An Analysis of the Virginia Farm Voluntary Agricultural Best Management Practices Inventory

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Executive Summary

The Virginia farm voluntary agricultural best management practices (BMP) inventory was designed to learn more about voluntary conservation practices on Virginia farms in the Chesapeake Bay watershed. Information shared by agricultural producers in response to this survey contributes to telling the story of what farmers are doing to conserve soil, improve water quality, and will help agriculture achieve its water quality goals for the Watershed Implementation Plan (WIP) for the Chesapeake Bay.

The survey used as the basis for the inventory was crafted over many months by members of Virginia's Voluntary Agricultural BMP Task Force. This task force was convened on June 25, 2019 by Ann Jennings, then Deputy Secretary of Natural Resources. Task force members worked closely together and included representatives from the: Natural Resources Conservation Service (NRCS), Virginia Association of Soil and Water Conservation Districts (VASWCD), Virginia Department of Conservation and Recreation (DCR), Virginia Agribusiness Council (VAC), Virginia Cooperative Extension (VCE), Virginia Department of Agriculture and Consumer Services (VDACS), United States Environmental Protection Agency (EPA), Virginia Department of Forestry (VDOF), Virginia Department of Environmental Quality (DEQ), Virginia Farm Bureau (VFB), and Virginia Tech Office of Analytics and Institutional Effectiveness (VTOAIE).

The survey was made available electronically and open for data collection from January 11, 2021 through March 12, 2021. Recognizing that not every producer had computer and/or Internet access, paper copies of the survey were made available through local VCE and SWCD offices. Participation in the survey was completely voluntary. Overall, 611 agricultural producers fully completed surveys.

To confirm the reliability of self-reported information, 14.6% of farms were selected for follow-up site visits. These site visits were conducted by VCE agents that had been trained by subject matter experts with DCR and the University of Maryland Cooperative Extension (UME). Upon completion of the site visits data was cleaned, de-duplicated, and statistical analyses carried out. During the statistical analyses consistent under-reporting by agricultural producers was identified.

Overall, this effort concludes that participating farmers in the Chesapeake Bay Watershed have collectively implemented non-cost shared and/or previously unreported conservation practices, as follows: core nitrogen and phosphorus nutrient management (88,475 acres); supplemental nitrogen nutrient management for rate (50,547 acres), placement (40,693 acres), and timing (25,174 acres); supplemental phosphorus nutrient management for rate (34,727 acres) and placement (47,715 acres); manure incorporation/injection (2,074 acres); 23 animal waste management units serving 634,218 animals; 131 barnyard water diversion and runoff control systems impacting 187,893 animals; 13,136 acres of prescribed grazing; 8,929 acres with soil conservation and water quality plans; 115,198 acres of no till/minimum tillage practices; 15,847

acres of traditional, traditional with fall nutrients, and commodity cover crops, and; 6,434 acres of riparian buffers (inclusive of all buffer types).

This final summarized data has been reviewed by the Voluntary Agricultural BMP Task Force and shared with DCR and DEQ to consider for inclusion with Virginia's annual data submission to the EPA Chesapeake Bay Program Office to assist Virginia with meeting goals for the Chesapeake Bay Watershed Implementation Plan (WIP).

Introduction

Virginia farmers have done much to improve water quality and soil health. The adoption of conservation practices implemented on agricultural lands with state and federal cost-share assistance is well documented. However, less is known about the extent of soil and water quality practices that farmers have implemented and maintained voluntarily, using their own means to do so. Many of the conservation practices that farmers have voluntarily implemented are not accounted for in tracking progress toward water quality goals, including cleaning up the Chesapeake Bay. Information shared by agricultural producers in response to this project contributes to telling the story of what farmers are doing to conserve soil, improve water quality, and will help agriculture achieve its water quality goals for the Chesapeake Bay WIP.

The process used as the basis for this project was modeled after a similar effort carried out by Pennsylvania in 2016 (Royer et. al. 2016). The survey instrument utilized was crafted over many months by members of Virginia's Voluntary Agricultural BMP Task Force. This task force was convened on June 25, 2019 by Ann Jennings, then Deputy Secretary of Natural Resources. Task force members worked closely together and included representatives from the: Natural Resources Conservation Service (NRCS), Virginia Association of Soil and Water Conservation Districts (VASWCD), Virginia Department of Conservation and Recreation (DCR), Virginia Agribusiness Council (VAC), Virginia Cooperative Extension (VCE), Virginia Department of Agriculture and Consumer Services (VDACS), United States Environmental Protection Agency (EPA), Virginia Department of Forestry (VDOF), Virginia Department of Environmental Quality (DEQ), Virginia Farm Bureau (VFB), and Virginia Tech Office of Analytics and Institutional Effectiveness (VTOAIE). VCE served as the survey administrator and the project was funded by Chesapeake Bay Restoration Funds made available by the Office of the Secretary of Natural Resources and federal Chesapeake Bay Program Funds available through DEQ.

Methods

Survey Methodology

Once the Voluntary Agriculture BMP Task Force members decided to do a producer survey, a subcommittee was established to carry out initial survey development. Subcommittee

members represented the VAC, VASWCD, DCR, DEQ, VCE, and Office of the Secretary of Natural Resources. Subcommittee members met in May and June 2020 using Pennsylvania's 2016 and 2020 survey instruments as a starting point for discussion. The Pennsylvania surveys were extensively modified to reflect Virginia conditions and the decision to utilize an electronic, rather than mailed, survey. Upon completion the draft survey was then further refined by the full Task Force during five subsequent meetings from July through November 2020. These conversations included input that was sought from the Senior Agricultural Advisor with UME regarding subject matter content. In addition, a VCE Research Associate Professor and faculty members from the VTOAIE regularly attended Task Force meetings to advise on survey design, methodology, and process.

Ultimately the survey was organized according to the following sections, with each section containing questions about practices pertaining to that theme:

- Introduction and Demographics
- Manure
- Nutrient Management
- Barnyards
- Pastures
- Conservation Planning
- Tilling
- Cover Crops
- Waterways

The final draft of the survey was then provided to 10 beta testers to identify any concerns that may have been overlooked by Task Force members and advisors. Beta testers included individuals affiliated with VFB, VCE, and SWCD, to include agricultural producers (6), Extension agents (3), and an Extension specialist. Beta testers were asked to address the following questions.

- Are the questions easy to understand?
- Is the survey easy to navigate?
- Did you have trouble at any point or find something confusing?
- What would make the survey better from the producer's perspective?

Beta testers were also asked to record how much time it took to complete the survey, along with any documents--such as a nutrient management plan--that might be helpful for producers to have on hand for reference purposes when they are completing the survey. Beta testers were asked to submit feedback by December 15, 2020. Nine of 10 beta testers provided feedback and the survey was further refined to reflect their input.

Throughout the development and design process every effort was made to develop a survey that dealt with a complex topic in a manner that was easy for the survey participant to

understand and navigate. The web-based survey used skip logic so that agricultural producers were only presented with questions that were relevant to their operation. For example, if a farmer indicated that he/she did not have barnyards, then he/she was not presented with the barnyard question set. In addition, the Assistant Director with VTOAIE established a help link in the survey where participants could ask questions about the survey directly of her or a staff member while in the process of completing the survey. Please see Appendix 1 for the final producer survey.

To support survey marketing efforts and consistency in messaging by agency staff, the Task Force members collaborated on an introductory letter, flier, news release, e-mail message, and social media verbiage (Appendix 2). In addition, VCE and VASWCD created a website https://vaswcd.org/virginia-farm-voluntary-agricultural-bmp-inventory to host the survey, provide background on the effort, and answer frequently asked questions. A training was held on January 8, 2021 (Appendix 3) for Extension agents and SWCD staff working in the Chesapeake Bay watershed region, as well as interested staff from partner organizations, to provide the project background, review the survey and website, and discuss ideas for farmer outreach. Over 130 individuals attended the training. The survey was officially opened on January 11, 2021.

Multiple methods were used to inform Virginia farmers about the survey, to include: e-mail messages by task force member agencies and partner groups to member/client listservs, newspaper articles, direct mail, word-of-mouth, references in newsletters, and social media posts, among others. In addition, VFB disseminated a recorded phone call from VFB President Pryor to 14,203 farm families and local VFB units mailed 6,799 post cards to farm families in the Chesapeake Bay watershed.

In several cases farmers requested a hard copy survey and were provided with a printed copy. Information from surveys completed in this manner was entered into the system on behalf of the producer.

The survey closed for data collection on March 12, 2021. Participants with surveys that were partially completed were contacted and offered an opportunity to complete the survey. The majority of these participants had completed, but not submitted, the survey.

Site Visit Methodology

Follow-up site visits are required by the Chesapeake Bay Program Partnership (CBPP) as part of the process to confirm the accuracy of survey responses. To support this “verification” process the survey administrator developed a site visit survey that paralleled the original producer survey.

To maintain consistency with the approved process utilized by Pennsylvania, VCE agents were tasked with conducting site visits. In total, 11 Extension agents volunteered to carry out this work. These 11 agents attended a six-hour training on July 14, 2021 led by the VCE Associate

Director, DCR Engineering Technician, and UME / U.S. EPA Chesapeake Bay Program Office Senior Agricultural Advisor. The training was held at the Shenandoah Valley Agricultural Research and Extension Center (SVAREC) and included both classroom and field components. Field components were conducted on the AREC and a nearby producer's dairy farm. Training topics included: project review; walk-through of the follow-up survey and corresponding technical information; field site visits at SVAREC to practice making determinations and completing the form for animal systems, and; site visits at the dairy farm to practice making determinations and completing the form for cropping systems (Appendix 4). The CBP Resource Improvement BMP expert panel report and accompanying checklists were used as a resource during the training (Ensor et. al. 2014). Extension agents made recommendations during the training that were used to improve the site visit survey, the final draft of which is located in Appendix 5.

Due to a small survey response (611) compared to the Pennsylvania survey effort, farming operations were selected for site visits based on preferences for three recommended criteria: 1) proximity to a Hydrologic Unit Code (HUC) 6 watershed boundary; 2) farming in multiple locations, and; 3) potential for both livestock and crop-related BMP's on the farm. Farms demonstrating all three criteria received highest priority for selection. Farms were then assigned to the Extension agents nearest to their locations where possible. The goal was to obtain a minimum number of 30 samples in each HUC6 watershed unit, for a total of 90 site visits or 14.7% of participating farms.

After the initial sample of farms was taken each farmer was contacted by phone, e-mail, or mailed letter and asked for permission to conduct the follow-up visit. If the farmer declined or did not respond the site visit was not conducted and another farm was chosen from a replacement sample. Agents conducted site visits from late July through late September 2021. Consistent with confidentiality measures, Extension agents were not provided with the survey responses of participating farmers. Rather, the producer and agent surveys were matched in the system using unique identifying numbers.

Reliability Data Analysis

To assess the reliability of our survey data, we compared the practices reported in the participant survey to the implemented practices recorded in the site visits. Differences between the "reported" values from the farm survey and the "verified" values from the follow-up visits were computed for each practice. To determine whether or not there is a statistically significant difference between these reported values and verified values, a series of paired t-tests were used. If a mean difference is not statistically significant from zero, then the survey data for that practice is considered as reliable, meaning that the reported data is not statistically different from the verified data. In other words:

- H0: The mean difference (reported result – verified result = 0) in Core nitrogen and phosphorus management is 0.

- H1: The mean difference (reported result – verified result ≠ 0) in Core nitrogen and phosphorus management is **not** 0.

For each conservation practice, the results from several survey items and farm visit form items were used to determine reported and verified values. Please refer to Appendix 6 for an overview of how survey item responses correspond to Chesapeake Bay Program Conservation Practices.

HUC6 Comparative Analysis

Follow-up site visit data were aggregated at the HUC6 watershed scale, the smallest acceptable reporting unit based on the sample size, and then summarized on a Chesapeake Bay watershed scale for inclusion with Virginia's annual reporting.

All three of the HUC6 watershed areas involved in the survey achieved a minimum of 10% sub-sampling for onsite verification, with one of the three watershed areas achieving a minimum of 30 sub-samples for onsite verification. To foster additional belief in the data, the confidence intervals and mean values for several groups of practices with a significant quantity value between the three watershed areas were calculated. This analytical comparison was not possible for all practice groups, and thus the focus was on those practice groups that had sufficient responses to support the comparative analysis. The purpose was to examine whether or not there is a significant difference in mean values between the three HUC6 watersheds. If no statistically significant difference is found then there should be no objection to treating the data from the three watershed areas the same for reporting, as well as summarizing the data to represent the entire Virginia Chesapeake Bay watershed for reporting. Comparative analyses were conducted for: nutrient management (core Nitrogen and Phosphorus, supplemental Nitrogen, and supplemental Phosphorus); prescribed grazing; tillage; cover crops, and; riparian buffers. Comparative analyses compared the James River and Rappahannock/York watersheds, and the James River and Shenandoah/Potomac watersheds.

Results and Discussion

In total, 611 agricultural producers in Virginia's Chesapeake Bay watershed region fully completed the Virginia Farm Voluntary Agricultural BMP Inventory. The survey included an addendum with several supplemental questions, including one question that asked participants to share how they learned about the survey. The majority (91.3%) of participants that answered this question (n=530) learned about the survey from a direct e-mail or other direct contact (i.e., postcard, newsletter, phone call, etc.) from an agency affiliate (i.e., VFB, VCE, VASWCD, etc.). Five percent (5%) learned about the survey through the recommendation of another farmer, 2.6% listed website/search engine, and 1.1% newspaper. These results emphasize the importance of personal contact with Virginia farmers in discussing the survey and potential benefits of completing it; opportunities that were limited during the survey

period due to COVID19 restrictions on in-person gatherings. This likely had a negative impact on survey participation.

Overall, 162 farms (26.5% of the total population) were contacted seeking permission to conduct site visits. Eighty-nine farms (55% of those contacted) provided permission to visit (14.6% of the total population). Agricultural producers appeared most likely to provide permission to visit their farm when contacted by the Extension agent working in their home county or region that they knew and trusted. Thirty-seven farms were visited in the James River Watershed (19%), 27 in the Rappahannock/York watershed (11.4%), and 25 in the Shenandoah/Potomac watershed (13.4%), for a total of 89 samples. These numbers exceeded the 10% sample required by EPA for the Pennsylvania survey, but fell slightly short of the goal of 30 samples per HUC6 watershed in two of the three Virginia watershed units. As a result, a comparative statistical analysis was performed comparing the James River watershed to the Rappahannock/York and Shenandoah/Potomac watersheds to look for statistically significant differences in the data sets and produce additional confidence in the data (Table 1). Note that a confidence interval for a difference in the mean scores of two groups that does not contain zero indicates a statistically significant difference in the mean scores of the groups. Significant differences are indicated with an *** in the table.

Based on these comparative analyses there were no significant differences between the James River and Rappahannock/York watersheds for nutrient management (core N&P, supplemental N, supplemental P), prescribed grazing, tillage, or riparian buffers. A significant difference between the James River and Rappahannock/York watersheds was noted for cover crops. By comparison, there were no significant differences between the James River and Shenandoah/Potomac watersheds for nutrient management (core N+P, supplemental P), prescribed grazing, tillage, cover crops, or riparian buffers. A significant difference between the James River and Shenandoah/Potomac watersheds was noted for nutrient management (supplemental N). Thus, out of 14 comparative analyses conducted only two demonstrated significant differences between practice implementation acreage, supporting data confidence.

Table 1: Comparative analysis between acres of selected practices in HUC6 watershed units.

Nutrient Management: Core (N+P).

HUC Comparison		Difference Between Means	Lower 95% CL	Upper 95% CL
James (n=52)	RappYork (n=72)	-103.5 (533.60 - 637.10)	-417.4	210.4
James (n=52)	ShenPot (n=58)	207.4 (533.60 -326.16)	-122.0	536.9

Nutrient Management: Supplemental Nitrogen.

