25% plant cover or crop residue cover and within 100 feet of a river, or perennial or intermittent stream
- identify BMPs to minimize accelerated erosion and sedimentation for animal heavy use areas
- be consistent with the current conditions and activities on the agricultural operation
- contain an implementation schedule

Observations: Of the 13 farms assessed, 12 plow and/or till more than 5,000 sq. ft. of land and are required to have E&S or Soil Conservation Plans. At the time of EPA's farm visits, seven of the 12 farms had developed plans: two had E&S Plans and five had Soil Conservation Plans. This assessment did not evaluate whether the E&S or Soil Conservation Plans limited soil loss from accelerated erosion to the soil loss tolerance (T) over the planned crop rotation, implemented additional BMPs to minimize accelerated erosion and sedimentation for agricultural plowing and tilling activities that will occur on fields with less than 25% plant cover or crop residue cover and within 100 feet of a river, or perennial or intermittent stream, identified BMPs to minimize accelerated erosion and sedimentation for animal heavy use areas, were consistent with the current conditions and activities on the agricultural operation or contained and followed an implementation schedule.

Of the five farms that did not have E&S Plans, PADEP had visited zero and LCCD had visited one. At the time of EPA's farm visits, the 12 farms plowed and/or tilled cropland ranging from 35 to 452 acres. The average acres plowed and/or tilled were approximately 146 acres.

VII. Observations Related to Beck Creek TMDL and Chesapeake Bay TMDL BMPs

a. Background

Beck Creek was listed as impaired in 1996 for nutrients due to agriculture for 7.14 miles. In 2001, EPA approved a sediment TMDL approved for the Quittapahilla Creek basin, and a Phosphorus TMDL specifically for Beck Creek. Based on the TMDL, Phosphorus would need to be reduced by approximately 57 percent for Beck Creek. From 2001 to 2006 the Quittapahilla Watershed Association (QWA) begun implementing some BMPs in the Beck Creek watershed, working specifically to address agricultural activities. These BMPs included nutrient management, stream fencing, riparian buffers, and cover crops among others. The Quittapahilla Watershed Association developed a draft TMDL watershed implementation plan (WIP) for the Quittapahilla Creek entitled "Watershed Implementation Plan Quittapahilla Watershed"¹⁰ dated May 2013. EPA provided comments, but the WIP was not revised and has not been approved. The Watershed Implementation Plan notes that the following conservation practices applicable to agriculture have been implemented by QWA:

- Stream Fencing
- Riparian Buffers
- Nutrient Management
- Crop Rotation
- No-till
- Cover Crops
- Residue Management

For the purposes of this assessment, EPA focused on a collection of BMPs required under Pennsylvania's various agriculture-related regulatory programs as well as agricultural practices in the Pennsylvania Watershed Implementation Plan (WIP) for the Chesapeake Bay TMDL that, when implemented, would achieve a significant portion of PA's nutrient and sediment reduction goals for animal agriculture. These include: 1) Soil Conservation Plans; 2) Nutrient Management; 3) Manure Management; 4) Livestock and Poultry Waste Management Systems; 5) Barnyard Runoff Control; 6) Stream Access Control with Fencing; 7) Forest and Grass Buffers; 8) Cover Crops; 9) Conservation Tillage; and, 10) Conservation Easements.

b. Observations

The Beck Creek phosphorus TMDL set a zero WLA (for point sources) and a LA of 3,067 pounds/year (covering all nonpoint sources) in the Beck Creek watershed in 2001. In 2013, upon application by one of the AFOs increasing the numbers of animals in its operation, PADEP issued an NPDES permit for a large CAFO point source. Upon review of the NPDES permit

¹⁰ <http://quittapahillwatershedassociation.org/documents/2013-May-WIP-Draft.pdf>

application for coverage under the General Permit for CAFOs and related documentation, there was no specific discussion of the TMDLs or the analysis of how the TMDLs addressed any additional loading from the newly permitted source.

In regards to the Chesapeake Bay TMDL BMPs, seven farms assessed had developed Soil Conservation Plans, five farms had developed and were implementing Nutrient Management, and four farms had written their own MMPs. In addition, twelve farms were implementing Livestock and Poultry Waste Management Systems, six farms were implementing Barnyard Runoff Control, seven farms were implementing stream fencing and buffers within Beck Creek watershed with an average width of 25 feet, and 10 farms were implementing field practices such as cover crops and conservation tillage. 70 percent of the farms implementing cover crops were applying manure on the cover crop.¹¹ Table 3 identifies the BMPs observed across all the assessed farms and where BMP implementation could be improved or increased to achieve water quality goals.

