Upper Wye East Watershed Action Plan

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1.0 Introduction

The purpose of this plan is to provide guidance on the restoration of the Upper Wye East watershed which is comprised of Sallie Harris creek and the non-tidal Wye East river (Figure 1). This watershed is a part of the larger Wye River Complex. The Upper East Watershed Action Plan outlines a series of recommendations for watershed restoration, describes management strategies, and identifies potential projects for implementation. Planning level funding sources are listed, where feasible, and a preliminary schedule for implementation is outlined. Financial and technical partners for plan implementation are suggested for various recommendations and projects. The watershed plan is intended to assist ShoreRivers, Talbot and Queen Anne's Counties Soil Conservation Districts, United States Department of Agriculture Natural Resource Conservation Service, local governments, agricultural consultants, and watershed residents in moving forward with restoration of the Upper Wye East watershed.

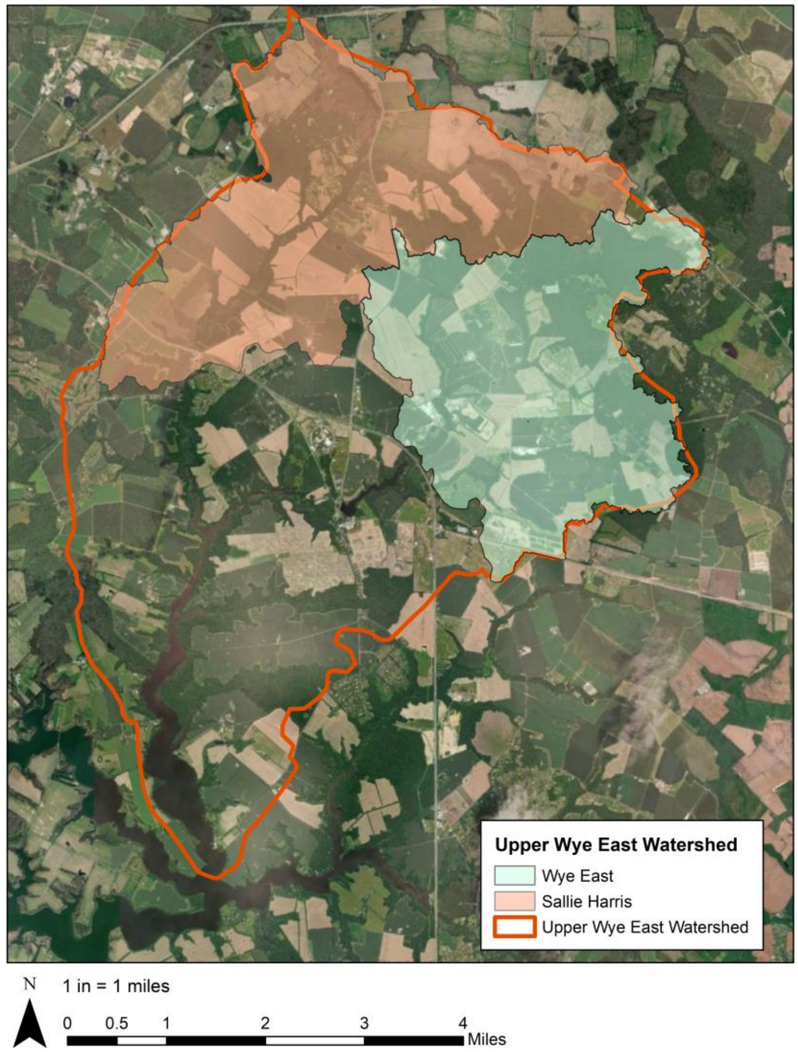

Figure 1. The non-tidal streams, Sallie Harris and Wye East, are the major tributaries to the larger Upper Wye East watershed that, which is a part of the Wye River Complex

1.1 U.S. EPA Watershed Planning

In 2003, the U.S. Environmental Protection Agency (EPA) required that all watershed restoration projects funded under Section 319 of the federal Clean Water Act be supported by a watershed plan[1]. The EPA identified nine key elements that are critical for improving water quality and

[1] For more information on visit MDE's Nonpoint Source Program (319) Management and Financial Assistance website at http://www.mde.state.md.us/programs/Water/319NonPointSource/Pages/index.aspx

should be included in watershed plans that intend to address water quality impairments. These nine elements have come to be known as the “A-I criteria”:

EPA A-I Criteria[2]

A. Identification of Causes and Sources of Impairments

B. Expected Load Reductions

C. Proposed Management Measures

D. Technical and Financial Assistance Needs

E. Information, Education, and Public Participation Component

F/G. Schedule and Milestones

H. Load Reduction Evaluation Criteria

I. Monitoring Component

This watershed plan meets the A-I criteria and Table 4 shows where these criteria are addressed throughout this watershed plan.