HUC Comparison		Difference Between Means	Lower 95% CL	Upper 95% CL
James (n=74)	RappYork (n=120)	-94.74 (528.83 - 623.57)	-334.22	144.74
James (n=74)	ShenPot (n=107) ***	292.09 (528.83 - 236.74)	48.02	536.16

Nutrient Management: Supplemental Phosphorus

HUC Comparison		Difference Between Means	Lower 95% CL	Upper 95% CL
James (n=66)	RappYork (n=66)	-94.74 (526.46 - 682.80)	-483.4	170.8
James (n=66)	ShenPot (n=76)	292.09 (526.46 - 238.62)	-21.9	597.6

Prescribed Grazing

HUC Comparison		Difference Between Means	Lower 95% CL	Upper 95% CL
James (n=58)	RappYork (n=49)	-38.47 (88.72 - 127.19	-100.46	23.53
James (n=58)	ShenPot (n=57)	28.89 (88.72 - 59.83)	-29.62	87.39

Tillage

HUC Comparison		Difference Between Means	Lower 95% CL	Upper 95% CL
James (n=83)	RappYork (n=112)	55.5 (770.80- 715.33	-1566.4	1677.3
James (n=83)	ShenPot (n=85)	643.3 (770.80- 127.50)	-1153.5	2440.1

Cover Crops

HUC Comparison		Difference Between Means	Lower 95% CL	Upper 95% CL
James (n=104)	RappYork (n=88) ***	-78.56 (39.62- 118.18)	-125.18	-31.94
James (n=104)	ShenPot (n=66)	-11.83 (39.62- 51.45)	-62.61	38.96

Riparian Buffers

HUC Comparison		Difference Between Means	Lower 95% CL	Upper 95% CL
James (n=201)	RappYork (n=215)	-32.64 (15.57- 48.21)	-72.17	6.89
James (n=201)	ShenPot (n=217)	-0.95 (15.57- 16.52)	-42.88	40.98

Data Analysis

Data were analyzed to ensure practices met relevant Chesapeake Bay Program standards, definitions, and to avoid double-counting of practices. The crosswalk of survey item responses to Chesapeake Bay Conservation Practices (Appendix 6) prepared by DCR was used to filter data before analysis, meaning that only those practices for which the producer indicated that no government cost share funding was used are reported. Tables 2 shows cumulative results for the overall data. (Results are presented by HUC6 code in Appendix 7). Results of the statistical analysis comparing the survey results with the site visits are reported with associated differences of mean and confidence intervals in Table 3.

Table 2: Cumulative results by conservation practice from the reported farm survey.

Practice	Amount Implemented								
Nutrient Management									
Core nutrient management (nitrogen + phosphorus)	Total acres 88,475								
Supplemental nitrogen nutrient management	Rate: 50,547 ac			Placement: 40,693 ac			Timing: 25,174 ac		
Supplemental phosphorus nutrient management	Rate: 22,464 + 12,263 = 34,727ac					Placement: 41,715 ac			
Manure									
Manure incorporation	High disturbance w/in 24 hours 333 ac			High disturbance w/in 1-3 days 100 ac			Low disturbance w/in 24 hours 233 ac		Low disturbance w/in 1-3 days 1,318 ac
Manure injection	Immediate injection w/in 24 hours 80 ac					Immediate injection w/in 1-3 days 10 ac			
Animal waste management storages	6 dairy units 920 animals		2 beef units 60 animals		11 poultry units 627,050 animals		2 swine units 6,160 animals		2 Equine units 28 animals
Barnyards									
Barnyard water diversion (Number of systems)	Total 85 systems	39 Beef units	6 Dairy units	16 Equine units	9 Goat units	7 Poultry units	6 Sheep/lambs units		2 Swine units
Barnyard water diversion (Number of animals)	133,419	2,756	453	50	371	129,112	654		23
Barnyard runoff (Number of systems)	Total 46 systems	15 Beef units	3 Dairy units	12 Equine units	7 Goat units	4 Poultry units	4 Sheep/lambs units		1 Swine unit
Barnyard runoff (Number of animals)	54,474	965	528	38	337	52,058	544		4
Pastures									
Prescribed grazing	13,136 ac								
Conservation Planning									
Soil conservation and water quality plans	Total 8,929 ac			Row crops 3,785 ac			Hay 1,714 ac		Pasture 3,430 ac
Tilling									
No-till/minimum tillage	15% - 29% high residue tillage management 4,505 ac			30% - 59% conservation tillage 8,846 ac			60% or greater reduced tillage 101,846 ac		
Cover Crops									
Cover crops Total	10,661 ac Traditional cover crops			665 ac Traditional cover crops with fall nutrients			4,521 ac Commodity cover crops		
Traditional cover crop	Non-Rye			Rye			Mix - Other		
	Early	Late	Normal	Early	Late	Normal	Early	Late	Normal
	753	1,147	4,123	326	464	2,082	876	685	205
Traditional cover crop with fall nutrients	Non-Rye			Rye			Mix - Other		
	Early	Late	Normal	Early	Late	Normal	Early	Late	Normal
	-	41	297	12	10	225	65	10	5
Commodity cover crop	Non-Rye			Rye			Mix - Other		
	Early	Late	Normal	Early	Late	Normal	Early	Late	Normal
	648	579	2,432	59	100	272	196	50	185
Waterways									
Riparian buffers (cropland)	Wide forest buffers 713 ac			Narrow forest buffers 253 ac			Grass buffers 1,039 ac		Narrow grass buffers 3,655 ac
Riparian buffers with stream exclusion fencing (pasture)	Forest buffers 138 ac			Narrow forest buffers 68 ac			Grass buffers 59 ac		Narrow grass buffers 509 ac

The confidence intervals in Table 3 help determine if there is a significant difference between the reported results and verified results. If the confidence interval contains zero it can be concluded that there is no statistically significant difference between the results. If not, the mean score for each respective practice needs to be checked. A positive mean score tells us that the farmers reported more acres (or number of units/animals) than the verified results, meaning there was potentially overreporting. Whereas, the negative means tell us the opposite, meaning that the farmers reported less acres than the verified results, indicating underreporting of results. For example, on average per farm, self-reported total acres for the core nutrient management practice are 36.5 acres less than the verified acres.

Table 3: Results of the statistical analysis comparing the survey results with the farm visit results.

Practice	n	Mean	Min	Max	Standard Deviation	Standard Error of the Mean	Lower 95% Confidence Bound	Upper 95% Confidence Bound
Core nitrogen+ phosphorus management	44	-36.5	-2000	450	125.8	19	-73.7	0.65
Supplemental nitrogen management	61	-34.6	-1,400	2,761	548.7	70.2	-172.2	103.1
Supplemental phosphorus management	48	-181.8	-2,200	1,952	551.9	79.7	-338	-25.7
Manure incorporation and injection	8	-19	-120	50	52.6	18.6	-63	25
Manure storages	-	-	-	-	-	-	-	-
Barnyard water diversion/ runoff controls	16	-0.37	-1	0	0.5	0.12	-0.64	-0.10
Prescribed grazing	31	-34.8	-330	200	109.5	19.7	-75	5.3
Soil conservation plans	-	-	-	-	-	-	-	-
No-till	45	43.9	-940	1,331	349.4	52.1	-58.2	146
Cover crops	31	-45.9	-600	200	128.3	14.7	-74.8	-17.1
Riparian buffers (Hayland)	49	-24.7	-775	20	104.7	10.9	-46.1	-3.3
Riparian buffers streams & pastures	18	-13.1	-111	25	30.3	6.2	-25.9	-0.3
Riparian buffers total	53	-22.3	-775	25	94.3	8.8	-39.5	-5.2

A few observations:

- For all farming practices except the supplemental phosphorus management, no-till, cover crops, and riparian buffer practices, the confidence intervals contain zero, which indicates there is no statistically significant difference in the mean scores of the practices.

- For those practices where the confidence intervals don't contain zero and the practices have a negative mean difference, acreage was underreported.

- For the tillage practice, there is a positive mean score but the confidence intervals contain zero, which indicates that there is no significant difference between the reported and verified data. Therefore, there is no evidence of overreporting for this practice.

- There were no cases in the farm visit/verified data that met the criteria for manure storage, so the analysis could not be run for this practice. The sample sizes in the verified data for soil conservation and water quality plans were too small, so the analysis was not run for these practices.

Table 4 shows the reported and estimated totals with lower and upper bounds for practices. Note that those results are found based on the respective n sizes for each practice. We used the same formula as the Pennsylvania project approach, which allows us to adjust the totals for each practice based on the unverified mean acreage or units. For those practices designated by ** the reported totals fall below the lower bound, which provides strong evidence that farmers underreported the practices. Since no reported totals fall above the upper bound, we can conclude that there is no strong evidence that farmers overreported any of these practices. In addition, there are no estimated totals with lower and upper bounds for animal waste management storages, barnyard runoff controls, and soil conservation and water quality plans, due to either low or no sample size.

Due to the low sample size (n=89) in the site visit data, subcategories previously reported in Tables 2 and Appendix 7 were aggregated. This aggregation is summarized as follows:

- Aggregation of barnyard water diversion units and runoff controls units.

- Aggregation of all three categories of supplemental nutrient management (acres under rate adjustment) + (acres under placement adjustment) + (acres under timing adjustment) was used as the basis for comparing reported acres with verified acres. However, nitrogen and phosphorus were analyzed separately.

Table 4: Reported totals and estimated (adjusted) totals by conservation practice, bounded by 95% confidence lower and upper bounds as applied to the cumulative totals.

Practice	Reported Totals	Lower 95% Bound	Estimated Totals	Upper 95% Bound
Core (N +P) nutrient management	88,475 ac (n=182)	88,355 ac	95,120 ac	101,886 ac
Supplemental N nutrient management	116,324 ac (n=153)	100,552 ac	121,619 ac	142,685
Supplemental P nutrient management	76,442 ac** (n=123)	79,601 ac	98,805 ac	118,009 ac
Manure incorporation/ injection	2,074 ac (n=29)	1348 ac	2,625 ac	5,524 ac
Animal waste management storages	6 dairy units 2 beef units 2 swine units 11 poultry units 2 Equine units	There are no data from the farm visits that meet the criteria for this practice ("no" to cost share, "yes" to M5 and M6a), so the confidence interval cannot be calculated.		
Barnyard Water Diversion	85 systems**	93 systems	120 systems	148 systems
Barnyard runoff controls	46 systems	The sample size for the farm visit data is very low, so the confidence interval cannot be calculated.		
Barnyard Systems Total	131**	145	180	215
Prescribed grazing	13,136 ac (n=164)	12,264 ac	18,849 ac	25,434 ac
Soil conservation and water quality plans	3,785 ac row crops 1,714 ac hay 3,430 ac pasture Total: 8,929 ac	The sample size for the farm visit data is very low, so confidence interval cannot be calculated.		
No till/minimum tillage	115,198 ac (n=280)	98,912 ac	102,903 ac	131, 484 ac
Cover crops	15,487 ac** (n=76)	17,146 ac	19,339 ac	21,532 ac
Riparian buffers (cropland)	5,660 ac** (n=92)	5,965 ac	7,934 ac (n=92)	9,903 ac
Riparian buffers with stream exclusion fencing (pasture)	774 ac** (n=18)	780 ac	1,010 ac	1,241 ac
Riparian Buffers (Total)	6,434 ac** (n=110)	7,002 ac	8,889 ac	10,776 ac

- Aggregation of all six categories of manure incorporation/injection (acres under high-disturbance incorporation within 24 hours) + (acres under high-disturbance incorporation within 1-3 days) + (acres under low-disturbance incorporation within 24 hours) + (acres under low-disturbance incorporation within 1-3 days) + (acres under immediate injection within 24 hours) + (acres under immediate injection within 1-3 days) was used as the basis for comparing reported acres with verified acres.
- Aggregation of two categories of riparian buffers (hayland/cropland and streams/pastures).

Figures 1 through 12 on the following pages show the reported acres/units vs. estimated acres/units with a 95% confidence interval for each practice.

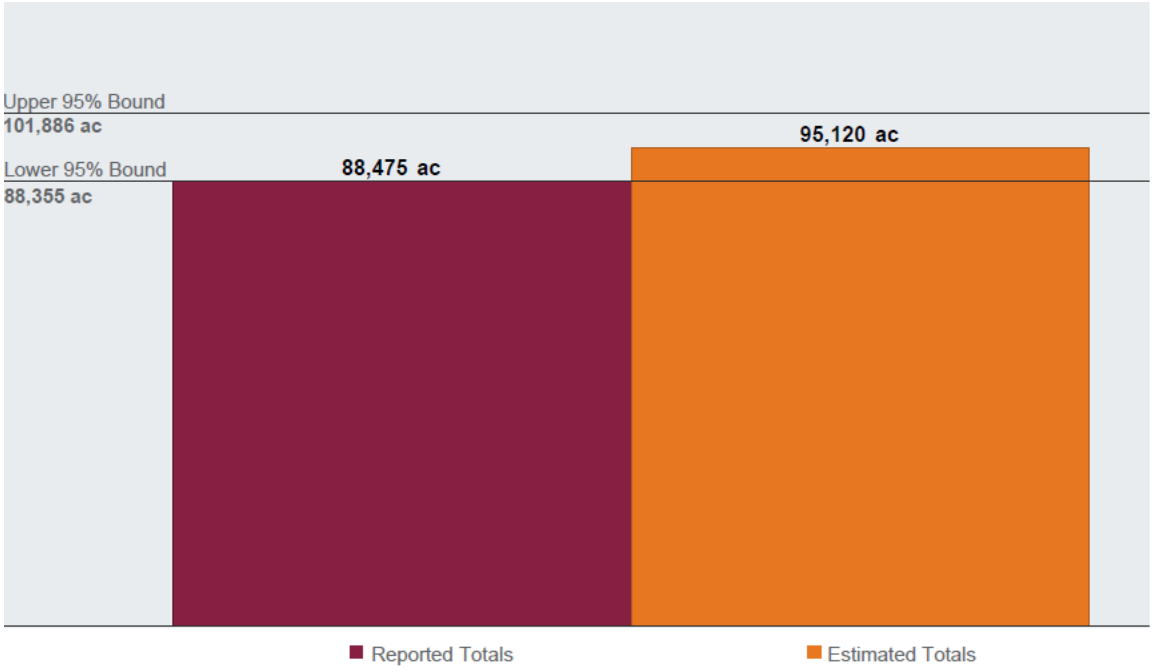

Figure 1: Reported acres vs. estimated acres with a 95% confidence interval for core (N + P) nutrient management.

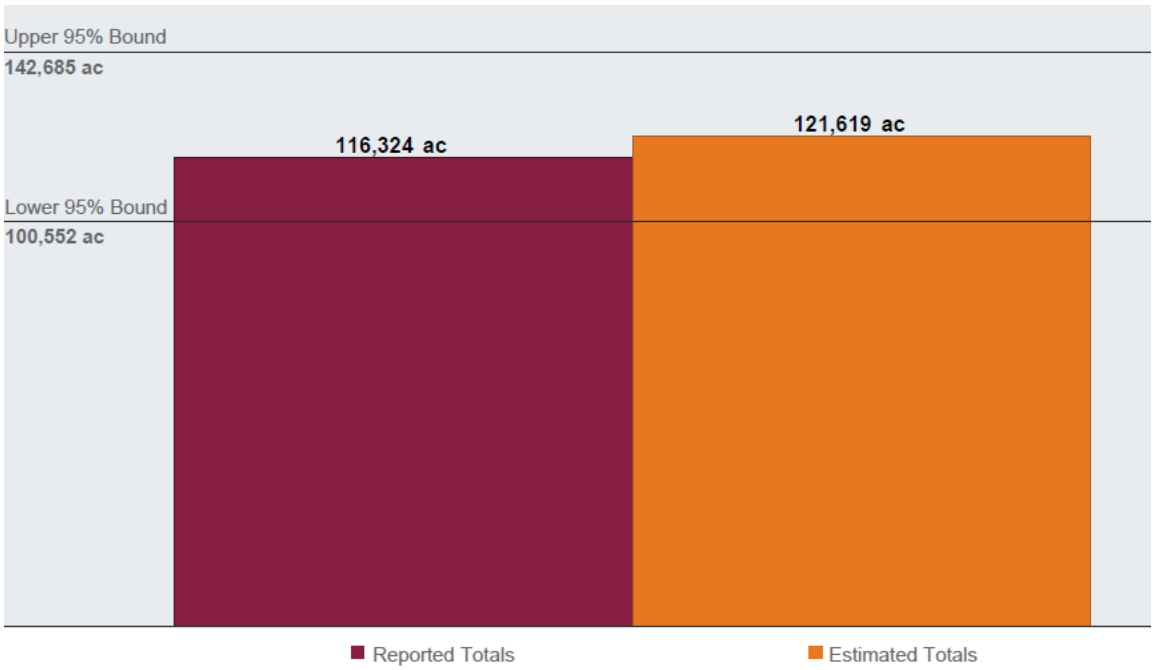

Figure 2: Reported acres vs. estimated acres with a 95% confidence interval for supplemental nitrogen nutrient management.