Table 3: Implementation of BMPs¹² at the 13 Assessed Farms

Best Management Practice (BMP)	# of farms with BMP	Potential to increase BMP implementation at farms
Soil Conservation Plans	7 farms	Five farms had developed NRCS soil conservation plans and two farms had developed Ag E&S Plans, but EPA did not assess whether the plans were being fully implemented. Five additional farms had not developed required Ag E&S Plans and must do so. One additional farm is not required to develop an Ag E&S Plan because it does not till cropland associated with the farm.
Nutrient Management	5 farms	Of the five farms, one CAFO, two CAOs, and one AFO had developed Tier 2 Nutrient Management and one AFO was implementing Tier 1 Nutrient Management. However, the CAFO's NMP did not account for all manure and fertilizer nutrients and will need to be revised. The AFO's NMP did not reflect the current state of the operation and needs to be updated.
Manure Management	4 farms	The four farms that had developed their own MMPs need to improve recording keeping and ensure plans are current and if developed by a certified nutrient management specialist may count as Tier 1 Nutrient Management. Four additional farms had not developed required MMPs and must develop them to meet PA requirements. These MMPs could also meet Tier 1 nutrient management if developed by a certified nutrient management specialist.

¹¹ Currently, the CBP Watershed Model (Phase 5.3.2) does not provide a nutrient reduction credit for traditional cover crops receiving additional nutrients in the fall or spring or for commodity cover crops receiving additional nutrients before March 1st.

¹² BMP definitions can be found under Source Data at: <http://www.casttool.org/Documentation.aspx>

Livestock and Poultry Waste Management Systems	12 farms	Nine of 12 farms had at least six months of liquid manure storage, two farms had four months, and one farm had two months manure storage. Two farms with less than six months of manure storage spread manure in winter and could increase liquid manure storage capacity.
Barnyard Runoff Control	6 farms	Four additional farms had barnyards where the farmer could install gutters and downspouts on the buildings or divert clean water away from manure, litter, feed, and bedding exposed to precipitation.
Stream Access Control with Fencing	7 farms	Beck Creek flows through eight of the 13 farm properties. Of those eight, the CAFO confined animals in barns and did not allow confined animals access to Beck Creek. Of the remaining seven farms, one was implementing stream fencing at less than 100% and could increase implementation level. One additional farm did not have any stream fencing and could increase implementation in the future.
Forest and Grass Buffers	7 farms	Beck Creek flows through eight of the 13 farm properties. Of the eight farms, one farm did not have any vegetative buffers along the creek and could increase implementation in the future.
Cover Crops	10 farms	Three of the 10 farms that implement cover crops do not apply manure to the cover crops, while seven do apply manure to cover crops. At least seven of the 10 farms were implementing cover crops on less than 100% of non-hayfields and could increase implementation levels. Two additional farms were not using any cover crops and could do so in the future.
Conservation Tillage	10 farms	Five of the 10 farms were implementing conservation tillage on less than 100% of non-hayfields and could increase implementation levels. Two additional farms were not implementing conservation tillage and could do so in the future.
Conservation Easements	6 farms	Six of the 13 farms have permanently preserved all or portions of their farms for agricultural production through the Pennsylvania Department of Agriculture's Pennsylvania Agricultural Conservation Easement Purchase Program. One of the six farms did not have an Ag E&S Plan and another did not have an MMP.

VIII. Conclusions

In January 2016, Pennsylvania released its “Strategy to Enhance Pennsylvania’s Chesapeake Bay Restoration Effort” (“Reboot Strategy”), which describes Pennsylvania’s intent to ramp up efforts in compliance, data tracking and reporting, and target funding for Best Management Practices (BMP) implementation in an effort to meet its 2025 Chesapeake Bay TMDL goals.