Table 1: Location of A-I Criteria Within this Report

Section of the Report	A	B	C	D	E	F	G	H	I
Section 1	X								
Section 2			X		X				
Section 3			X						
Section 4		X	X						
Section 5				X		X	X		
Section 6								X	X

1.2 Background

The Upper Wye East watershed is identified by the United States Geological Survey (USGS) as

[2] For a more detailed description on the nine key elements review Chapter 2 of the EPA’s Handbook for Developing Watershed Plans to Restore and Protect Our Waters https://www.epa.gov/sites/production/files/2015-09/documents/2008_04_18_nps_watershed_handbook_handbook-2.pdf

a hydrologic unit code 12 subwatershed (ID #020600020602) of Eastern Bay in Queen Anne's and Talbot Counties. The Upper Wye East watershed is also part of the Wye River Complex, which is composed of three interconnected tidal waterways; Wye River, Wye East River, and Wye Narrows. Separating each waterway is Wye Island, a state park. The Wye River Complex has an average depth of 8.6 ft. with a water surface area of approximately 10 square miles. In general, the dominant land use for the entire watershed is agricultural with very small urbanized areas (Figure 2).

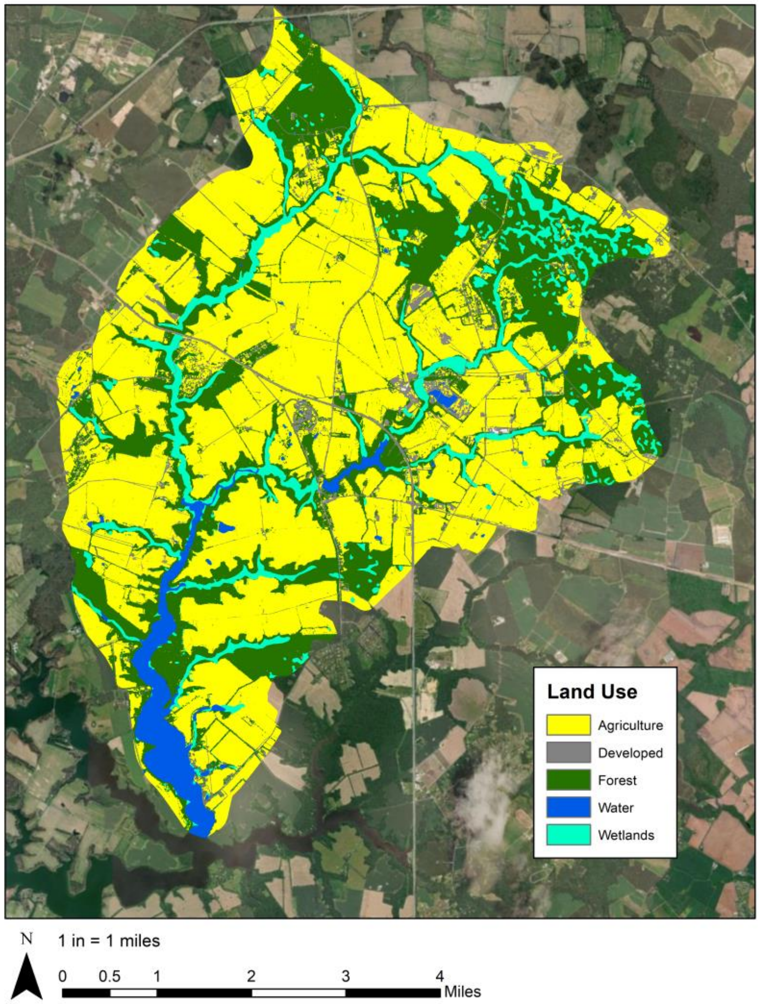

Figure 2. Land use of the Upper Wye East watershed in Queen Anne's County and Talbot County, MD.

The Upper Wye East watershed is 30.4 mi^2 (19,439.8 acres) and has two main tributaries, Sallie Harris Creek and Wye East River (Figure 1). Sallie Harris has the larger watershed area than Wye East River, encompassing 5,651 acres. This stream has a United States Geological Survey (USGS) gaging station located adjacent to the eastbound lane of Route 50. The stream flows into the tidal Wye East. The Wye East River comprises two tributaries that discharge into Wye Mills Lake, which then flows into the tidal Wye East. The stream that directly borders Sallie Harris watershed is the mainstem Wye East River. This stream flows by Friel's Cannery, which discharges wastewater into the stream. This stream has a watershed area of 3,318 acres. The other stream is an unnamed tributary to Wye East River that flows by a Delmarva Power substation where it then flows underneath Route 50. This stream has the smallest watershed covering only 1,678 acres.

The Wye River Complex was first identified as impaired by the Maryland Department of Environment (MDE) as part of the 1996 303(d) list that was submitted to the U.S Environmental

Protection Agency (EPA). As of 2004, the Wye River Complex is impaired by sediments, nutrients, fecal coliform, and the non-tidal sections are impaired for biological impacts (MDE, 2006).