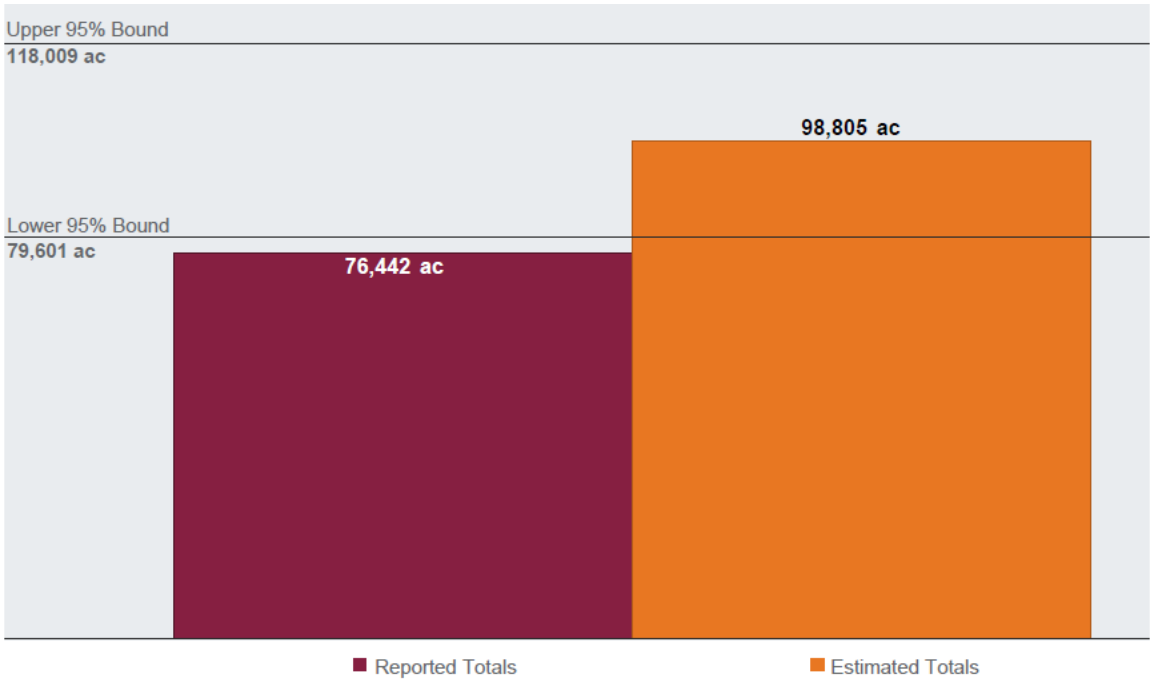

Figure 3: Reported acres vs. estimated acres with a 95% confidence interval for supplemental phosphorus nutrient management.

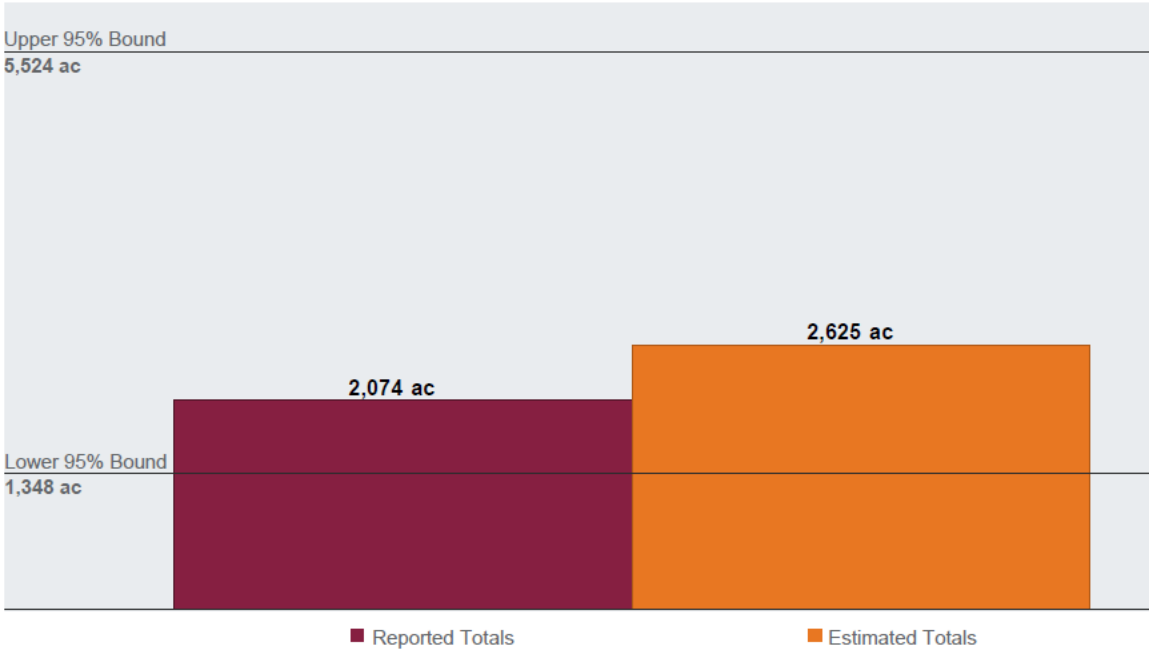

Figure 4: Reported acres vs. estimated acres with a 95% confidence interval for manure incorporation/injection.

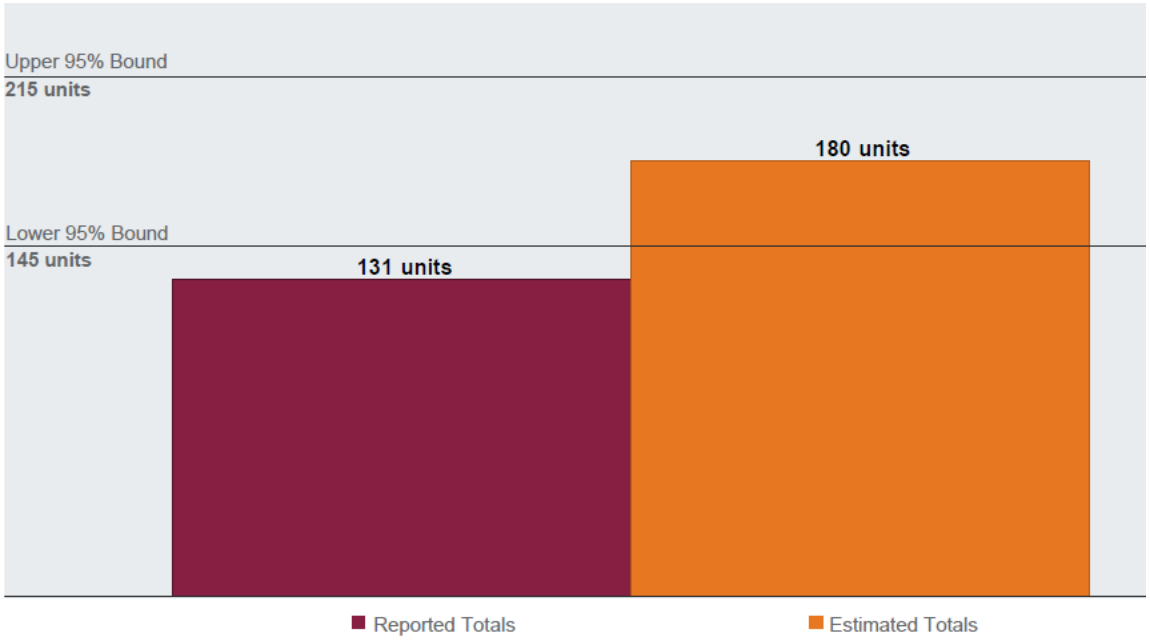

Figure 5: Reported units vs. estimated units with a 95% confidence interval for barnyard systems (total).

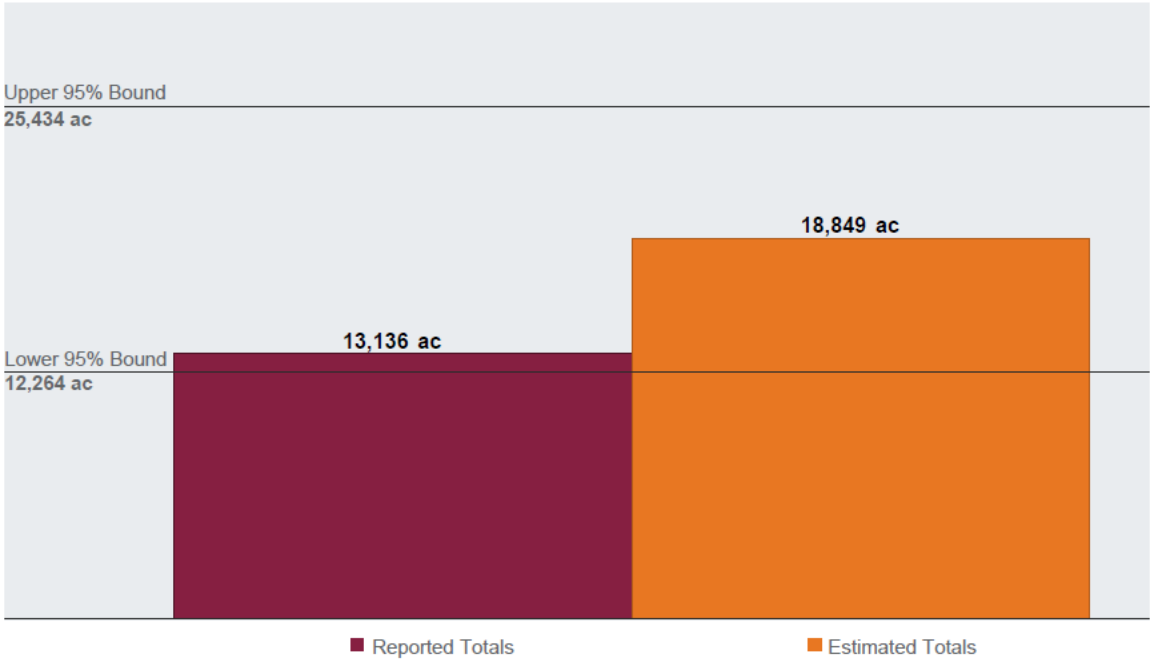

Figure 6: Reported acres vs. estimated acres with a 95% confidence interval for prescribed grazing.

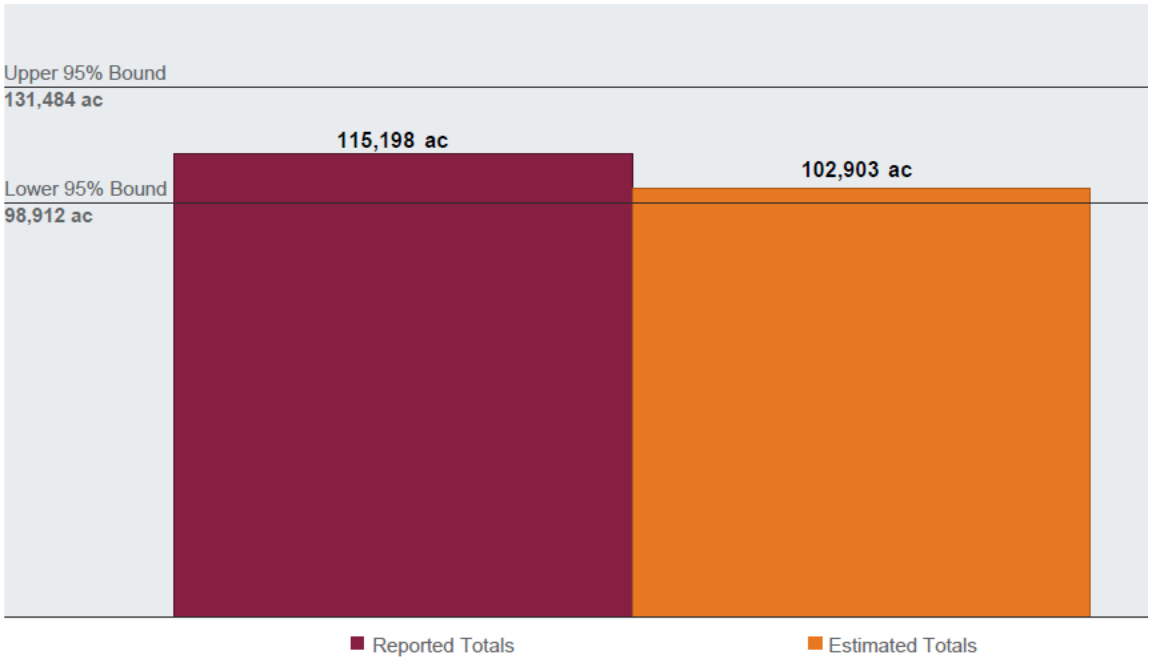

Figure 7: Reported acres vs. estimated acres with a 95% confidence interval for no-till / minimum tillage.

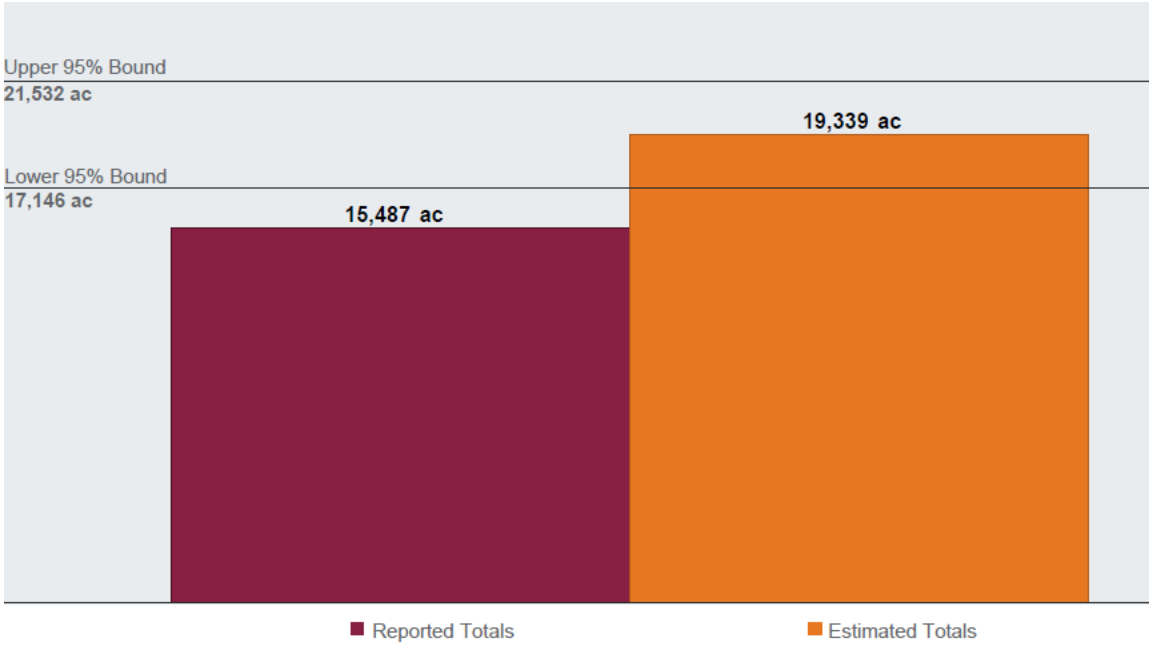

Figure 8: Reported acres vs. estimated acres with a 95% confidence interval for cover crops.