Pennsylvania is relying on farms achieving compliance with current regulations to implement BMPs to achieve reduction in nitrogen, phosphorus and sediment. Yet, while Pennsylvania has had these agriculture-related requirements in place for almost four decades, assuring farms achieve and maintain compliance with all the requirements remains a challenge. Furthermore, Pennsylvania is required to provide reasonable assurance that all the BMPs being implemented across the farm are in accordance with regulations, technical guidance such as NRCS’ conservation practices standards, Pennsylvania’s Technical Guide and the Penn State Agronomy Guide.

All Pennsylvania farmers plowing or tilling are required to control erosion from their fields and animal heavy use areas with either an implemented conservation plan or an erosion and sedimentation control (E&S) plan meeting Chapter 102 regulations. The implementation and maintenance of erosion and sediment control BMPs are required to minimize the potential for accelerated erosion and sedimentation, including for those activities which disturb less than 5,000 square feet. Written E&S Plans are required for activities that disturb 5,000 square feet (464.5 square meters) or more of land, including agricultural plowing or tilling activities and animal heavy use areas.

Two farms had developed E&S Plans and five had developed NRCS conservation plans. E&S Plans or NRCS plans are critical because of the need for Pennsylvania to address the impacts of erosion and sedimentation from farm fields and animal heavy use areas, which is the second leading cause of impairment of streams in this Commonwealth. Agricultural animal heavy use areas are a significant source of this sediment and can negatively affect downstream uses. The agricultural E&S Plan is the most appropriate mechanism to address the control of accelerated erosion from these areas. The BMPs identified in the E&S Plan to address the resource concerns on a specific farm are the same BMPs needed to achieve local and Chesapeake Bay TMDL reduction goals.

Since 1977, all farmers that produce, store or apply manure are regulated under the Clean Streams Law. PADEP’s Manure Management Manual identifies the preferred practices to comply with Pa. Code § 91.36. Pennsylvania’s Manure Management Program applies to ten farms of which six had developed written MMPs. However, only two of these six farms were implementing current MMPs including maintaining crop yield records and manure application records ensuring manure is land applied at appropriate times of the year for crop nutrient uptake. Of those two, one MMP was developed by a certified nutrient management specialist and would meet the definition of a Tier 1 Nutrient Management to meet the Chesapeake Bay TMDL reduction goals. In addition, this one farm was implementing precision agriculture using global positioning system and telemetry guidance for planting, spraying, and manure spreading on all owned and rented cropland.

The CAFO and CAO programs require farms to implement an approved NMP written by a certified nutrient management specialist. CAFOs are required to meet additional provisions in an NPDES permit. One of the thirteen farms assessed was a CAFO and had an NPDES permit. Two of the farms were regulated under Pennsylvania's Act 38 Nutrient Management program as CAOs. Both CAOs had developed and were implementing current NMPs. However, the swine CAO did not till cropland. The CAFO's recordkeeping needs improvement. Recordkeeping and documentation are essential to assuring permit compliance and the implementation of NMPs.

With regard to Pennsylvania's oversight of the assessed farms, of the five farms that had not developed E&S plans, PADEP had visited none of the farms and LCCD had visited two of the farms. Of the four farms that had not developed MMPs, PADEP had visited none of the farms and LCCD had visited one of the farms. Six of the thirteen farms were in the Lebanon County Agricultural Preservation Program. Five of those six farms had been visited by LCCD to determine compliance with the agricultural conservation easements. The one farm that had not been visited did not develop an MMP. One of the five farms visited by LCCD did not develop an E&S Plan. There is a need and opportunity for all of the various Pennsylvania agencies and stakeholders with a role or interest in ensuring farms meet agriculture-related regulatory requirements and TMDL-related BMP verification activities to coordinate efforts and maximize resources more effectively.

With regard to BMP implementation at the 13 farms, this assessment did not verify if the practices the farmer stated were being implemented were in accordance with regulations and standards. This assessment was based on interviews with the farmers and observations of whether a practice was present. For field conservation practices, cover crops and conservation tillage were implemented at 83 percent and 92 percent of the farms, respectively. However, seven of the ten farms implementing cover crops or 70 percent were applying manure on the cover crops.