Currently, the waters of the Wye River are impaired for nitrogen, phosphorous, sediment and seasonally for bacteria. They are listed on US EPA's 303d list. Impacts include shellfish closures, decreased recreation, and health and safety issues. As a threat to public health, these closures directly impact human recreational opportunities, commercial and recreational harvest opportunities, tourism, and overall aquatic habitat.

Ambient Conditions

Water quality measures were intensely monitored over the period August 2015 through June 2018. Data were collected at three locations within the Upper Wye East watershed, Sallie Harris at Arlington Rd. (site name SHNT-1), mainstem Wye East upstream of U.S. Route 50 (site name WENT-2), and unnamed tributary to Wye East (site name WENT-3) upstream of U.S. Route 50. Non-tidal water quality data were collected twice a month throughout the year at most sites. The data collection consisted of the dissolved nutrients nitrate-nitrogen ($NO^{-}{}_{3}$-N), ammonium-nitrogen ($NH^{+}{}_{4}$ -N) and orthophosphate (PO_4^{3-}-P), water discharge, water depth, pH, dissolved oxygen, oxidation reduction potential, and temperature.

Water samples were collected monthly to bi-monthly (twice a month) to assess concentrations of nitrate-nitrogen ($NO^{-}{}_{3}$-N), ammonium-nitrogen ($NH^{+}{}_{4}$ -N) and orthophosphate (PO_4^{3-}-P). Samples were filtered in the field and stored on ice until delivered to the office where they were frozen. Frozen samples were transported to University of Maryland Center for Environmental Sciences Horn Point Lab Analytical Services to be analyzed for NO_3-N and PO_4^{3-}-P.

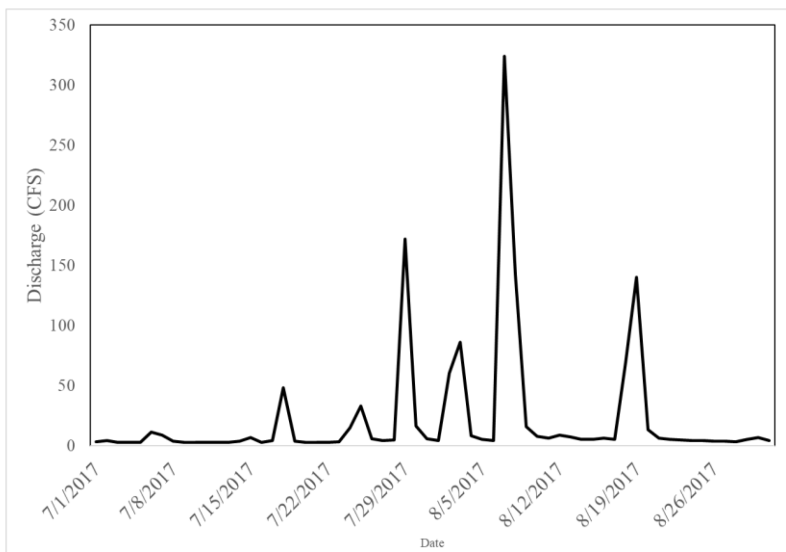

Figure 3. Storm events during the summer dramatically change$_3$ stream discharge at SHNT-1.

Discharge data were measured using a Sontek FlowTracker on a monthly-to-bi-monthly basis. Discharge is the volume of the water flowing in a stream calculated from velocity and the area of the stream at a specific point at a specific time. Sallie Harris (SHNT-1) has discharge monitored by the United States Geological Survey

Table 2. Stream flow characteristics.			
Discharge	SHNT-1	WENT-3	WENT-2
Average (CFS)	10.7	2.9	5.6
Max (CFS)	331.0	86.3	125.7
Min (CFS)	2.7	0.8	2.6

(USGS). Stream discharge collected from this site was plotted against discharge measured at the other sites in this study to produce regression equations to estimate stream discharge for days when discharge was not collected in the field. The regressions between Sallie Harris discharge and the other streams all correlated well (r^2>0.40), providing good equations to estimate daily stream discharge.

Peak water discharge occurred February through May and generally declined through September and started to increase again in October. SHNT-1 had the greatest average discharge, followed by WENT-2, and WENT-3. Storms during the summer can greatly influence stream discharge, which was observed in late July through August 2017 (Figure 3) when discharge at SHNT-1 went from below 5 cubic feet per second (CFS) to over 300 CFS during one rain event.

From the non-tidal data collection it was clear the unnamed tributary to the Wye East River (WENT-3) had the highest NO^{-}_{3}-N concentration for any of the sites (Table 3). Sallie Harris (SHNT-1) and the mainstem Wye East (WENT-2) had comparable NO^{-}_{3}-N concentrations (Table 3). All sites had NO^{-}_{3}-N concentrations higher than what would be expected to be found under natural conditions (0.5 mg/l). WENT-3 also had the highest PO_4^{3-}-P concentrations with all sites marginally higher than natural conditions (0.03 mg/l). Ammonium (NH^{+}_{4} -N) was within the range of natural levels in SHNT-1 and WENT-3, but was much higher in WENT-2.