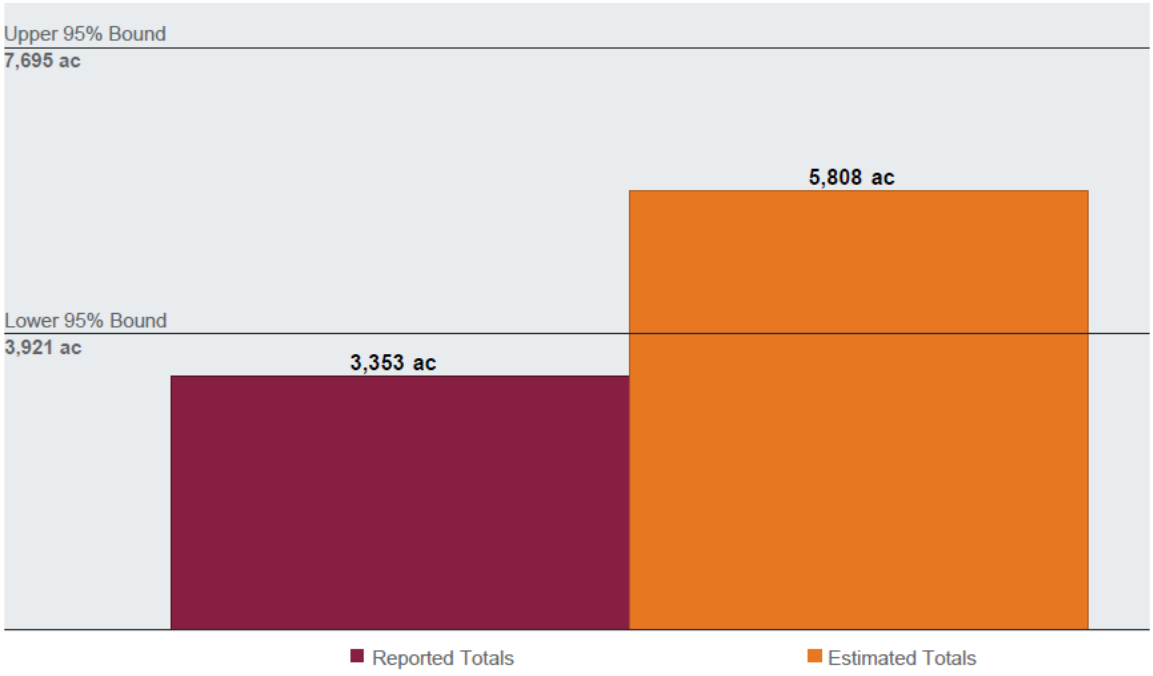

Figure 9: Reported acres vs. estimated acres with a 95% confidence interval for riparian buffers (total).

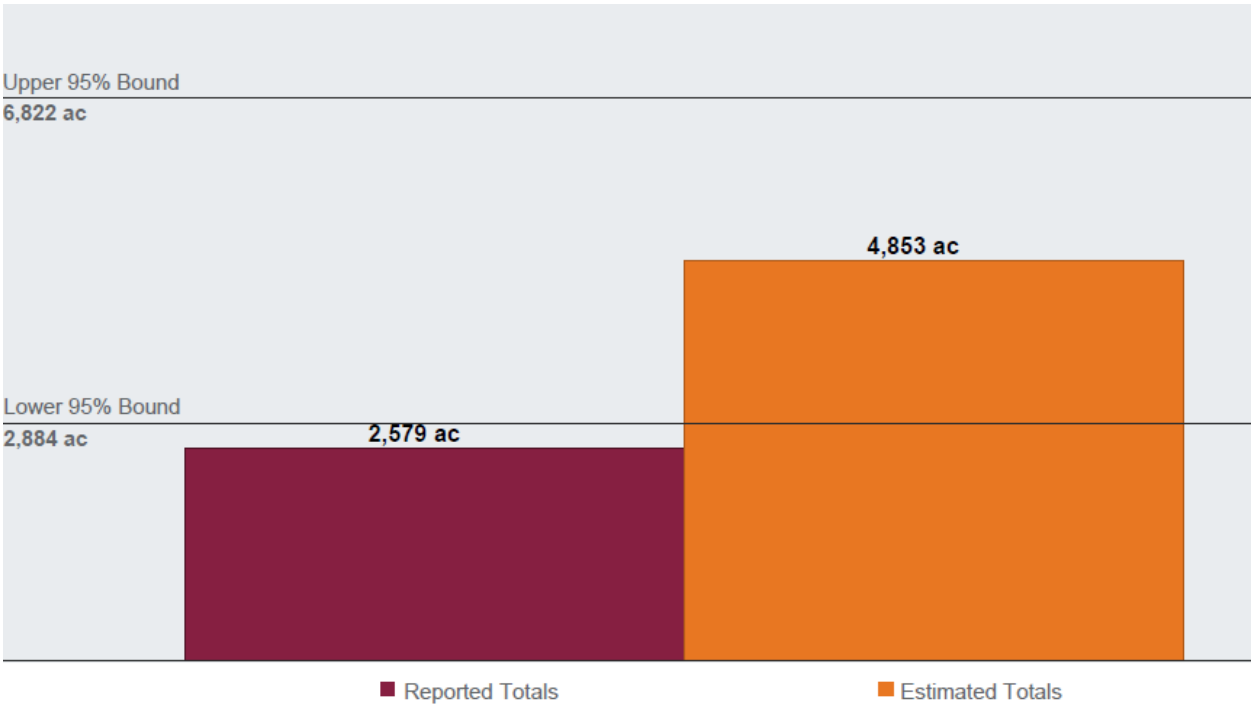

Figure 10: Reported acres vs. estimated acres with a 95% confidence interval for riparian buffers (cropland).

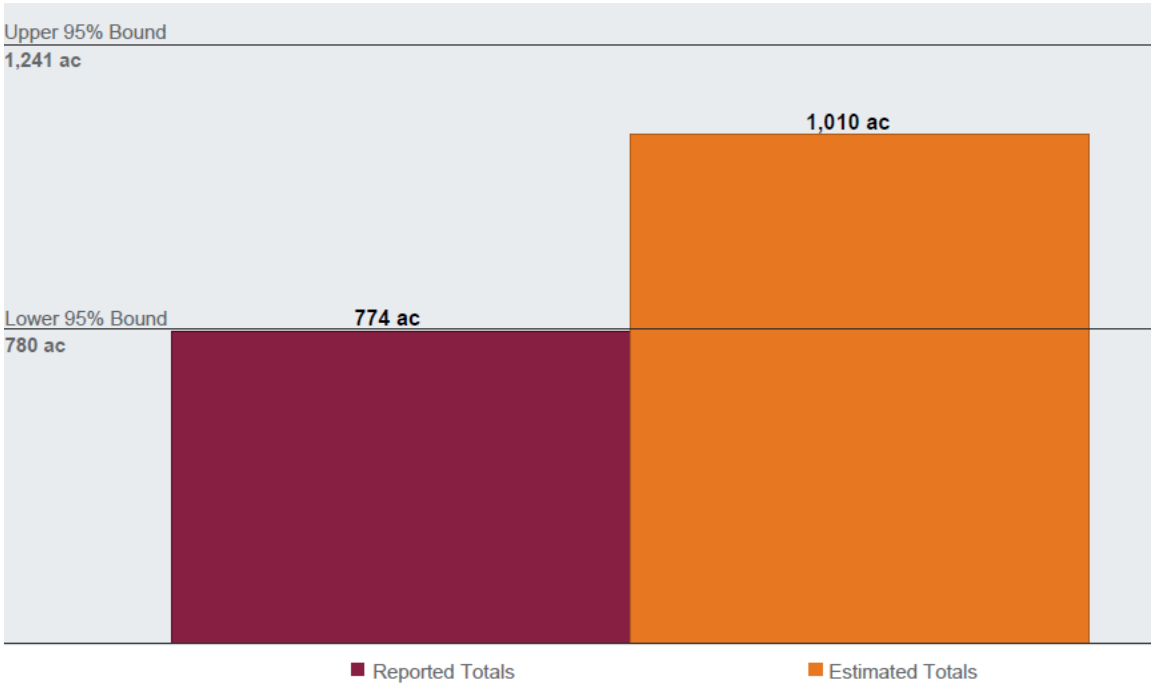

Figure 11: Reported acres vs. estimated acres with a 95% confidence interval for riparian buffers (pasture).

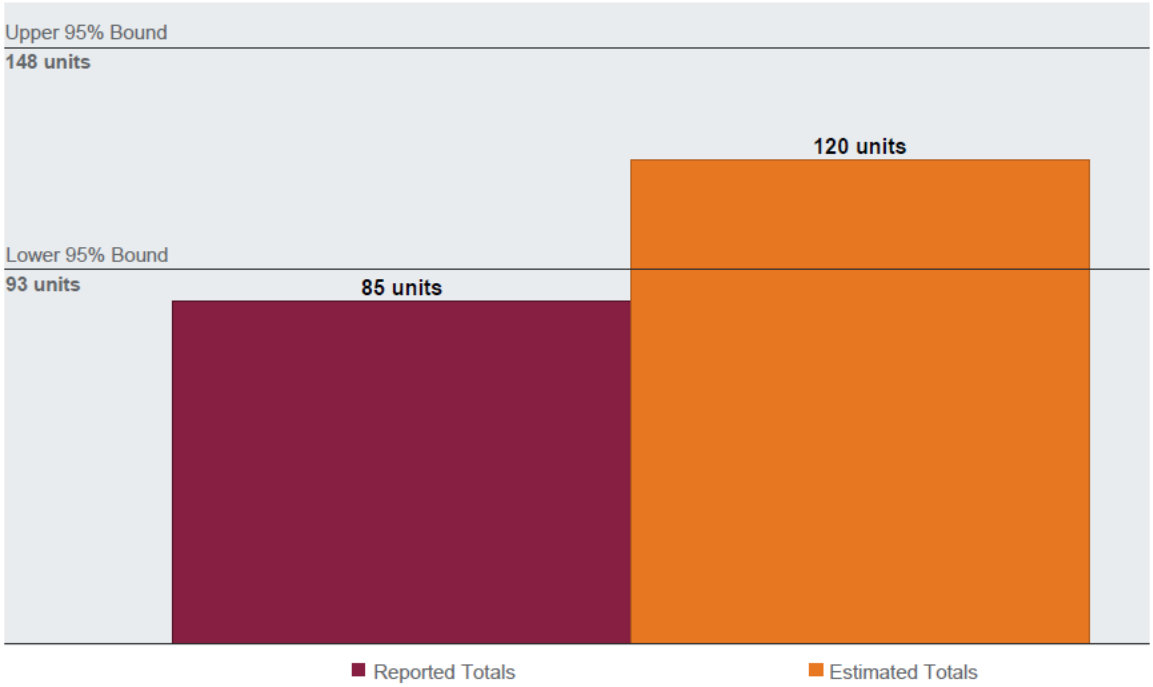

Figure 12: Reported units vs. estimated units with a 95% confidence interval for barnyard water diversion systems.

Conclusion

Reliability data analysis between the survey participant and verified data revealed that survey responses for each practice were either no different from verified data, or that survey responses underreported when compared to verified data. Therefore, for all practices, reported data represent the most conservative estimates of implementation, and so are reported here for all conservation practices for which the Commonwealth intends to use the survey results to report voluntary practices. Themes include the following and are accompanied by the acreage figures reported in Table 2 in the Results and Discussion section.

- Core and supplemental nutrient management (nitrogen and phosphorus).
- Manure incorporation, injection, and animal waste management systems.
- Barnyard water diversion and runoff controls.
- Prescribed grazing.
- Soil conservation and water quality plans.
- Cover crops.
- Riparian buffers on cropland and pasture.

Overall, this effort concludes that participating farmers in the Chesapeake Bay Watershed have collectively implemented non-cost shared and/or previously unreported conservation practices,

as follows: core nitrogen and phosphorus nutrient management (88,475 acres); supplemental nitrogen nutrient management for rate (50,547 acres), placement (40,693 acres), and timing (25,174 acres); supplemental phosphorus nutrient management for rate (34,727 acres) and placement (47,715 acres); manure incorporation/injection (2,074 acres); 23 animal waste management units serving 634,218 animals; 131 barnyard water diversion and runoff control systems impacting 187,893 animals; 13,136 acres of prescribed grazing; 8,929 acres with soil conservation and water quality plans; 115,198 acres of no till/minimum tillage practices; 15,847 acres of traditional, traditional with fall nutrients, and commodity cover crops, and; 6,434 acres of riparian buffers (inclusive of all buffer types).

References

Ensor, R. et. al. 2014. *Chesapeake Bay Program Resource Improvement Practice Definitions and Verification Visual Indicators Report*. Agriculture Workgroup's Resource Improvement Technical Review Panel. 41 p.

Royer, M., J. Shortle, and A. Cook. 2016. *An Analysis of the Pennsylvania Farm Conservation Practices Inventory for Purposes of Reporting Practices to the Chesapeake Bay Program.* Penn State College of Agricultural Sciences. 91 p.

Appendix 1:

Producer Survey

VCE Virginia Farmer Survey 10.13.2020

Start of Block: Introduction and Demographics

ID1
Virginia Farmer Survey of
Best Management Practices Application

Dear friend,

We hope you will consider participating in this survey to help us learn more about voluntary conservation practices on Virginia farms in the Chesapeake Bay watershed like yours! The information you provide will help Virginia tell the story of what farmers are doing to conserve soil and improve water quality. This is incredibly important information that can help agriculture to achieve its water quality goals for the Watershed Implementation Plan III for the Chesapeake Bay.

This survey was crafted over many months by members of Virginia's Voluntary Agricultural Best Management Practices Task Force. Task force members worked closely together and include representatives from the: Natural Resources Conservation Service, Virginia Association of Soil and Water Conservation Districts, Virginia Department of Conservation and Recreation, Virginia Agribusiness Council, Virginia Cooperative Extension, Virginia Department of Agriculture and Consumer Services, Virginia Department of Forestry, Virginia Farm Bureau, and Virginia Tech Office of Analytics and Institutional Effectiveness, among other partners.

Your privacy is very important to us. When completing this survey please know that your responses will be protected and the final survey results will never be associated with your name or location information. For more information about participant confidentiality and what happens after the survey closes, please visit the frequently asked questions portion of the survey webpage located here: https://vaswcd.org/virginia-farm-voluntary-agricultural-bmp-inventory.

Please answer each question the best you know how. You will be able to more quickly and completely answer the survey questions if you have the following information with you:

BMP contracts
Nutrient Management Plan USDA “Producer Farm Data Report” Farm, tract, and field acreage data
Farm records on crops and fertilization, length of fence, length and width of buffers

The first part of this inventory asks basic questions about your farming operation(s). The rest of this inventory asks whether you are practicing certain conservation practices in your farming operations, and then asks some additional questions about each practice. Some of the practices listed may not apply to your farming operation. If you do not utilize a practice, please answer “No” and continue on to the next question. Throughout the survey, you will see references to the following acronyms, which we have spelled out below for your convenience:

DCR - Department of Conservation and Recreation
SWCD - Soil and Water Conservation Districts
NRCS - Natural Resources Conservation Service

27 **Please complete this survey by March 12, 2021. The survey is set up so that your answers will automatically save and you can come back to it in the same web browser on the same computer.**

If you need help completing the survey please contact your local Extension office or local Soil and Water Conservation District office.

We sincerely appreciate your time and effort with this survey and the hard work you do every day to be stewards of the land and provide Virginians and others with a safe and stable food supply.

Sincerely,

Virginia’s Voluntary Agricultural Best Management Practices Task Force

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ID1a The first set of questions below asks for some details about your farming operation. If you have autofill, please ensure that it has not improperly filled in any questions.

For the purposes of this survey, we would like to know about your farming practices that take place ***only in Virginia in the Chesapeake Bay***

Watershed. If your farming operation crosses state lines, please only respond with the practices that are used in Virginia in the watershed. If you are not sure whether your operation is located within the Chesapeake Bay Watershed, you can look up your address on this interactive map (click here). If your farming operation is not located in the watershed, then you should not take this survey.

ID2 Please enter your name:

- First Name _____
- Middle Initial _____
- Last Name _____
- Suffix (Jr., Sr., III, etc.) _____

ID3 Please enter your home address:

_____

ID4 City/Town (If your city or town is not listed, please select "Other" at the bottom of the list):

▼ Abingdon (Washington County) ... Other

ID4a If you selected "Other" and your city/town was not listed in the previous question, please enter your city/town here:

_____

ID5 County:

▼ Accomack ... N/A - I live in a city.