Of the eight farms that Beck Creek flows through, stream access control was implemented at various levels on seven of the eight farms or 88 percent. Buffers, either on cropland or pasture were implemented on both sides of Beck Creek on seven of the eight or 88 percent of the farms that Beck Creek flowed across. The average width of the buffer was 25 feet. According to the Quittapahilla Creek Watershed Association (QWA) website, a 1999 Pennsylvania Watershed Restoration and Assistance Program (WRAP) grant installed fencing and planted riparian buffers along the stream banks of seven farms in the Beck Creek watershed. The QWA installed 10,115 feet of stream bank fencing, and established a riparian buffer by planting trees & shrubs along the stream banks of the seven farms that were fenced. This was atop the cattle crossings, riparian buffers, and 25,451 feet of stream bank fencing installed the previous year, in 1998, under the WRAP. The WRAP proceeded Pennsylvania's Growing Greener program.

In contrast, although 75 percent of the farms had more than six months manure storage, half of these farms reported they had applied manure during the winter on frozen and/or snow covered ground. While winter spreading of manure is not prohibited by Pennsylvania's regulations, this is not a preferred approach due to the potential for increased nutrient losses to surface waters. EPA maintains that the application of manure on frozen or snow covered fields does not constitute the agronomic application of nutrients. For example, EPA NPDES regulations require

that manure is applied only at agronomic rates, which does not occur on frozen or snow covered ground. Of the 12 farms visited, 10 had raw materials, products, or byproducts including manure, litter, feed, milk, eggs or bedding exposed to precipitation. Roof gutters and downspouts were installed on the buildings around concrete barnyards at six of the ten farms to direct clean water away from manure.

The development and implementation of written E&S Plans, MMPs, and NMPs assist a farmer in selecting BMPs to implement, which ultimately helps maintain and restore local water quality. Moving forward, compliance assurance programs for Pennsylvania's agriculture-related regulatory programs need to focus on the farm's development of the required management plans, which include a grouping of conservation practices and management activities that, when implemented as part of a whole farm conservation system, will ensure the implementation of BMPs based on technical standards to achieve the pollutant reduction and water quality goals at the local and regional level as identified in the respective TMDLs.

Appendix A

Sample AFO Farm Visit Checklist

This checklist was used to collect information such as the owner/operator, animal inventory, farm management documentation, management of sources of nutrients and an inventory of BMPs.

PENNSYLVANIA AFO ON-SITE ASSESSMENT FORM

Form to be completed by EPA personnel

Date: _____ Time In: _____ (AM PM) Time Out: _____ (AM PM)

Weather: _____

Were Biosecurity Measures Implemented in Addition to EPA Protocols? *Yes No*

Additional Measures Taken: _____

Photos Taken: *Yes (see Photo Log) No*

Samples Taken: *Yes (see Lab Results) No*

EPA Inspector(s): _____

Contractor(s): _____

PADEP Staff: _____

SCC/PDA Staff: _____

CD Staff: _____

Other Participants: _____

Person(s) Interviewed: _____

Farm Name (if any): _____

Farm Address _____

GPS coordinates (entrance) Latitude: _____ Longitude: _____

Owner/Operator Information

Owner(s) Name: _____

Operator(s): _____

Phone: _____ *home work cell fax na*

Phone: _____ *home work cell fax na*

Email Address: _____

Owner Address: _____

Operator Address: _____

Mailing Address: _____

Farm History

Yes No Has the farm been visited by PADEP? Date: _____

Yes No Has the farm been visited by CD, SCC or NRCS? Date: _____

Animal Inventory

Animal Type	Current No.	Weight	Animal Type	Current No.	Weight
Milking Cows			Beef Cattle		
Dry Cows			Swine		
Heifers >1 yr			Horses		
Heifers <1 yr			Mules		
Calves <2 mos			Broilers/Layers		
Bulls			Other		

Overview of Business Information

Livestock Type: Dairy Beef Swine Layer Broilers Turkey Other: _____

Number of days animals are stabled/confined and fed/maintained over any 12-month period.