Over the period of record (August 2015 to June 2018) there was a significant ($p<0.05$) decreasing trend in NO^{-}_{3}-N at WENT-2. There was no significant trend for NO^{-}_{3}-N at the other sites and there was no trend for PO_4^{3-}-P or NH^{+}_{4} -N at any of the sites.

Table 3. Stream water quality characteristics for three tributaries to the tidal Upper Wye East.								
Site	**Watershed Area**	**Mean Discharge**	**NO^{-}_{3}-N**	**PO_4^{3-}-P**	**NO^{-}_{3}-N**	**PO_4^{3-}-P**	**NO^{-}_{3}-N**	**PO_4^{3-}-P**
	Acres	**CFS**	**mg/l**		**lbs/yr**		**lbs/acre**	
SHNT-1	5,651	10.7	3.37	0.05	70,990	1,053	12.56	0.19
WENT-2	3,318	5.6	3.89	0.03	39,579	331	11.93	0.10
WENT-3	1,678	2.9	6.15	0.07	35,112	400	20.93	0.24
				Total	**145,681**	**1,784**		

The easiest way to understand a subwatersheds' contribution to nutrient pollution is to analyze the nutrient yield. Yield is simply the load (lbs) of nutrients divided by the watershed size (acres), creating a weighted value in lbs/acre that allows for comparison to other watersheds of different sizes. Using the average nutrient concentrations and average discharge, load was calculated, and nutrient yield was estimated for each watershed. For both NO^{-}_{3}-N and PO_4^{3-}–P WENT-3 (unnamed tributary to Wye East) had the greatest yields. SHNT-1 and WRNT-2 were comparable for NO^{-}_{3}-N, but SHNT-1 had greater PO_4^{3-}–P yield (Table 3).

Causes and Sources of Pollution

Nonpoint Source Pollution and Sources: Upper Wye East watershed is 58% agriculture, 5% residential/developed, 26% forested, 8 % wetlands, and 3.3% open water (Figure 2.). Since agriculture is the predominant land use, it is also the largest source of nonpoint source nitrogen, phosphorus, and sediment pollution.

Nutrient loads were estimated using data collected from SHNT-1, WENT-2, and WENT-3. The data collected from site WENT-2 and WENT-3 were summed to estimate the total loads coming from the non-tidal Wye East watershed. The site SHNT-1 represents the total loads coming from the Sallie Harris watershed. Combined, the Sallie Harris and Wye East watershed areas represent the largest contributing area to the tidal Upper Wye East. Sediment data were not collected by ShoreRivers and were estimated using Stroud Water research Center Model My Watershed application that is part of WikiWatershed. Model My Watershed uses the Generalized watershed Loading Function enhance (GWLF-E) algorithms to simulate 30-years of daily water fluxes to estimate different water quality parameters, such as sediment. To estimate sediment loading the average sediment concentration from the model was used with the discharge data collected by ShoreRivers.

Table 4. Nutrient and sediment load to the Upper Wye East.

Sallie Harris	**Sediment**	**Nitrate-Nitrogen**	**Orthophosphate-Phosphorus**
Total Loads (lbs)	2,969,799	70,990	1,053
Loading Rates (lbs/acre)	525.54	12.56	0.19
Mean Annual Concentration (mg/l)	140.98	3.37	0.03
Wye East	**Sediment**	**Nitrate-Nitrogen**	**Orthophosphate-Phosphorus**
Total Loads (lbs)	1,648,150	74,692	730
Loading Rates (lbs/ha)	329.89	14.95	0.15
Mean Annual Concentration (mg/l)	98.49	5.02	0.05
Total Watershed Loads (lbs)	4,617,949	145,682	1,789

Point Source Pollution and Sources: In 1972 a component of the Clean Water Act was established to control point source water pollution through a permitting system. Point sources are defined as any conveyance such as a pipe or a man-made ditch that eventually discharges directly into the surface water. Municipal, industrial, and other facilities must obtain a National Pollution Discharge Elimination (NPDES) permits if their discharges go directly to surface waters. Maryland Department of the Environment (MDE) issues the NPDES permits in Maryland as a means of limiting the amount of pollution entering surface waters from industrial and municipal facilities. There are three permitted facilities that discharge into the Upper Wye East watershed (Table 5).