*

ID6 ZIP code:

_____

ID7 Please name the county or city in which you farm, along with corresponding acreage. Counties are listed first in the dropdown menus below, and cities are listed after counties. If you farm in multiple counties, please use the additional rows provided to list them all:

	County/City	Acreage
		(Nearest Whole Number)
County/City #1	▼ Accomack ... Winchester	
County/City #2	▼ Accomack ... Winchester	
County/City #3	▼ Accomack ... Winchester	
County/City #4	▼ Accomack ... Winchester	
County/City #5	▼ Accomack ... Winchester	

ID8 If you are comfortable doing so, please provide your email address and phone number (answering this question is not required):

- ○ Email Address _____
- ○ Phone Number _____

End of Block: Introduction and Demographics

Start of Block: Manure

M1 In this set of questions, we will ask you about your best management practices on your farming operations in Virginia related to manure use and/or storage.

M2 Did you apply manure in 2020 (for the purpose of this survey, manure does not include biosolids)?

- ○ Yes
- ○ No

M3 When you applied manure, did you inject or incorporate the manure?

- ○ Yes
- ○ No

M4 Please indicate the total acres for each manure injection/incorporation method listed below with the timing of manure incorporation. (Please use the nearest whole number)

	Within 24 hours after application	Within 1-3 days after application
Low-disturbance incorporation (ex: vertical tillage or rolling tine aerators)		
High-disturbance incorporation (ex: any other tillage system, which may include chisel plow, moldboard plow, aggressive disking, etc.)		
Immediate injection (ex: shallow disk or narrow shank injectors)		

M5 Do you have any animal waste storage systems (manure storages) for your farming operations?

- ○ Yes
- ○ No

M6 Please answer the following questions regarding your manure storage. Please use additional lines if you have more than one manure storage system.

	Type Of Animal							Months of Storage Provided	Was the storage installed with cost share under DCR, SWCD, NRCS funds or tax credits?		Was a certified engineer design used to construct the storage?		Month Storage was Constructed	Year Storage was Constructed	Is the storage maintained under a current cost share contract?		Number of Animals	Type of Storage
	Dairy	Beef	Swine	Poultry	Equine	Goat	Sheep/Lambs	(Nearest Whole Number)	Yes	No	Yes	No	(MM)	(YYYY)	Yes	No	(Nearest Whole Number)	(Lagoon, Pond, Pit, etc.)
Manure Storage System	○	○	○	○	○	○	○		○	○	○	○			○	○		
Additional Manure Storage	○	○	○	○	○	○	○		○	○	○	○			○	○		
Additional Manure Storage	○	○	○	○	○	○	○		○	○	○	○			○	○		

End of Block: Manure

Start of Block: Nutrient Management

NM1 In the next set of questions, we will ask you about your best management practices on your farming operations in Virginia related to nutrient management.

NM2 Do you have a current nutrient management plan for your farming operations?

- Yes
- No

NM3 Please answer the following questions regarding your nutrient management plan:

	Number of Acres Covered in Plan (Please answer in numerical format)	Was your plan developed with cost share under DCR, SWCD, or NRCS funds or tax credits?		Do you follow your plan when you apply nutrients to your land?		Do you keep nutrient application records in accordance with your plan?		Month Plan was Written or Updated	Year Plan was Written or Updated	Is your plan supported under a current cost share contract?	
	(Nearest Whole Number)	Yes	No	Yes	No	Yes	No	(MM)	(YYYY)	Yes	No
Nutrient Management Plan		○	○	○	○	○	○			○	○

NM4 Next we would like to ask you about the specifics of your nitrogen applications. In calendar year 2020, did you follow any of the practices described below that affect the rate of your nitrogen applications? If yes, please indicate the number of acres on which you used the practice.

	Did you use this practice?		If yes, on how many acres?
	Yes	No	(Nearest Whole Number)
Nitrogen was applied to crop by multiple lower rate split applications made throughout the growing year (ex: corn side-dress, small grain split applications, etc.)	○	○	
Nitrogen was applied while maintaining a setback of 100 feet from any wellheads or springs used for drinking water and 100 feet (or 35 feet if there is a permanent vegetative buffer) from any streams, lakes, ponds or sinkholes.	○	○	
Nitrogen was applied at variable rates **OR** at the sub-field level based on variable crop response data from historical records or Pre-side dress Nitrate Test (PSNT), chlorophyll meter, NDVI sensor, plant sampling, nitrogen modeling, etc.	○	○	

NM5 Next we would like to ask you about your phosphorus applications. In calendar year 2020, did you follow any of the practices described below that affect the rate of your phosphorus applications? If yes, please indicate the number of acres on which you used the practice.

	Did you use this practice?		If yes, on how many acres?
	Yes	No	(Nearest Whole Number)
Applications of manure were based on annual crop removal of phosphorus rather than nitrogen.	○	○	
Phosphorus was applied while maintaining a setback of 100 feet from any wellheads or springs used for drinking water and 100 feet (or 35 feet if there is a permanent vegetative buffer) from any streams, lakes, ponds or sinkholes.	○	○	
Phosphorus was applied at variable rates at the sub-field level based on crop response data from historical records or tools like optical crop sensors.	○	○	

End of Block: Nutrient Management

Start of Block: Barnyards

B1 In next set of questions, we will ask you about your best management practices on your farming operations in Virginia related to barnyards.

B2 Do you have any barnyards where animals are kept on your operation?

- ○ Yes
- ○ No

B3 Do you have any barnyard runoff controls on these barnyards? (This includes practices that divert clean water from entering the barnyard, provide stabilized surfaces in the barnyard, and control runoff from barnyard areas).

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- ○ Yes
- ○ No

B4 Do you use diversions to direct clean water runoff away from barnyards (such as roof gutters, downspouts, and outlets to send runoff away from barnyards)?

- ○ Yes
- ○ No

*

B5 Please answer the following questions about your use of water diversions:

	Was this practice installed with cost share under DCR, SWCD, or NRCS funds or tax credits?		Type and Number of Animals to Which This Practice is Applied (Please answer in numerical format)							Month Practice was Constructed	Year Practice was Constructed	Is this practice maintained under a current cost share contract?	
	Yes	No	Dairy	Beef	Swine	Poultry	Equine	Goat	Sheep/Lambs	(MM)	(YYYY)	Yes	No
Barnyard water diversion.	○	○										○	○

B5a If you have additional barnyard water diversions, please describe them below:

	Was this practice installed with cost share under DCR, SWCD, or NRCS funds or tax credits?		Type and Number of Animals to Which This Practice is Applied (Please answer in numerical format)							Month Practice was Constructed	Year Practice was Constructed	Is this practice maintained under a current cost share contract?	
	Yes	No	Dairy	Beef	Swine	Poultry	Equine	Goat	Sheep/Lambs	(MM)	(YYYY)	Yes	No
Additional barnyard water diversion.	○	○										○	○
Additional barnyard water diversion.	○	○										○	○

B6 Do you use a stabilized barnyard surface with concrete, stone aggregate, or other suitable materials?

- ○ Yes
- ○ No

B7 Please answer the following questions about your use of stabilized barnyard surfaces:

	Was this practice installed with cost share under DCR, SWCD, or NCRS funds or tax credits?		Type and Number of Animals to Which This Practice is Applied (Please answer in numerical format)							Month Practice was Constructed	Year Practice was Constructed	Is this practice maintained under a current cost share contract?	
	Yes	No	Dairy	Beef	Swine	Poultry	Equine	Goat	Sheep/Lambs	(MM)	(YYYY)	Yes	No
Stabilized barnyard surface.	○	○										○	○

B7a If you have additional stabilized barnyard surfaces, please describe them below:

	Was this practice installed with cost share under DCR, SWCD, or NRCS funds or tax credits?		Type and Number of Animals to Which This Practice is Applied (Please answer in numerical format)							Month Practice was Constructed	Year Practice was Constructed	Is this practice maintained under a current cost share contract?	
	Yes	No	Dairy	Beef	Swine	Poultry	Equine	Goat	Sheep/Lambs	(MM)	(YYYY)	Yes	No
Additional stabilized barnyard surface	○	○										○	○
Additional stabilized barnyard surface	○	○										○	○

B8 Do you use a system to catch barnyard runoff and direct it to storage or a stabilized vegetated filter area?

○ Yes

○ No

B9 Please answer the following questions about your system to direct barnyard runoff:

	Was this practice installed with cost share under DCR, SWCD, or NRCS funds or tax credits?		Type and Number of Animals to Which This Practice is Applied (Please answer in numerical format)							Month Practice was Constructed	Year Practice was Constructed	Is this practice maintained under a current cost share contract?	
	Yes	No	Dairy	Beef	Swine	Poultry	Equine	Goat	Sheep/Lambs	(MM)	(YYYY)	Yes	No
System to direct barnyard runoff.	○	○										○	○

B9a If you have additional systems for directing barnyard runoff, please describe them below:

	Was this practice installed with cost share under DCR, SWCD, or NRCS funds or tax credits?		Type and Number of Animals to Which This Practice is Applied (Please answer in numerical format)							Month Practice was Constructed	Year Practice was Constructed	Is this practice maintained under a current cost share contract?	
	Yes	No	Dairy	Beef	Swine	Poultry	Equine	Goat	Sheep/Lambs	(MM)	(YYYY)	Yes	No
Additional system to direct barnyard runoff.	○	○										○	○
Additional system to direct barnyard runoff.	○	○										○	○

End of Block: Barnyards

Start of Block: Pastures

P1 In the next set of questions, we will ask you about your best management practices on your farming operations in Virginia related to pasture management.

P2 Do you have any pastures where you graze animals?

- Yes
- No

P3 Do you follow a rotational grazing plan or practice?

- Yes
- No

45 P4 Please answer the following questions about your rotational grazing practices:

	Was this practice installed with cost share under DCR, SWCD, or NRCS funds or tax credits?		Acres on Which Rotational Grazing is Applied	Month Your Plan was Written or Last Updated	Year Your Plan was Written or Last Updated	Is this practice maintained under a current cost share contract?	
	Yes	No	(Nearest Whole Number)	(MM)	(YYYY)	Yes	No
Rotational grazing practices.	○	○				○	○

End of Block: Pastures

Start of Block: Conservation Planning

CP1 In the next set of questions, we will ask you about your best management practices on your farming operations in Virginia related to conservation planning.

CP2 Do you have a current conservation plan for your farming operation?

- ○ Yes
- ○ No

CP3 Please answer the following questions about your conservation plan:

	Number and Use of Acres Covered by Plan			Was your plan developed with cost share under DCR, SWCD, or NRCS funds or tax credits?		Are you on schedule for implementing this plan?		Month Your Plan was Written or Last Updated	Year Your Plan was Written or Last Updated	Is your plan supported by a current cost share contract?	
	Row Crops	Hay	Pasture	Yes	No	Yes	No	(MM)	(YYYY)	Yes	No
Conservation Plan				○	○	○	○			○	○

CP4 My conservation plan is a (please check all that apply):

- [ ] DCR Resource Management Plan
- [ ] SWCD Conservation Plan
- [ ] Grazing Management Plan
- [ ] Chesapeake Bay Act Agricultural Plan
- [ ] NRCS Conservation Plan

End of Block: Conservation Planning

Start of Block: Tilling

T1 In this set of questions, we will ask you about your best management practices on your farming operations in Virginia related to tillage.

T2 Did you practice no till or minimum till in calendar year 2020?

- ○ Yes
- ○ No

T3 The following questions are about your tilling practices and field residue. **If you are unsure of the actual number of acres, please provide your best estimates**. A visual representation of different residue levels is available here to assist you.

	Number of Acres on Which the Following Amounts of Residue were Left in the Field at the Time of Planting (Nearest Whole Number)		
	60% or Greater	30% to 59%	15% to 29%
Tilling practices.			

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End of Block: Tilling

Start of Block: Cover Crops

CC1 In this set of questions, we will ask you about your best management practices on your farming operations in Virginia related to cover crops.

CC2 Did you plant cover crops or winter crops in calendar year 2020?

- ○ Yes
- ○ No

CC3 Virginia Planting Dates Table. This table is provided to help with filling in the tables below.

Region	Early Planting	Standard Planting	Late Planting
Cities of Chesapeake & VA	November 10	November 30	After November 30
Coastal Plain (includes Eastern Shore)	October 25	November 15	After November 15
Piedmont	October 10	November 1	After November 1
Mountain and Valley	October 5	October 25	After October 25

CC4 Please tell us about the cover crops you planted in 2020. If you planted more than 6 cover crops, please use the additional table below. (While six rows were provided, only three are shown here for legibility).

	What did you plant?	How did you plant it?	When did you plant it? (Please use the planting table above (CC3), to determine whether your planting was "early," "normal," or "late")			Did you apply a fall nutrient manure treatment?		Did you apply a spring nutrient manure treatment? (Before March 1st)		Were DCR, SWCD, or NRCS funds or tax credits used to support your use of cover crop?		Number of Acres Planted	Number of Acres to be Harvested in Spring
			Early	Normal	Late	Yes	No	Yes	No	Yes	No	(Nearest Whole Number)	(Nearest Whole Number)
Cover crop #1	▼ Wheat ... Mix or Other	▼ Drilled with seed drill ... Other	○	○	○	○	○	○	○	○	○		
Cover crop #2	▼ Wheat ... Mix or Other	▼ Drilled with seed drill ... Other	○	○	○	○	○	○	○	○	○		
Cover crop #3	▼ Wheat ... Mix or Other	▼ Drilled with seed drill ... Other	○	○	○	○	○	○	○	○	○		

CC5 Please tell us about your additional cover crops in the table below: (While six rows were provided, only three are shown here for legibility)

	What did you plant?	How did you plant it?	When did you plant it? (Please use the planting table above (CC3), to determine whether your planting was "early," "normal," or "late")			Did you apply a fall nutrient manure treatment?		Did you apply a spring nutrient manure treatment? (Before March 1st)		Were DCR, SWCD, or NRCS funds or tax credits used to support your use of cover crop?		Number of Acres Planted	Number of Acres to be Harvested in Spring
			Early	Normal	Late	Yes	No	Yes	No	Yes	No	(Nearest Whole Number)	(Nearest Whole Number)
Cover crop #7	▼ Wheat ... Mix or Other	▼ Drilled with seed drill ... Other	○	○	○	○	○	○	○	○	○		
Cover crop #8	▼ Wheat ... Mix or Other	▼ Drilled with seed drill ... Other	○	○	○	○	○	○	○	○	○		
Cover crop #9	▼ Wheat ... Mix or Other	▼ Drilled with seed drill ... Other	○	○	○	○	○	○	○	○	○		

End of Block: Cover Crops

Start of Block: Waterways

W1 In this set of questions, we will ask you about your best management practices on your farming operations in Virginia related to streams and waterways.

W2 Are there any streams or waterways on the lands that are part of your farming operation?

- ○ Yes
- ○ No

W3 Do you maintain permanent vegetation of a minimum width of at least 10 feet between the stream bank or waterway and any of your **hayland or cropland**?

- ○ Yes
- ○ No

W4 For all such areas **between streams and haylands or croplands** on your farming operation, fill out the chart below to provide additional information about this best management practice.

	Was this practice installed with cost share under DCR, SWCD, or NRCS funds or tax credits?		Total Acres of Buffer	Year Buffer was Established	Is this practice maintained under a current cost share contract?	
	Yes	No	(Nearest Whole Number)	(YYYY)	Yes	No
Grass with minimum width of at least 10 but less than 35 feet	○	○			○	○
Grass with minimum width of 35 feet or greater	○	○			○	○
Trees and/or shrubs with minimum width between 10 feet and 35 feet	○	○			○	○
Trees and/or shrubs with minimum width of 35 feet or greater	○	○			○	○

W5 Do you maintain permanent vegetation of a minimum width of at least 10 feet between the stream bank or waterway and any **pastures** that are part of your operation?

- ○ Yes
- ○ No

W6 For all such areas **between streams and pastures** on your farming operation, fill out the chart below to provide additional information about this best management practice.