_____ 45 Days or More _____ Less than 45 Days

Integrator/Company: _____

of employees _____ Hours of operation _____

Production Level (i.e. gals/day of milk, flocks/year): _____

CAFO/CAO/AFO Status

- Concentrated Animal Feeding Operation (CAFO)
- Concentrated Animal Operation (CAO)¹³
- Volunteer Animal Operation (VAO)
- Animal Feeding Operation (AFO)¹⁴
- None of the Above

Farm Management Documents and Plans

- PA CAFO Permit Coverage (Permit No. _____ and Date _____)
- Agriculture Erosion & Sediment Control Plan (Ag. E&S Plan)
(Date _____, Author _____)
- Manure Management Plan (MMP)
(Date _____, Author _____)
- Nutrient Management Plan (NMP)
(Date _____, Author _____)
 - Private Certified Nutrient Management Planner
 - Soil & Water Conservation District
 - Pennsylvania Cooperative Extension
 - Other: _____
- NRCS Comprehensive Nutrient Management Plan (CNMP)
(Date _____, Author _____)
- NRCS Conservation Plan
(Date _____, Author _____)

¹³ CAOs are defined as agricultural operations where the animal density of all livestock on the farm exceeds 2 animal equivalent units (AEUs) per acre on an annualized basis. AEUs for each type of animal = [average number of animals on a typical day that the animals are there × animal weight (lb) ÷ 1,000] × [number of days the animals are on the operation per year ÷ 365].

¹⁴ AFO means a lot or facility where animals have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period, and crops, vegetation, forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility.

Other Farm Management Plan(s) _____

Cropland/Pasture/Field Management

Own: Total _____ ac Crops: _____ ac Pasture: _____ ac Production Area: _____ ac

Rented: Total _____ ac Crops: _____ ac Pasture: _____ ac

Rented From: _____

Crops Grown:	<input type="checkbox"/> Corn	_____ ac	Receive manure?	<i>Yes</i>	<i>No</i>
	<input type="checkbox"/> Soybean	_____ ac	Receive manure?	<i>Yes</i>	<i>No</i>
	<input type="checkbox"/> Alfalfa	_____ ac	Receive manure?	<i>Yes</i>	<i>No</i>
	<input type="checkbox"/> Other(s) (_____)	_____ ac	Receive manure?	<i>Yes</i>	<i>No</i>

Crop Rotation: _____

Regular Soils Tests: *Yes No* Each field tested once every 1 2 3 4 5 yrs

Date of last soil test: _____ Laboratory results available for onsite review: *Yes No*

Notes: _____

Nutrient Sources

Yes No Does the farm's NMP account for all sources of manure?

Yes No Does the farm export manure?
Annual amount of imported manure: _____ %/gal/tons

Yes No Does the farm import manure?
Annual amount of imported manure: _____ %/gal/tons
Source of imported manure? _____

Yes No Does the farm use inorganic Fertilizer?
Type/Product: _____

Yes No Does the farm use biosolids?
Source: _____
Annual amount of biosolids used: _____

Yes No Does the farm use irrigation?

Yes No Is manure spread on pastures?
Pasture acres receiving manure: _____ acres

Yes No Does the farm spreads manure during the winter¹⁵?
If yes, when was the last time: _____
If yes, which crops receive manure: _____
If yes, which fields receive manure: _____

Why does winter application of manure occur? _____

¹⁵ Winter is defined as: December 15 – February 28, or Ground is frozen 4 inches or deeper, or Ground is snow covered.

Raw Materials Management

Type of feed produced on farm: _____

Type of feed imported to farm: _____

Type of feed storage: _____

Yes No Is feed formulation managed to reduce nutrient content in manure?

Yes No Is stored feed exposed to precipitation?

Yes No Is silage Leachate present?

Yes No Is bedding material exposed to precipitation?

Wastewater Management

How is milk house/parlor washwater handled?

Mortality Management

Method of Disposal (select all that apply)	Routine Mortality	Catastrophic Mortality	Comments
Compost in compost shed	<input type="checkbox"/>	<input type="checkbox"/>	
Compost in manure shed	<input type="checkbox"/>	<input type="checkbox"/>	
Outdoor composting	<input type="checkbox"/>	<input type="checkbox"/>	
Burial	<input type="checkbox"/>	<input type="checkbox"/>	
Incineration	<input type="checkbox"/>	<input type="checkbox"/>	
Rendering	<input type="checkbox"/>	<input type="checkbox"/>	
Other (describe):	<input type="checkbox"/>	<input type="checkbox"/>	

Surface Water and Stormwater Management (use Site Maps to identify location)

Yes No Is surface water present on the farm? Name: _____
Location: _____

Yes No Are man-made ditches, flushing systems, or other similar man-made devices present?
Location: _____

Yes No Does stormwater come into contact with any raw materials, products, or byproducts including manure, litter, feed, milk, eggs or bedding?
Location: _____