Table 5. NPDES permitted facilities in the Upper Wye East Watershed

Facility Name	Address	Permit Type	Permit No.
S.E.W Friel	120 Friel's Rd. Wye Mills, MD 21679	[Individual Permit] Discharge Permit	MD0000043
Chesapeake College WWTP	MD Route 213/Route 50 East, Wye Mills, MD 21679	[Individual Permit] Discharge Permit	MD0024384
		[General Permit] Discharge associated with water supply	MDG766648
David A. Bramble – Wye Mills Plant	451 Grange Hall Rd., Wye Mills, MD 21679	[General Permit] Discharges associated with asphalt paving mixtures and blocks	MDG490766

The discharge or "effluent" from these facilities includes toxics, nutrients, organic, and inorganic materials that can have a devastating impact on the water quality of the Upper Wye East if permit limits are exceeded. All three permitted facilities have been inspected in the past five years and have had Significant/Category 1 Noncompliance, the most serious level of violation noted in Environmental Protection Agency (EPA) databases. At the publication of this watershed plan Chesapeake College WWTP was, as of the most recent quarter (01/01/19-03/31/19), in Significant/Category 1 Noncompliance for failing to report discharge monitoring report (DMR) and in violation of total suspended solids (TSS) concentration. Chesapeake College WWTP was in Significant/Category 1 Noncompliance for TSS concentration for two out of the four quarters in 2018. David A. Bramble – Wye Mills Plant was also in Significant/Category 1 noncompliance for failing to report discharge monitoring report (DMR) in the most recent quarter as well as the two previous quarters. S.E.W Friel was in compliance at the publication of this report, but was in Significant/Category 1 Noncompliance for two quarters in 2017 for total nitrogen and nitrate. The two quarters for noncompliance were 07/01/17 – 09/20/17 and 10/01/17 – 12/31/17, which is the time frame when the plant is processing corn for canning. This operation discharges directly into the mainstem non-tidal Wye East (WENT-2), which has the highest ammonium concentration of any of the Upper Wye East streams (Table 6). Ammonium is a strong indicator of waste from a food processing facility.

Table 6. Ammonium (NH^{+}_{4} -N) **concentrations (mg/l).**

Site	Average (mg/l)	Min (mg/l)	Max (mg/l)
WENT-2	0.25	0.02	0.53
WENT-3	0.03	0.005	0.35
SHNT-1	0.06	0.01	0.34

Maryland's NPDES program offers key avenues for public participation in the permit issuing process. By being involved, citizen and watershed groups can advocate for permit limits that protect local water quality, and enforceable conditions that provide accountability when permit limits are violated. For a full description of this process, basic information, tools and tips to assist anyone in analyzing and commenting on NPDES permits in Maryland, reference the Citizens Guide to Public Participation in Maryland's NPDES Permitting Program. In terms of protecting the Upper Wye East from point sources of pollution it is critical that citizen advocacy and enforcement groups monitor the permitted facilities mentioned in Table 5 and reference the Citizen Guide to effectively navigate the process and advocated for strong, enforceable permits.

2.0 Watershed Goal, Strategies and Recommendations

Restoration of the Upper Wye East is a community-wide effort that requires participation from a number of stakeholders. The watershed is predominately agriculture; thus, it is imperative that the agricultural community buys into the plan and is invested into execution of the plan. Chesapeake College is located on the watershed and the institution has already been very proactive in addressing water quality issues within the property. The college represents a resource to bring in the local community to view and discuss best management practices as well as be a leader in carrying out the plan. University of Maryland Wye Research Center is another academic institution in the watershed that has the foremost academics that are tackling major agricultural nutrient issues and represent a resource to work with the farm community to discuss options for nutrient management and the most innovative agricultural best management practices. Finally, the local community has an important role to play because environmental health is critical to quality of life and long-term economic vitality. The plan was developed using a best management practice citing tool, The Agricultural Conservation Planning Framework (ACPF), developed by the United States Department of Agriculture to help streamline best management practice identification and prioritization.

2.1 Watershed Goal

A healthy Upper Wye East that is safe for swimming, recreational boating, commercial and recreational fishing, and is free from all water quality impairments such that a healthy human and wildlife communities can be sustained for generations.

2.2 Strategies

1. **Quantify the problem in terms of nutrient loads.** Identify the quantity and sources of nutrients, as well as the flow path from the pollution sources to the water.
2. **Public-private partnerships.** Leverage both Talbot and Queen Anne's Counties' resources in collaboration with the technical skills and expertise from the diverse group of watershed partners including farmers, landowners, nutrient management specialist, Chesapeake College, and University of Maryland Wye Research Center.
3. **Increase the knowledge of farmers, property owners, local government and agricultural consultants.** Use education to change behavior and increase the likelihood that individuals will be mindful of the impact of land management on downstream water quality. Utilize conservation leases between landowner and farmers to ensure a clear understanding of the conservation interests for the property.
4. **Manage nutrient application according to the best available science.** Applying nutrients using the 4R Nutrient Stewardship[3] concept (right fertilizer source, right rate, right time, right place) and the Phosphorus Management Tool[4] will increase efficiency and reduce runoff.
5. **Implement the appropriate nutrient management practices wherever space and site conditions allow.** Site-specific, also referred to as *full-farm conservation planning* is the best way to efficiently manage agricultural runoff.
6. **Maintain and update septic systems within the watershed.** Properly maintained systems and Best Available Technology (BAT) systems are proven to remove the greatest amount of nutrients from the wastewater.
7. **Ensure all NPDES are following their permits.** Point sources can be easily managed through the NPDES process, but it is important that the facilities do not exceed their discharge allocations and concentrations and that the permits are stringent enough to ensure no water quality impacts.
8. **Incorporate climate change adaptation strategies in project planning and implementation.** Impacts of climate change will affect how restoration practices perform into the future.