	Was this practice installed with cost share under DCR, SWCD, or NRCS funds or tax credits?		Total Acres of Buffer	If pastures are actively used for grazing, are animals excluded from the buffer area (for example, with fencing)?		Year Buffer was Established	Is this practice maintained under a current cost share contract?	
	Yes	No	(Nearest Whole Number)	Yes	No	(YYYY)	Yes	No
Grass with minimum width of at least 10 but less than 35 feet	○	○		○	○		○	○
Grass with minimum width of 35 feet or greater	○	○		○	○		○	○
Trees and/or shrubs with minimum width between 10 feet and 35 feet	○	○		○	○		○	○
Trees and/or shrubs with minimum width of 35 feet or greater	○	○		○	○		○	○

End of Block: Waterways

Start of Block: Survey End

SE1 Thank you for completing the Virginia Farmer Survey. We invite you to provide additional information in the optional questions below, which will help us in improving how we communicate with and serve Virginia farmers.

SE2 For one or more best management practices, if you are not participating in the Virginia Agriculture BMP Cost Share (VACS) Soil and Water Program, please tell us why not?

_____

_____

_____

_____

_____

SE3 Would changes to the VACS Program allow you to participate? Your feedback will allow the VACS program, DCR and the SWCDs to improve services.

_____

SE4 What other additional comments do you have about the VACS Program or this survey?

_____

SE5 Please indicate how you found out about this survey (check all that apply).

- [ ] Newspaper
- [ ] Search Engine
- [ ] Direct Email
- [ ] Website
- [ ] Farmer Recommendation
- [ ] Other: _____

End of Block: Survey End

Appendix 2:

Marketing Materials

VIRGINIA FARM VOLUNTARY AGRICULTURAL BEST MANAGEMENT PRACTICES INVENTORY

We hope you will consider participating in this survey to help us learn more about voluntary conservation practices on Virginia farms in the Chesapeake Bay watershed… like yours! The information you provide will help Virginia tell the story of what farmers are doing to conserve soil and improve water quality. This is incredibly important information that can help agriculture achieve its water quality goals for the Watershed Implementation Plan for the Chesapeake Bay.

For more information please visit
https://vaswcd.org/virginia-farm-voluntary-agricultural-bmp-inventory
or contact your local Extension or SWCD office.

Virginia Cooperative Extension
Virginia Tech • Virginia State University

Virginia Association of SWCD
Soil & Water Conservation Districts

DCR
Virginia Department of Conservation & Recreation

Farm Bureau Virginia

USDA United States Department of Agriculture
Natural Resources Conservation Service

Virginia Agribusiness Council
The Unified Voice of Agribusiness

Virginia Department of Agriculture and Consumer Services

Virginia Cooperative Extension
Virginia Tech • Virginia State University

For immediate release:

Survey of Farm Conservation Practices in the Chesapeake Bay Watershed

If you're a farm operator in Virginia's Chesapeake Bay watershed region, you soon will have a chance to highlight your contributions to conserve soil and improve water quality. "This is incredibly important information that can help Virginia achieve its water quality goals for the Watershed Implementation Plan for the Chesapeake Bay," observed Dr. Ed Jones, Director, Virginia Cooperative Extension.

The survey was crafted over many months by members of Virginia's Voluntary Agricultural Best Management Practices Task Force. Task force members worked closely together and include representatives from the: Natural Resources Conservation Service, Virginia Association of Soil and Water Conservation Districts, Virginia Department of Conservation and Recreation, Virginia Agribusiness Council, Virginia Cooperative Extension, Virginia Department of Agriculture and Consumer Services, Virginia Department of Forestry, Virginia Farm Bureau, and Virginia Tech Office of Analytics and Institutional Effectiveness, among other partners. Virginia Cooperative Extension/Virginia Tech serves as the survey administrator.

During development of Virginia's Chesapeake Bay Watershed Implementation Plan (WIP), farmers noted that many of the conservation practices that they have voluntarily implemented over the years are not accounted for in tracking the progress made toward meeting priority water quality goals, including improvements in Chesapeake Bay water quality. Responding to those concerns, the final WIP called for development of this survey.

"Virginia agriculture has done much to improve water quality in our local rivers and streams and the Chesapeake Bay," said Martha Moore, Vice President of Governmental Relations at Virginia Farm Bureau Federation. "We have always said that farmers are utilizing more conservation practices than what is reported into the Chesapeake Bay model. This survey will help prove this fact and why it is so important for farmers to fill out this survey."

"While farmers often receive cost-share support to implement certain conservation practices, they also invest their own time and money to establish conservation practices voluntarily," said Clyde Cristman, Director of the Virginia Department of Conservation and Recreation. "This survey will enable farmers in Virginia's Chesapeake Bay watershed to share conservation practices that they have voluntarily established or continued to maintain after the cost-share has expired."

Kendall Tyree, Executive Director of the Virginia Association of Soil and Water Conservation Districts, observed that the survey data will also help inform technical assistance and educational programs. "This is a great opportunity to learn about ways to enhance producer programs," Tyree said, "particularly those that assist producers with expanding best management practices implementation."

“I am proud of the work Virginia farmers have performed to conserve soil and improve water quality," said Virginia Department of Agriculture and Consumer Services Commissioner Jewel Bronaugh. "In addition to acknowledging their work, this survey will help identify areas of improvement and best practices."

The survey will respect participant confidentiality. For more information about the survey, frequently asked questions, or to access the survey link online, please visit https://vaswcd.org/virginia-farm-voluntary-agricultural-bmp-inventory . Participants are asked to submit their responses by March 12, 2021.

Virginia Farm

Voluntary Agricultural Best Management Practices Inventory

Dear friend,

We hope you will consider participating in this survey to help us learn more about voluntary conservation practices on Virginia farms in the Chesapeake Bay watershed…like yours! The information you provide will help Virginia tell the story of what farmers are doing to conserve soil and improve water quality. This is incredibly important information that can help agriculture achieve its water quality goals for the Watershed Implementation Plan for the Chesapeake Bay.

This survey was crafted over many months by members of Virginia's Voluntary Agricultural Best Management Practices (BMP) Task Force. Task force members worked closely together and include representatives from the: Natural Resources Conservation Service, Virginia Association of Soil and Water Conservation Districts, Virginia Department of Conservation and Recreation, Virginia Agribusiness Council, Virginia Cooperative Extension, Virginia Department of Agriculture and Consumer Services, Virginia Department of Forestry, Virginia Farm Bureau, and Virginia Tech Office of Analytics and Institutional Effectiveness, among other partners.

Your privacy is very important to us. When completing this survey please know that your responses will be protected and the final survey results will never be associated with your name or location information. For more information about participant confidentiality and what happens after the survey closes, please visit the frequently asked questions portion of the survey webpage located here: https://vaswcd.org/virginia-farm-voluntary-agricultural-bmp-inventory.

Please answer each question the best you know how. You will be able to more quickly and completely answer the survey questions if you have copies of your nutrient management plan(s) and any BMP contracts with you.

Please complete the survey by March 12, 2021 by clicking on this link: https://tinyurl.com/VAfarmersurvey . If you need help completing the survey please contact your local Extension office or local Soil and Water Conservation District office.

We sincerely appreciate your time and effort with this survey and the hard work you do every day to be stewards of the land and provide Virginians and others with a safe and stable food supply.

Sincerely,

Virginia's Voluntary Agricultural Best Management Practices Task Force

Appendix 3:

Staff Training Agenda

Virginia Farm Voluntary Agricultural Best Management Practices Inventory Project

In-service Training

January 8, 2021

10:00a.m. – 11:15a.m.

10:00a.m. Welcome to First Fridays: Hermon Maclin, Extension agent, VCE-Prince George County

10:00a.m. Opening Remarks – Dr. Dan Goerlich, Associate Director, Virginia Cooperative Extension

10:05a.m. Virginia Farm Voluntary Agricultural Best Management Practices Project Background and Goals – Ann Jennings, Deputy Secretary of Natural Resources for the Chesapeake Bay, Office of the Secretary of Natural Resources

10:15a.m. Survey Walkthrough: Dr. Lauren Bryant, Assistant Director, Virginia Tech Office of Analytics and Institutional Effectiveness

10:30a.m. Website Overview: Dr. Kendall Tyree, Executive Director, Virginia Association of Soil and Water Conservation Districts

10:40a.m. Farmer Outreach: Martha Moore, Vice President Governmental Relations, Virginia Farm Bureau Federation

10:50a.m. Next Steps and Follow-up: Dr. Dan Goerlich, Associate Director, Virginia Cooperative Extension

11:00a.m. Questions

11:15a.m. Adjourn

Appendix 4:

Site Visit Training Agenda

Virginia Farm Voluntary Agricultural Best Management Practices Inventory Project

In-service Training, Raphine, VA

January 8, 2021

- 9:00a.m. - 9:15a.m. - Welcome and Introductions / Project Review (15")
- 9:15a.m. - 11:00a.m. - Review Follow-up Survey and Relevant Corresponding Technical Information (1.5 hrs)
- 11:00-12:00p.m. Visit Sites at the AREC to Practice Making Determinations and Filling out the Form (animal systems)
- 12:00p.m. Lunch
- 12:45p.m. – 1:30p.m. Review Additional Topics at AREC
- 1:30p.m. – 3:30p.m. Visit Sites at Dairy Farm to Practice Making Determinations and Filling out the Form (cropping systems)
- 3:30p.m. Adjourn

Appendix 5:

Site Visit Survey

VCE Virginia Farmer On-Site Survey

Start of Block: Introduction and Demographics

ID1
Virginia Farmer Survey
Farm Visit Report

ID2 Name of Individual Completing Report:

_____

ID3 Date the on-site visit was conducted:

_____

ID4 Survey Number:

_____

End of Block: Introduction and Demographics

Start of Block: Manure

M2 Did the producer apply manure in 2020 (for the purpose of this survey, manure does not include biosolids)?

- ○ Yes
- ○ No

M3 When the producer applied manure, did they inject or incorporate the manure? If yes, please answer M4.

- ○ Yes
- ○ No

M4 Please indicate the total acres for each manure injection/incorporation method listed below with the timing of manure incorporation. (Please use the nearest whole number)

	Within 24 hours after application	Within 1-3 days after application
Low-disturbance incorporation (ex: vertical tillage or rolling tine aerators)		
High-disturbance incorporation (ex: any other tillage system, which may include chisel plow, moldboard plow, aggressive disking, etc.)		
Immediate injection (ex: shallow disk or narrow shank injectors)		

M5 Does the producer have any animal waste storage systems (manure storages) for their farming operations? If yes, please answer M6.

- ○ Yes
- ○ No

M6 Please answer the following questions regarding the producer's manure storage. Please use the additional table below if they have more than three manure storage systems.

	Type Of Animal							Months of Storage Provided	Was the storage installed with cost share under DCR, SWCD, NRCS funds or tax credits?		Was a certified engineer design used to construct the storage?		Month Storage was Constructed	Year Storage was Constructed	Is the storage maintained under a current cost share contract?		Number of Animals	Type of Storage
	Dairy	Beef	Swine	Poultry	Equine	Goat	Sheep/Lambs	(Nearest Whole Number)	Yes	No	Yes	No	(MM)	(YYYY)	Yes	No	(Nearest Whole Number)	(Lagoon, Pond, Pit, etc.)
Manure Storage System	○	○	○	○	○	○	○		○	○	○	○			○	○		
Additional Manure Storage	○	○	○	○	○	○	○		○	○	○	○			○	○		
Additional Manure Storage	○	○	○	○	○	○	○		○	○	○	○			○	○		

	Type Of Animal							Months of Storage Provided	Was the storage installed with cost share under DCR, SWCD, NRCS funds or tax credits?		Was a certified engineer design used to construct the storage?		Month Storage was Constructed	Year Storage was Constructed	Is the storage maintained under a current cost share contract?		Number of Animals	Type of Storage
	Dairy	Beef	Swine	Poultry	Equine	Goat	Sheep/Lambs	(Nearest Whole Number)	Yes	No	Yes	No	(MM)	(YYYY)	Yes	No	(Nearest Whole Number)	(Lagoon, Pond, Pit, etc.)
Additional Storage System	○	○	○	○	○	○	○		○	○	○	○			○	○		
Additional Manure Storage	○	○	○	○	○	○	○		○	○	○	○			○	○		

End of Block: Manure

Start of Block: Nutrient Management

NM2 Does the producer have a current nutrient management plan for their farming operations? If yes, please answer NM3.

- ○ Yes
- ○ No

NM3 Please answer the following questions regarding the producer's nutrient management plan:

	Number of Acres Covered in Plan (Please answer in numerical format)	Was the plan developed with cost share under DCR, SWCD, or NRCS funds or tax credits?		Does the producer follow the plan when they apply nutrients to their land?		Does the producer keep nutrient application records in accordance with their plan?		Month Plan was Written or Updated	Year Plan was Written or Updated	Is the plan supported under a current cost share contract?	
	(Nearest Whole Number)	Yes	No	Yes	No	Yes	No	(MM)	(YYYY)	Yes	No
Nutrient Management Plan		○	○	○	○	○	○			○	○

NM4 In calendar year 2020, did the producer follow any of the practices described below that affect the rate of their nitrogen applications? If yes, please indicate the number of acres on which they used the practice.

	Did the producer use this practice?		If yes, on how many acres?
	Yes	No	(Nearest Whole Number)
Nitrogen was applied to crop by multiple lower rate split applications made throughout the growing year (ex: corn side-dress, small grain split applications, etc.)	○	○	
Nitrogen was applied while maintaining a setback of 100 feet from any wellheads or springs used for drinking water and 100 feet (or 35 feet if there is a permanent vegetative buffer) from any streams, lakes, ponds or sinkholes.	○	○	
Nitrogen was applied at variable rates **OR** at the sub-field level based on variable crop response data from historical records or Pre-side dress Nitrate Test (PSNT), chlorophyll meter, NDVI sensor, plant sampling, nitrogen modeling, etc.	○	○	

NM5 In calendar year 2020, did the producer follow any of the practices described below that affect the rate of their phosphorus applications? If yes, please indicate the number of acres on which they used the practice.

	Did the producer use this practice?		If yes, on how many acres?
	Yes	No	(Nearest Whole Number)
Applications of manure were based on annual crop removal of phosphorus rather than nitrogen.	○	○	
Phosphorus was applied while maintaining a setback of 100 feet from any wellheads or springs used for drinking water and 100 feet (or 35 feet if there is a permanent vegetative buffer) from any streams, lakes, ponds or sinkholes.	○	○	
Phosphorus was applied at variable rates at the sub-field level based on crop response data from historical records or tools like optical crop sensors.	○	○	

End of Block: Nutrient Management

Start of Block: Barnyards

B2 Does the producer have any barnyards where animals are kept on their operation?

- ○ Yes
- ○ No

B3 Does the producer have any barnyard runoff controls on these barnyards? (This includes practices that divert clean water from entering the barnyard, provide stabilized surfaces in the barnyard, and control runoff from barnyard areas).

- ○ Yes
- ○ No

B4 Does the producer use diversions to direct clean water runoff away from barnyards (such as roof gutters, downspouts, and outlets to send runoff away from barnyards)? If yes, please answer B5.

- ○ Yes
- ○ No

B5 Please answer the following questions about the producer's use of water diversions:

	Was this practice installed with cost share under DCR, SWCD, or NRCS funds or tax credits?		Type and Number of Animals to Which This Practice is Applied (Please answer in numerical format)							Month Practice was Constructed	Year Practice was Constructed	Is this practice maintained under a current cost share contract?	
	Yes	No	Dairy	Beef	Swine	Poultry	Equine	Goat	Sheep/Lambs	(MM)	(YYYY)	Yes	No
Barnyard water diversion.	○	○										○	○

B5a If the producer has additional barnyard water diversions, please describe them below:

	Was this practice installed with cost share under DCR, SWCD, or NRCS funds or tax credits?		Type and Number of Animals to Which This Practice is Applied (Please answer in numerical format)							Month Practice was Constructed	Year Practice was Constructed	Is this practice maintained under a current cost share contract?	
	Yes	No	Dairy	Beef	Swine	Poultry	Equine	Goat	Sheep/Lambs	(MM)	(YYYY)	Yes	No
Additional barnyard water diversion.	○	○										○	○
Additional barnyard water diversion.	○	○										○	○

B6 Does the producer use a stabilized barnyard surface with concrete, stone aggregate, or other suitable materials? If yes, please answer B7.