Yes No Does surface water come into direct contact with the animals confined in the operation?
Location: _____

Notes: _____

Best Management Practices

Yes No Does the farm implement conservation tillage (No-Till/Low Till)?
Type: _____
Implementation Level: _____ ac / %

Yes No Does the farm plant cover crops?
Current year implementation level: _____ ac
Typical year implementation level: _____ ac
Type of cover crop: _____
Does cover crop receive manure? *Yes No*
Amount of manure applied to cover crops: _____ gal/tons

Yes No Does the farm implement livestock stream exclusion practices? (if applicable)
Implementation Level: _____ ft
Are stream banks are fenced on both sides of stream? *Yes No*

Yes No Does the farm implement vegetated buffers on cropland? (if applicable)
Implementation Level: _____ ft
Average width of buffer: _____ ft
Minimum width of buffer: _____ ft *Maximum* width of buffer: _____ ft

Yes No Does the farm implement vegetated buffers on pasture? (if applicable)
Implementation Level: _____ ft
Average width of buffer: _____ ft
Minimum width of buffer: _____ ft *Maximum* width of buffer: _____ ft

Yes No Do buildings/structures around the barnyard have operational gutters and downspouts?

Yes No Is the farm in any preservation program?
Name: _____
Acres in Program: _____

Notes: _____

Manure Storage(s)

Storage 1: _____

Type (ex. earthen, HDPE-lined earthen, concrete): _____

Dimensions: _____ Capacity: _____ gals _____ *months or days*

Age/Date Built: _____

Freeboard maintained (inches): _____ Lining: _____

Did farm use any government cost-share funding? *Yes No* Program: _____

Input Sources (manure, washwater, rainwater): _____

How often is manure tested? Never Once every 1 2 3 4 5 years Not Routinely

Date of last manure test: _____

Storage 2: _____

Type (ex. earthen, HDPE-lined earthen, concrete): _____

Dimensions: _____ Capacity: _____ gals _____ *months or days*

Age/Date Built: _____

Freeboard maintained (inches): _____ Lining: _____

Did farm use any government cost-share funding? *Yes No* Program: _____

Input Sources (manure, washwater, rainwater): _____

How often is manure tested? Never Once every 1 2 3 4 5 years Not Routinely

Date of last manure test: _____

Storage 3: _____

Type (ex. earthen, HDPE-lined earthen, concrete): _____

Dimensions: _____ Capacity: _____ gals _____ *months or days*

Age/Date Built: _____ Freeboard maintained (inches): _____

Did farm use any government cost-share funding? *Yes No* Program: _____

Input Sources (manure, washwater, rainwater): _____

How often is manure tested? Never Once every 1 2 3 4 5 years Not Routinely

Date of last manure test: _____

Notes: _____

Animal Confinement Area Worksheet

Animal Confinement Area <i>(Barn, Freestall Barn, Lot, Loafing Area, Parlor, Pasture)</i>	Livestock Description	Materials Entering Area	Materials Leaving Area
Location: _____	Livestock present: _____	<input type="checkbox"/> Manure	<input type="checkbox"/> No materials collected/stored
<i>Access To Stream</i> <input type="checkbox"/> Yes <input type="checkbox"/> No	Capacity: Current:	<input type="checkbox"/> Bedding (Type _____)	<input type="checkbox"/> Manure scraped/stacked/stored _____
<i>Covered</i> <input type="checkbox"/> Yes <input type="checkbox"/> Partially <input type="checkbox"/> No	Present _____ hrs / day	<input type="checkbox"/> Rainwater	<input type="checkbox"/> Runoff/ Process wastewater _____
<i>Impervious Surface</i> <input type="checkbox"/> Yes <input type="checkbox"/> Partially <input type="checkbox"/> No	Present _____ months / year	<input type="checkbox"/> Other (_____)	<input type="checkbox"/> Other (_____)
Location: _____	Livestock present: _____	<input type="checkbox"/> Manure	<input type="checkbox"/> No materials collected/stored
<i>Access To Stream</i> <input type="checkbox"/> Yes <input type="checkbox"/> No	Capacity: Current:	<input type="checkbox"/> Bedding (Type _____)	<input type="checkbox"/> Manure scraped/stacked/stored _____
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