2.3 Recommendations

This section describes 7 recommendations for restoring the Upper Wye East watershed. Not listed in order of priority, these recommendations are a result of modeling and first hand

[3] To learn more about the 4Rs visit the Nutrient Stewardship website: https://www.nutrientstewardship.com/4rs/

[4] To learn more about Maryland's agricultural phosphorus initiative, the Phosphorus Management Tool, visit Department of Agriculture's website: https://mda.maryland.gov/Pages/PMT.aspx

knowledge of the watershed. When possible, multiple recommendations should be implemented simultaneously in order to effectively bring about restored water quality. Combining these efforts with education and pollution prevention can lead to long-term behavioral change. Targeted outreach to landowners and farmers can have a beneficial impact while additional funding can be secured for the more costly recommendations.

1. **Utilize federal and state cost-share programs to accelerate the rate of project implementation**. Work with Talbot and Queen Anne's Counties Soil and Conservation Districts and Natural Resource Conservation Services (NRCS) to utilize cost-share funding for applicable projects. To further incentivize the implementation of these practices, look for additional grant funding to pay for costs that exceed what the cost-share covers.
2. **Full-farm management.** Approach the management of the farm property holistically. Utilize water control structures on the outlets of tile drains and ditches and filtering practices on the inlets. Balance buffers and wetlands with production areas to maintain or increase crop yields, while achieving water quality goals. Ensure cover crops are planted early and soil health is a priority. Drainage water management and irrigation management are other tools that can be used in full-farm planning.
3. **Implement projects that can benefit as a demonstration effort.** Demonstration projects are a great tool to encourage other landowners to utilize a nutrient removal project. When working with a landowner, ask for permission to access their property to show the project to stakeholders, funders and other landowners.
4. **Provide outreach and technical assistance to landowners and farmers.** Use the projects identified in this plan as a guide for landowner outreach. Providing direct outreach and landowner technical assistance will help to encourage greater participation in these plans. When possible, partner with NRCS and Soil Conservation Districts for a more targeted approach to landowners, and for a better understanding of the available resources at the state and federal level.
5. **Provide resources to periodically maintain and upgrade septic systems.** Work with the Queen Anne's and Talbot Health Departments to identify failing septic systems within the watershed. Provide education to the homeowners of those failing systems and encourage regular pump-outs and manufacturer recommended maintenance. When it is time for an upgrade or new system, encourage the use of BAT systems and identify opportunities to use Bay Restoration Funds for the upgrades.
6. **Plan for increased rainfall amounts, rainfall intensity, and regional plant species migration due to changing climate patterns.** By planning for these expected changes we will be able to implement projects that are more resilient to the effects of climate change. Rain fall is more intense and more frequent, while we are also experiencing longer periods of drought-like conditions. These changes will have an effect on the size of water quality practices, as well as the plants that are used in natural filtration projects.

7. **Monitor the health of the Upper Wye East as a means of tracking progress.** Keep a pulse on the health of Upper Wye East by conducting an on-going water quality monitoring program. Test the water for physical degradations as well as chemical impairments. Test the dissolved oxygen levels at the surface and the bottom of the water column. Test the nutrients and bacteria levels from different areas throughout the water body and the surrounding watershed. Identify emerging hot-spots of pollution. Utilize partners like the Department of Natural Resources and local watershed organizations to facilitate the effort.

3.0 Watershed Restoration Practices

This section provides an overview of the practices recommended for restoring Upper Wye East watershed. Successful restoration requires collaboration among local, county and state government, watershed partners, landowners, and farmers. Local and state governments are able to implement projects on public property as well as financially support efforts on private property through cost-share programs and other incentives. Watershed partners, landowners, and farmers are encouraged to implement projects and programs on private property where they will be most effective. The variety of practices recommended in this plan are primarily efforts to control agricultural runoff and are described in more detail below.

Table 7: Project applicability to different agricultural landscape features and practices.