- ○ Yes
- ○ No

B7 Please answer the following questions about the producer's use of stabilized barnyard surfaces:

	Was this practice installed with cost share under DCR, SWCD, or NCRS funds or tax credits?		Type and Number of Animals to Which This Practice is Applied (Please answer in numerical format)							Month Practice was Constructed	Year Practice was Constructed	Is this practice maintained under a current cost share contract?	
	Yes	No	Dairy	Beef	Swine	Poultry	Equine	Goat	Sheep/Lambs	(MM)	(YYYY)	Yes	No
Stabilized barnyard surface.	○	○										○	○

B7a If the producer has additional stabilized barnyard surfaces, please describe them below:

	Was this practice installed with cost share under DCR, SWCD, or NRCS funds or tax credits?		Type and Number of Animals to Which This Practice is Applied (Please answer in numerical format)							Month Practice was Constructed	Year Practice was Constructed	Is this practice maintained under a current cost share contract?	
	Yes	No	Dairy	Beef	Swine	Poultry	Equine	Goat	Sheep/Lambs	(MM)	(YYYY)	Yes	No
Additional stabilized barnyard surface	○	○										○	○
Additional stabilized barnyard surface	○	○										○	○

B8 Does the producer use a system to catch barnyard runoff and direct it to storage or a stabilized vegetated filter area? If yes, please answer B9.

- ○ Yes
- ○ No

B9 Please answer the following questions about the producer's system to direct barnyard runoff:

	Was this practice installed with cost share under DCR, SWCD, or NRCS funds or tax credits?		Type and Number of Animals to Which This Practice is Applied (Please answer in numerical format)							Month Practice was Constructed	Year Practice was Constructed	Is this practice maintained under a current cost share contract?	
	Yes	No	Dairy	Beef	Swine	Poultry	Equine	Goat	Sheep/Lambs	(MM)	(YYYY)	Yes	No
System to direct barnyard runoff.	○	○										○	○

B9a If the producer has additional systems for directing barnyard runoff, please describe them below:

	Was this practice installed with cost share under DCR, SWCD, or NRCS funds or tax credits?		Type and Number of Animals to Which This Practice is Applied (Please answer in numerical format)							Month Practice was Constructed	Year Practice was Constructed	Is this practice maintained under a current cost share contract?	
	Yes	No	Dairy	Beef	Swine	Poultry	Equine	Goat	Sheep/Lambs	(MM)	(YYYY)	Yes	No
Additional system to direct barnyard runoff.	○	○										○	○
Additional system to direct barnyard runoff.	○	○										○	○

End of Block: Barnyards

Start of Block: Pastures

P2 Does the producer have any pastures where they graze animals?

- ○ Yes
- ○ No

P3 Does the producer follow a rotational grazing plan or practice? If yes, please answer P4.

- ○ Yes
- ○ No

83 P4 Please answer the following questions about the producer's rotational grazing practices:

	Was this practice installed with cost share under DCR, SWCD, or NRCS funds or tax credits?		Acres on Which Rotational Grazing is Applied	Month the Plan was Written or Last Updated	Year the Plan was Written or Last Updated	Is this practice maintained under a current cost share contract?	
	Yes	No	(Nearest Whole Number)	(MM)	(YYYY)	Yes	No
Rotational grazing practices.	○	○				○	○

End of Block: Pastures

Start of Block: Conservation Planning

CP2 Does the producer have a current conservation plan for their farming operation? If yes, please answer CP3.

- ○ Yes
- ○ No

CP3 Please answer the following questions about the producer's conservation plan:

	Number and Use of Acres Covered by Plan			Was the plan developed with cost share under DCR, SWCD, or NRCS funds or tax credits?		Is the producer on schedule for implementing this plan?		Month the Plan was Written or Last Updated	Year the Plan was Written or Last Updated	Is the plan supported by a current cost share contract?	
	Row Crops	Hay	Pasture	Yes	No	Yes	No	(MM)	(YYYY)	Yes	No
Conservation Plan				○	○	○	○			○	○

CP4 The producer's conservation plan is a (please check all that apply):

- [ ] DCR Resource Management Plan
- [ ] SWCD Conservation Plan
- [ ] Grazing Management Plan
- [ ] Chesapeake Bay Act Agricultural Plan
- [ ] NRCS Conservation Plan

End of Block: Conservation Planning

85 **Start of Block: Tilling**

T2 Did the producer practice no till or minimum till in calendar year 2020? If yes, please answer T3.

- ○ Yes
- ○ No

T3 The following questions are about the producer's tilling practices and field residue. **If you are unsure of the actual number of acres, please provide your best estimates**. A visual representation of different residue levels is provided below this table to assist you.

	Number of Acres on Which the Following Amounts of Residue were Left in the Field at the Time of Planting (Nearest Whole Number)		
	60% or Greater	30% to 59%	15% to 29%
Tilling practices.			


10% or 160 lbs.
wheat residue


20% or 350 lbs.
wheat residue


30% or 550 lbs.
wheat residue


40% or 790 lbs.
wheat residue

60% or 1420 lbs.
wheat residue

50% or 1080 lbs.
wheat residue

70% or 1870 lbs.
wheat residue

End of Block: Tilling

Start of Block: Cover Crops

CC2 Did the producer plant cover crops or winter crops in calendar year 2020? If yes, please answer CC4.

- ○ Yes
- ○ No

CC3 Virginia Planting Dates Table. This table is provided to help with filling in the tables below.

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Region	Early Planting	Standard Planting	Late Planting
Cities of Chesapeake & VA	November 10	November 30	After November 30
Coastal Plain (includes Eastern Shore)	October 25	November 15	After November 15
Piedmont	October 10	November 1	After November 1
Mountain and Valley	October 5	October 25	After October 25

CC4 Please tell us about the cover crops the producer planted in 2020. If they planted more than 2 cover crops, please use the additional table below. Otherwise, skip to page 30.

	What did the producer plant?					How did they plant it?					When did the producer plant it? (Please use the planting table above (CC3), to determine whether your planting was "early," "normal," or "late")			Did the producer apply a fall nutrient manure treatment?		Did the producer apply a spring nutrient manure treatment? (Before March 1st)		Were DCR, SWCD, or NRCS funds or tax credits used to support their use of cover crop?		Number of Acres Planted	Number of Acres to be Harvested in Spring
	Wheat	Rye	Annual Legume	Forage Radish	Mix or Other	Drilled with seed drill	Broadcast with incorporation	Broadcast without incorporation	Aerial seeding w/ aircraft	Other	Early	Normal	Late	Yes	No	Yes	No	Yes	No	(Nearest Whole Number)	(Nearest Whole Number)
Cover crop #1	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
Cover crop #2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		

	What did the producer plant?					How did they plant it?					When did the producer plant it? (Please use the planting table above (CC3), to determine whether your planting was "early," "normal," or "late")			Did the producer apply a fall nutrient manure treatment?		Did the producer apply a spring nutrient manure treatment? (Before March 1st)		Were DCR, SWCD, or NRCS funds or tax credits used to support their use of cover crop?		Number of Acres Planted	Number of Acres to be Harvested in Spring
	Wheat	Rye	Annual Legume	Forage Radish	Mix or Other	Drilled with seed drill	Broadcast with incorporation	Broadcast without incorporation	Aerial seeding w/ aircraft	Other	Early	Normal	Late	Yes	No	Yes	No	Yes	No	(Nearest Whole Number)	(Nearest Whole Number)
Cover crop #3	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
Cover crop #4	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		

	What did the producer plant?					How did they plant it?					When did the producer plant it? (Please use the planting table above (CC3), to determine whether your planting was "early," "normal," or "late")			Did the producer apply a fall nutrient manure treatment?		Did the producer apply a spring nutrient manure treatment? (Before March 1st)		Were DCR, SWCD, or NRCS funds or tax credits used to support their use of cover crop?		Number of Acres Planted	Number of Acres to be Harvested in Spring
	Wheat	Rye	Annual Legume	Forage Radish	Mix or Other	Drilled with seed drill	Broadcast with incorporation	Broadcast without incorporation	Aerial seeding w/ aircraft	Other	Early	Normal	Late	Yes	No	Yes	No	Yes	No	(Nearest Whole Number)	(Nearest Whole Number)
Cover crop #5	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
Cover crop #6	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		

	What did the producer plant?					How did they plant it?					When did the producer plant it? (Please use the planting table above (CC3), to determine whether your planting was "early," "normal," or "late")			Did the producer apply a fall nutrient manure treatment?		Did the producer apply a spring nutrient manure treatment? (Before March 1st)		Were DCR, SWCD, or NRCS funds or tax credits used to support their use of cover crop?		Number of Acres Planted	Number of Acres to be Harvested in Spring
	Wheat	Rye	Annual Legume	Forage Radish	Mix or Other	Drilled with seed drill	Broadcast with incorporation	Broadcast without incorporation	Aerial seeding w/ aircraft	Other	Early	Normal	Late	Yes	No	Yes	No	Yes	No	(Nearest Whole Number)	(Nearest Whole Number)
Cover crop #7	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
Cover crop #8	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		

	What did the producer plant?					How did they plant it?					When did the producer plant it? (Please use the planting table above (CC3), to determine whether your planting was "early," "normal," or "late")			Did the producer apply a fall nutrient manure treatment?		Did the producer apply a spring nutrient manure treatment? (Before March 1st)		Were DCR, SWCD, or NRCS funds or tax credits used to support their use of cover crop?		Number of Acres Planted	Number of Acres to be Harvested in Spring
	Wheat	Rye	Annual Legume	Forage Radish	Mix or Other	Drilled with seed drill	Broadcast with incorporation	Broadcast without incorporation	Aerial seeding w/ aircraft	Other	Early	Normal	Late	Yes	No	Yes	No	Yes	No	(Nearest Whole Number)	(Nearest Whole Number)
Cover crop #9	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
Cover crop #10	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		

	What did the producer plant?					How did they plant it?					When did the producer plant it? (Please use the planting table above (CC3), to determine whether your planting was "early," "normal," or "late")			Did the producer apply a fall nutrient manure treatment?		Did the producer apply a spring nutrient manure treatment? (Before March 1st)		Were DCR, SWCD, or NRCS funds or tax credits used to support their use of cover crop?		Number of Acres Planted	Number of Acres to be Harvested in Spring
	Wheat	Rye	Annual Legume	Forage Radish	Mix or Other	Drilled with seed drill	Broadcast with incorporation	Broadcast without incorporation	Aerial seeding w/ aircraft	Other	Early	Normal	Late	Yes	No	Yes	No	Yes	No	(Nearest Whole Number)	(Nearest Whole Number)
Cover crop #11	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
Cover crop #12	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		

End of Block: Cover Crops

Start of Block: Waterways

W2 Are there any streams or waterways on the lands that are part of the producer's farming operation?

- ○ Yes
- ○ No

W3 Does the producer maintain permanent vegetation of a minimum width of at least 10 feet between the stream bank or waterway and any of their **hayland or cropland**? If yes, please answer W4.

- ○ Yes
- ○ No

W4 For all such areas **between streams and haylands or croplands** on the producer's farming operation, fill out the chart below to provide additional information about this best management practice.

	Was this practice installed with cost share under DCR, SWCD, or NRCS funds or tax credits?		Total Acres of Buffer	Year Buffer was Established	Is this practice maintained under a current cost share contract?	
	Yes	No	(Nearest Whole Number)	(YYYY)	Yes	No
Grass with minimum width of at least 10 but less than 35 feet	○	○			○	○
Grass with minimum width of 35 feet or greater	○	○			○	○
Trees and/or shrubs with minimum width between 10 feet and 35 feet	○	○			○	○
Trees and/or shrubs with minimum width of 35 feet or greater	○	○			○	○

W5 Does the producer maintain permanent vegetation of a minimum width of at least 10 feet between the stream bank or waterway and any **pastures** that are part of their operation? If yes, please answer W6.

- ○ Yes
- ○ No

W6 For all such areas **between streams and pastures** on the producer's farming operation, fill out the chart below to provide additional information about this best management practice.

	Was this practice installed with cost share under DCR, SWCD, or NRCS funds or tax credits?		Total Acres of Buffer	If pastures are actively used for grazing, are animals excluded from the buffer area (for example, with fencing)?		Year Buffer was Established	Is this practice maintained under a current cost share contract?	
	Yes	No	(Nearest Whole Number)	Yes	No	(YYYY)	Yes	No
Grass with minimum width of at least 10 but less than 35 feet	○	○		○	○		○	○
Grass with minimum width of 35 feet or greater	○	○		○	○		○	○
Trees and/or shrubs with minimum width between 10 feet and 35 feet	○	○		○	○		○	○
Trees and/or shrubs with minimum width of 35 feet or greater	○	○		○	○		○	○

End of Block: Waterways

Start of Block: Other Practices

OP1 Is there an off stream watering source present?

- ○ Yes
- ○ No

OP2 Please enter the number of acres or percentage of the total recorded acres, which have the alternative watering source.

_____

OP3 Please enter the month and year the watering systems were installed.

100

	Month	Year
Please Select:		

OP4 Is a Mortality Management system in place?

- ○ Yes
- ○ No

OP5 Please enter the type of livestock covered in the Mortality Management system.

_____

OP6 Please enter the number of animals or the percentage of total annual livestock population.

_____

OP7 Please enter the composted AEUs or the average weights of mortality composted in 2019.

_____

OP8 Please enter the month and year the mortality composting system was installed.

	Month	Year
Please Select:		

OP9 Other observations:

_____

_____

_____

_____

_____

End of Block: Other Practices

This is the end of the Virginia Farmer On-Site Survey. Thank you for conducting this on-site survey. You can enter your data in at this link: https://tinyurl.com/vceonsite. If you have any issues entering your data, please contact Lauren Bryant at labryant@vt.edu.