Project	Ditch	Tile	Field	Stream
Blind/Rock Inlet (Vertical Drain)		X		
Cover Crops			x	
Denitrifying Bioreactor/wall	x	X	x	
Drainage Water Management		X		
Grass Waterway			x	
Irrigation Water Management Plan			x	
Irrigation Water Reuse	x	X	x	
Nutrient Management Plans			x	

Phosphorus Sorbing Material in Agricultural Ditches	x	X		
Riparian Forest Buffer	x			x
Saturated Buffer		X		
Stream Restoration	x			x
Structure for Water Control	x	X		
Wetland Restoration/Creation	x	X	x	x
Two-Stage Ditch (Open Channel)	x			

1. **Blind Inlet (Vertical Drain), NRCS Standard 630 -** Also known as a "French Drain," is constructed by placing small aggregate and sand over perforated pipe which is connected to a underground outlet. Because the blind inlet acts as a filter, it can reduce the amount of sediment and other contaminants discharged through the outlet compared with perforated risers or flush inlets. Blind Inlets also provide obstruction-free equipment operations because they eliminate the perforated riser inlet.

Figure 4: Blind inlet example showing the filter (gravel) being placed over the subsurface perforated drainage pipes.

2. **Cover Crops, NRCS Standard 340 -** Growing a crop of grass, small grain or legumes primarily for seasonal protection and soil improvement. Cover crops reduce erosion from wind and water while also utilizing excessive soil nutrients and increasing soil health by adding organic matter. It is critical to get them planted by late summer and early fall and to either plant green or terminate just before planting the next crop. Mixed cover crops also provide the added benefit of diversity and help develop better soil structure.

Figure 5: Cover crop example showing vegetation covering the soil. (photo: Farmfuture.com)

3. **Denitrifying Bioreactor, NRCS Standard 605** - A structure that uses a carbon source to reduce the concentration of nitrate-nitrogen in subsurface tile or ditch agricultural drainage flow via enhanced denitrification. This edge-of-field subsurface practice improves water quality by reducing nitrogen content of agricultural drainage flow. This practice usually involves a water control structure.

Figure 6: Denitrification Bioreactor example showing the subsurface woodchip-filled pit.

4. **Drainage Water Management, NRCS Standard 554 -** The process of managing the drainage volume and water table elevation by regulating the flow from a surface or

subsurface agricultural drainage system. Managing drainage water reduces nutrient loading, improves productivity and health of plants, and improves soil health.

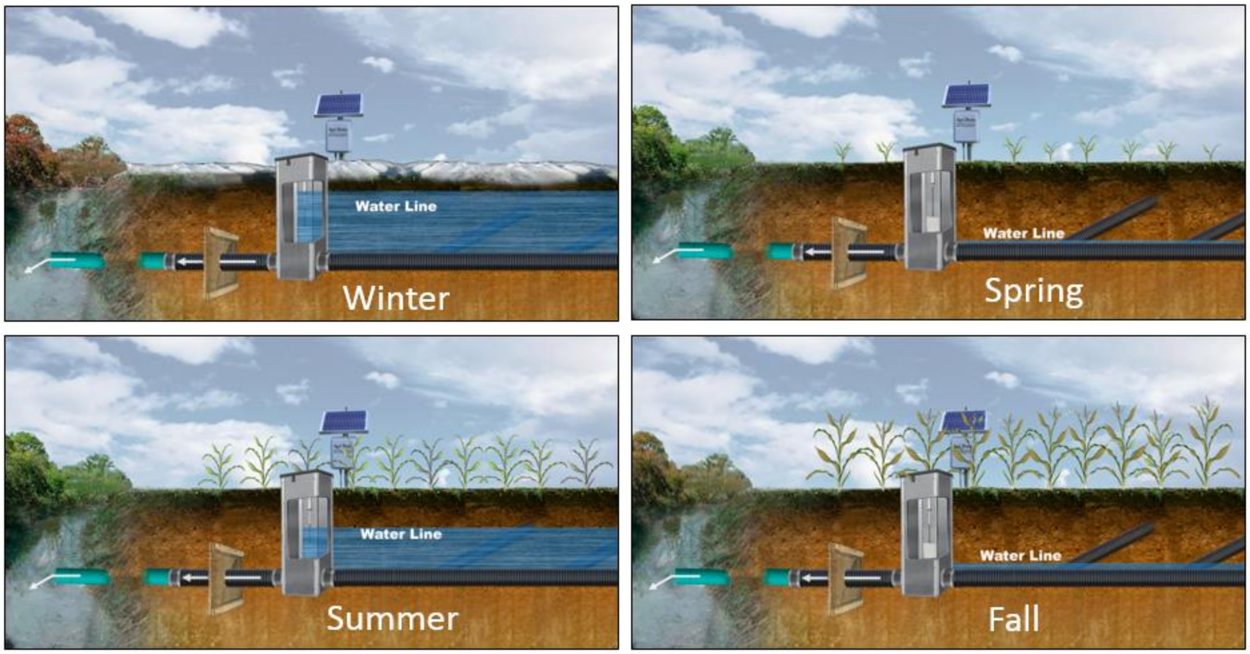

Figure 7: How Drainage Water Management works for better yields and nutrient management. (Photo Ecosystem Services Exchange)

5. **Grassed Waterway, NRCS Standard 412–** A graded or shaped channel established with vegetation suitable to convey water at a non-erosive velocity using a broad and shallow cross section. Grassed waterways protect and improve water quality by filtering runoff and maintaining vegetative cover on water conveyance channels.