Appendix 6:

Crosswalk of Survey Themes and Chesapeake Bay Program Conservation Practices

Survey Questions to CB Program Conservation Practices

** Survey document contains markup showing Practice ID #*

* All reported BMPs require date, name, measurement name, measurement unit, extent, and location

Practice ID	Conservation Practice	Survey Question #s	Summary	BMP WH Practice	Measures to Return
1	Manure incorporation (high disturbance within 24 hours)	M2, M3, M4b	Answered yes to M2 and M3 Acreage indicated in M4b	Manure Incorporation High Disturbance Immediate	Acreage
2	Manure incorporation (high disturbance within 1- 3 days)	M2, M3,M4e	Answered yes to M2 and M3 Acreage indicated in M4e	Manure Incorporation High Disturbance	Acreage
3	Manure incorporation (low disturbance within 24 hours)	M2, M3, M4a, M4c	Answered yes to M2 and M3 Acreage indicated in M4a and/or M4c	Manure Incorporation Low Disturbance Immediate	Acreage
4	Manure incorporation (low disturbance within 1- 3 days)	M2, M3, M4d, M4f	Answered yes to M2 and M3 Acreage indicated in M4d and/or M4f	Manure Incorporation Low Disturbance	Acreage
5	Animal waste storage systems	M5, M6a	Answered yes to M5 and M6a (certified engineer)	Waste Storage Facility	Type and number of animals
6	Core nitrogrent nutrient management	NM2, NM3a, NM3b, NM3c	Answered yes to NM2, NM3a, and NM3b Enter Acres listed in NM3c	Nutrient Management Core N	Acreage
7	Core phosphorous nutrient management	NM2, NM3a, NM3b, NM3c	Answered yes to NM2, NM3a, and NM3b Enter Acres listed in NM3c	Nutrient Management Core P	Acreage
8	Supplemental nitrogen nutrient management - rate	NM2, NM3a, NM3b, NM4a	Answered yes to NM2, NM3a, and NM3b Answered yes to NM4a - Enter Acres Listed	Nutrient Management N Rate	Acreage
9	Supplemental nitrogen nutrient management - placement	NM2, NM3a, NM3b, NM4b	Answered yes to NM2, NM3a, and NM3b Answered yes to NM4b - Enter Acres Listed	Nutrient Management N Placement	Acreage
10	Supplemental nitrogen nutrient management - timing	NM2, NM3a, NM3b, NM4c	Answered yes to NM2, NM3a, and NM3b Answered yes to NM4c - Enter Acres Listed	Nutrient Management N Timing	Acreage
11	Supplemental phosphorus nutrient management - rate	NM2, NM3a, NM3b, NM5a, NM5c	Answered yes to NM2, NM3a, and NM3b Answered yes to NM5a and NM5c - Enter Acres Listed for NM5c	Nutrient Management P Rate	Acreage
12	Supplemental phosphorus nutrient management - placement	NM2, NM3a, NM3b, NM5a, NM5b	Answered yes to NM2, NM3a, and NM3b Answered yes to NM5a and NM5c - Enter Acres Listed for NM5b	Nutrient Management P Placement	Acreage
13	Barnyard runoff controls	B2, B3, B4, B5, B5a, B8, B9, B9a	1. Answered yes to B2, B3, and B4 Enter number and animal types from B5 and B5a 2. Answered yes to B2, B3, and B8 Enter number and animal types from B9 and B9a	Barnyard Runoff Controls	Number of Systems, Number/Type Animals
14	Prescribed Grazing	P2, P3, P4a	Answered yes to P2 and P3 Enter acres listed in P4a	Prescribed Grazing	Acreage
15	Conservation Plans	CP2, CP3a	Answered yes to CP2 and CP3a Enter number and type of acres covered by plan	Conservation Plans	Acreage
16	High residue, minimum soil disturbance tillage	T2, T3a	Answered yes to T2, Acreage indicated in T3a	High Residue Tillage Management	Acreage
17	Conservation Tillage	T2, T3b	Answered yes to T2, Acreage indicated in T3b	Conservation Tillage	Acreage
18	Low residue tillage	T2, T3c	Answered yes to T2, Acreage indicated in T3c	Reduced Tillage	Acreage
19	Traditional cover crop	CC2, CC4a, CC4b, CC4c, CC4e, CC4f, CC4g, CC5a, CC5b, CC5c, CC5e, CC5f, CC5g	Answered yes to CC2 Answered no to CC4d or CC5d No acres indicated in CC4g or CC5g (acres harvested)	Cover Crop, Cover Crops (Early Other Rye, Early Other Wheat, Late Other Wheat, Standard Other Rye, Standard Other Wheat)	Acres planted, crop type (rye/nonrye), when planted, fall nutrient (yes/no)
20	Traditional cover crop with fall nutrients	CC2, CC4a, CC4b, CC4c, CC4d, CC4e, CC4f, CC4g, CC5a, CC5b, CC5c, CC5d, CC5e, CC5f, CC5g	Answered yes to CC2 Answered yes to CC4d or CC5d No acres indicated in CC4g or CC5g (acres harvested)	Cover Crops (Traditional with Fall Nutrients Rye Normal Other, Traditional with Fall Nutrients Rye Early Other, Traditional with Fall Nutrients Wheat Normal Other, Traditional with Fall Nutrients Wheat Early Other,)	Acres planted, crop type (rye/nonrye), when planted, fall nutrient (yes/no)
21	Commodity cover crops	CC2, CC4a, CC4b, CC4c, CC4e, CC4f, CC4g, CC5a, CC5b, CC5c, CC5e, CC5f, CC5g	Answered yes to CC2 Answered no to CC4d or CC5d Acres indicated in CC4g or CC5g (acres harvested)	Commodity Cover Crop - Standard	Acres planted
22	Forest buffer	W2, W3, W4d	Answered yes to W2 Answered yes to W3 Acres indicated in W4d (forest 35 or greater)	Riparian Forest Buffers	Acreage
23	Narrow forest buffer	W2, W3, W4c	Answered yes to W2 Answered yes to W3 Acres indicated in W4c (forest 10 - 35)	Narrow Forest Buffers	Acreage
24	Grass buffer	W2, W3, W4b	Answered yes to W2 Answered yes to W3 Acres indicated in W4b (grass 35 or greater)	Riparian Herbaceous Cover	Acreage
25	Narrow grass buffer	W2, W3, W4a	Answered yes to W2 Answered yes to W3 Acres indicated in W4a (grass 10 - 35)	Narrow Grass Buffers	Acreage
26	Forest buffer (with stream exclusion fencing)	W2, W5, W6a, W6e	Answered yes to W2 Answered yes to W5 Answered yes to W6a (excluded) Acres indicated in W6e (forest 35 or greater)	Exclusion Fence with Forest Buffer	Acreage
27	Narrow forest buffer (with stream exclusion fencing)	W2, W5, W6a, W6d	Answered yes to W2 Answered yes to W5 Answered yes to W6a (excluded) Acres indicated in W6d (forest 10 - 35)	Exclusion Fence with Narrow Forest Buffer	Acreage
28	Grass buffer (with stream exclusion fencing)	W2, W5, W6a, W6c	Answered yes to W2 Answered yes to W5 Answered yes to W6a (excluded) Acres indicated in W6c (grass 35 or greater)	Exclusion Fence with Grass Buffer	Acreage
29	Narrow grass buffer (with stream exclusion fencing)	W2, W5, W6a, W6b	Answered yes to W2 Answered yes to W5 Answered yes to W6a (excluded) Acres indicated in W6b (grass 10 - 35)	Exclusion Fence with Narrow Grass Buffer	Acreage

Appendix 7:

Cumulative Results by Conservation Practice from the Reported Farm Survey by HUC6 Code James River Basin (J), Rappahannock/York River Basin (R/Y), Shenandoah/Potomac River Basin (S/P)

Practice	Amount Implemented											
Nutrient Management												
Core nutrient management (nitrogen + phosphorus)	Total Acres 88,475											
	J			R/Y			S/P					
	25,613 ac			44,597 ac			18,265 ac					
Supplemental nitrogen nutrient management	Rate: 50,547 ac			Placement: 40,693 ac			Timing: 25,174 ac					
	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P			
	14,080 ac	27,422 ac	8,955 ac	14,543 ac	19,764 ac	6,386 ac	7,866 ac	12,053 ac	5,255 ac			
Supplemental phosphorus nutrient management	Rate: 22,464 + 12,263= 34,727ac						Placement: 41,715 ac					
	J		R/Y		S/P		J		R/Y		S/P	
	13,090 ac		14,795 ac		6,842 ac		15,339 ac		18,662 ac		7,714 ac	
Manure												
Manure incorporation	High disturbance w/in 24 hours 333 ac			High disturbance w/in 1-3 days 100 ac			Low disturbance w/in 24 hours 233 ac			Low disturbance w/in 1-3 days 1,318 ac		
	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P
	-	3 ac	330 ac	66 ac	18 ac	16 ac	76 ac	144 ac	13 ac	504 ac	740 ac	74 ac
Manure injection	Immediate injection w/in 24 hours: 80 ac						Immediate injection w/in 1-3 days: 10 ac					
	J		R/Y		S/P		J		R/Y		S/P	
	-		-		80 ac		-		-		10 ac	
Animal waste management storages	6 Dairy units 920 animals			2 Beef units 60 animals			11 Poultry units 627,050 animals					
	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P			
	2 550	2 200	2 170	-	1 30	1 30	5 185,050	-	6 442,000			
	2 Swine units 6,160 animals				2 Equine units 28 animals							
	J	R/Y	S/P		J	R/Y	S/P					
	2 6,160	-	-		1 8	-	1 20					
Barnyards												
Barnyard water diversion (Number of systems)	Total - 85 systems			39 - Beef units			6 - Dairy units			16 - Equine units		
	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P
	22	33	30	13	13	13	1	1	4	5	5	6
	9 - Goat units			7 - Poultry units			6 - Sheep/lambs units			2 - Swine units		
	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P
	1	5	3	-	4	3	2	3	1	-	2	-
Barnyard water diversion (Number of animals)	Total - 133,419			2,756 - Beef			453 - Dairy			50 - Equine		
	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P
	2,001	56,150	75,268	1,126	770	860	15	100	338	20	11	19
	371 - Goat			129,112 - Poultry			654 - Sheep/lamb			23 - Swine		
	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P
	300	48	23	-	55,089	74,023	540	109	5	-	23	-

Barnyards												
Barnyard runoff (Number of systems)	Total - 46 systems			15 - Beef units			3 - Dairy units			12 - Equine units		
	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P
	9	16	21	6	4	5	-	-	3	1	3	8
	7 - Goat units			4 - Poultry units			4 - Sheep/lambs units			1 - Swine unit		
	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P
	1	4	2	-	3	1	1	1	2	-	1	-
Barnyard runoff (Number of animals)	Total - 54,474			965 - Beef			528 - Dairy			38 - Equine		
	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P
	1,078	52,244	1,152	293	157	515	-	-	528	5	8	25
	337 - Goat			52,058 - Poultry			544 – Sheep/lamb			4 - Swine		
	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P
	300	21	16	-	52,050	8	480	4	60	-	4	-

Pastures				
Prescribed grazing	Total	J	R/Y	S/P
	13,136 ac	4,436 ac	5,469 ac	3,231 ac

Conservation Planning												
Soil conservation and water quality plans	Total 8,929 ac			Row crops 3,785 ac			Hay 1,714 ac			Pasture 3,430 ac		
	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P
	3,860 ac	2,210 ac	2,859 ac	2,323 ac	200 ac	1,262 ac	471 ac	630 ac	613 ac	1,066 ac	1,380 ac	984 ac

Tilling									
No-till/minimum tillage	15% - 29% High residue tillage Management 4,505 ac			30% - 59% Conservation tillage 8,846 ac			60% or greater reduced tillage 101,846 ac		
	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P
	758 ac	2,710 ac	1,037 ac	2,428 ac	3,923 ac	2,495 ac	29,998 ac	60,973 ac	10,875 ac

Waterways												
Riparian buffers (cropland)	Wide forest buffers 713 ac			Narrow forest buffers 253 ac			Grass buffers 1,039 ac			Narrow grass buffers 3,655 ac		
	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P
	105 ac	492 ac	116 ac	98 ac	150 ac	5 ac	85 ac	706 ac	248 ac	502 ac	2,575 ac	578 ac
Riparian buffers with stream exclusion fencing (pasture)	Forest buffers 138 ac			Narrow forest buffers 68 ac			Grass buffers 59 ac			Narrow grass buffers 509 ac		
	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P
	99 ac	17 ac	22 ac	13 ac	28 ac	27 ac	19 ac	25 ac	15 ac	356 ac	57 ac	96 ac

Cover Crops									
Cover crops Total	10,661 ac traditional cover crops			665 ac traditional cover crops with fall nutrients			4,521 ac commodity cover crops		
	J	R/Y	S/P	J	R/Y	S/P	J	R/Y	S/P
	2,464 ac	6,182 ac	2,015 ac	155 ac	28 ac	482 ac	1,026 ac	3,008 ac	487 ac
Traditional cover crop	James								
	Total	Non-Rye			Rye			Mix - Other	
	2,464 ac	Early	Late	Normal	Early	Late	Normal	Early	Late	Normal
		274 ac	165 ac	920 ac	86 ac	36 ac	68 ac	795 ac	50 ac	70 ac
	Rappahannock/York								
	Total	Non-Rye			Rye			Mix - Other	
	6,182 ac	Early	Late	Normal	Early	Late	Normal	Early	Late	Normal
		460 ac	688 ac	3,188 ac	165 ac	265 ac	779 ac	76 ac	500 ac	61 ac
	Shenandoah/Potomac								
	Total	Non-Rye			Rye			Mix - Other	
	2,015 ac	Early	Late	Normal	Early	Late	Normal	Early	Late	Normal
		19 ac	294 ac	15 ac	75 ac	163 ac	1,235 ac	5 ac	135 ac	74 ac
Traditional cover crop with fall nutrients	James								
	Total	Non-Rye			Rye			Mix – Other	
	155 ac	Early	Late	Normal	Early	Late	Normal	Early	Late	Normal
		-	-	135 ac	-	10 ac	-	-	10 ac	-
	Rappahannock/York								
	Total	Non-Rye			Rye			Mix - Other	
	28 ac	Early	Late	Normal	Early	Late	Normal	Early	Late	Normal
		-	-	2 ac	1 ac	-	25 ac	-	-	-
	Shenandoah/Potomac								
	Total	Non-Rye			Rye			Mix - Other	
	482 ac	Early	Late	Normal	Early	Late	Normal	Early	Late	Normal
		-	41 ac	160 ac	11 ac	-	200 ac	65 ac	-	5 ac
Commodity cover crops	James								
	Total	Non-Rye			Rye			Mix - Other	
	1,026 ac	Early	Late	Normal	Early	Late	Normal	Early	Late	Normal
		170 ac	-	660 ac	21 ac	-	8 ac	115 ac	-	52 ac
	Rappahannock/York								
	Total	Non-Rye			Rye			Mix – Other	
	3,008 ac	Early	Late	Normal	Early	Late	Normal	Early	Late	Normal
		460 ac	443 ac	1,757 ac	38 ac	-	175 ac	76 ac	-	59 ac
	Shenandoah/Potomac								
	Total	Non-Rye			Rye			Mix – Other	
	487 ac	Early	Late	Normal	Early	Late	Normal	Early	Late	Normal
		18 ac	136 ac	15 ac	-	100 ac	89 ac	5 ac	50 ac	74 ac

Appendix 8:

Sample Calculation to Determine Estimated (Adjusted) Acres and Upper and Lower 95% Confidence Limits for Aggregate Data

In order to establish total "estimated" results, the per-farm mean differences reported and verified data, as well as the 95% confidence intervals, presented in Table 3, were applied as follows:

Estimated totals = reported totals – (mean unverified acres per farm) x n

Where n = total number of farms with survey returns (differs by practice). Using this formula, reported totals for certain practices can be adjusted to account for average over- or under-reporting uncovered by the farm visit (verified) data. From here, lower and upper 95% confidence bounds can be calculated on the estimated totals by substituting the upper and lower 95% bounds from Table 3 in place of mean unverified acres per farm in the expression above.

As an example, there are 88,475 acres of core nitrogen and phosphorus nutrient management reported in the survey responses.

Reported Acres: 88,475 (n = 182) (Table 4)

The verification data can be used to calculate per farm mean differences and upper and lower 95% confidence bounds around this mean difference:

Verification Data: (for n = 44) (Table 3) Core nitrogen and phosphorus nutrient management)

Mean unverified acres per farm: **-36.5 acres**
Standard deviation: **125.8**
Standard error of the mean: **19**
Critical t-value for a two-sided test at the 95% confidence level: **1.96**

Lower 95% confidence bound on unverified acres per farm: **-73.7**
(mean difference – critical t value x standard error of the mean)

Upper 95% confidence bound on unverified acres per farm: **0.65**
(mean difference + critical t value x standard error of the mean)

Using these statistical results, which were calculated on a per-farm basis, an estimate of the mostly likely value for cumulative totals and a range around this estimate can be generated as follows:

Estimated total acres based on mean unverified acres per farm (n = 182):

Reported acres – (mean difference per farm) x n
= 88,475 – (-36.5) x (182)
= 95,120

Adjusted total acres corresponding to the upper 95% confidence bound on unverified acres per farm (n = 182):

Reported acres – (upper 95% confidence bound on unverified acres per farm) x (n)
= 88,475 – (0.65) x (182)
= 88,355

Adjusted total acres corresponding to the lower 95% confidence bound on unverified acres per farm (n = 182)

Reported acres – (lower 95% confidence bound on unverified acres per farm) x (n)
= 88,475 – (-73.7) x (182)
= 101,886

Given that the estimated total for core nitrogen and phosphorus nutrient management is within the lower and upper 95% confidence bounds, the reported totals are not statistically significantly different from the verified totals. There is slight (not statistically significant) evidence of underreporting. Therefore, the reported total of 88,475 acres represents the more conservative estimate, and is the number used for reporting. Table 4 shows the results of these calculations for all practices. For seven of these practices, reported totals fell below the lower 95% confidence bound, providing statistical evidence of systematic underreporting (supplemental phosphorus nutrient management, barnyard water diversion, barnyard systems control, cover crops, riparian buffers for cropland, riparian buffers with stream exclusion, and total riparian buffers). For these practices, the reported total represents the more conservative estimate, and so are used for reporting. Discussion of nuances for other practices is included elsewhere in the report. Overall, analyses revealed no evidence of overreporting. Therefore, any reporting adjustments to the survey response results are not recommended.