Figure 8: Grassed Waterways example showing the vegetative cover over the drainage channel. (Photo: NRCS)

6. **Irrigation System, Tailwater Recovery, NRCS Standard 447 –** Irrigation system designed to collect, store and convey rainwater runoff and irrigation tailwater for reuse in irrigation. The practice of capture and reuse irrigation water benefits offsite water quality, improves water use efficiency, and reduces energy use.

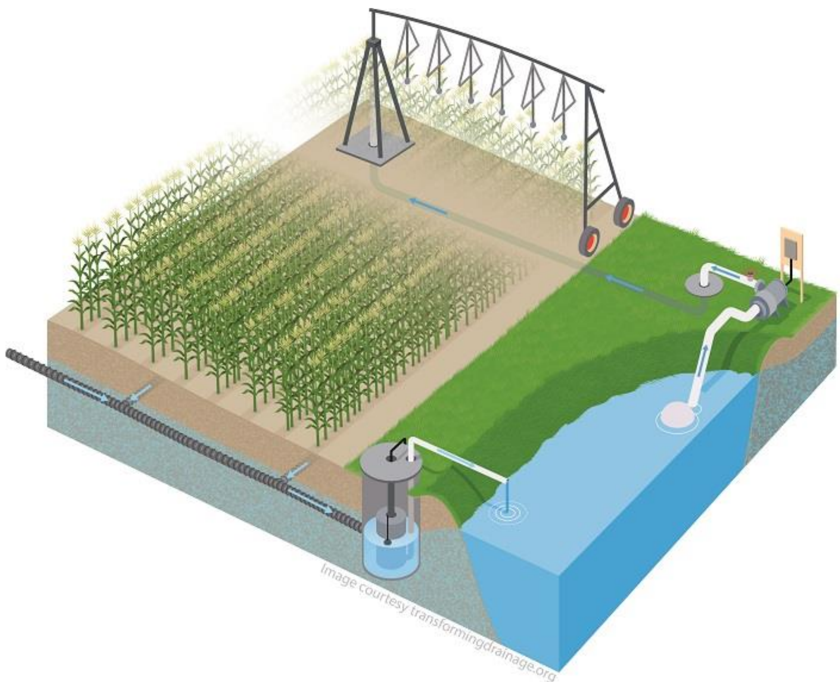

Figure 9: Tailwater recovery example showing captured runoff from a pond being used as irrigation.

7. **Irrigation Water Management Plan, NRCS Standard 449 -** The process of determining and controlling the volume, frequency, and application rate of irrigation water. Developing and implementing this plan will improve water use efficiency, minimize soil erosion, and decrease degradation of surface and groundwater resources.

8. **Nutrient Management [Plans], NRCS Standard 590 –** The certified plan and subsequent actions to manage the amount, source, placement, form and timing of the application of nutrients. Obtaining and following a nutrient management plan helps to minimize agricultural nonpoint source pollution and properly utilize manure and other organic fertilizers.

9. **Phosphorus Sorbing Materials in Agricultural Ditch[5] -** the application of "Phosphorus-sorbing" materials to absorb available dissolved phosphorus in cropland drainage systems

[5] For more on Phosphorus Sorbing Materials visit the Maryland Department of Agriculture's website. https://mda.maryland.gov/resource_conservation/WIPCountyDocs/bmpdef_pg.pdf

for removal and reuse as an agricultural fertilizer. These in-channel engineered systems can capture significant amounts of dissolved phosphorus in agricultural drainage water by passing them through phosphorus-sorbing materials, such as gypsum, drinking water treatment residuals, or acid mine drainage residuals.

10. **Riparian Forest Buffer, NRCS Standard 391 -** A corridor of trees and/or shrubs planted adjacent to a river, stream, wetland or water body. The planting is of sufficient width and up-gradient and near the water body to insure adequate functioning. The primary purposes for installing a riparian forest buffer includes protecting near-stream soils from over-bank flows, trap harmful chemicals or sediment transported by surface and subsurface flows from adjacent land uses, or provide shade, detritus and large woody debris for the in-stream ecosystem.

Figure 10: Riparian forest buffer example showing shorelines buffered from farm field by thick stands of trees.

11. **Saturated Buffer, NRCS Standard 604 -** A subsurface, perforated distribution pipe is used to divert and spread drainage system discharge to a vegetated area to increase soil saturation. This practice helps to reduce nitrate loading to surface water from subsurface drain outlets.

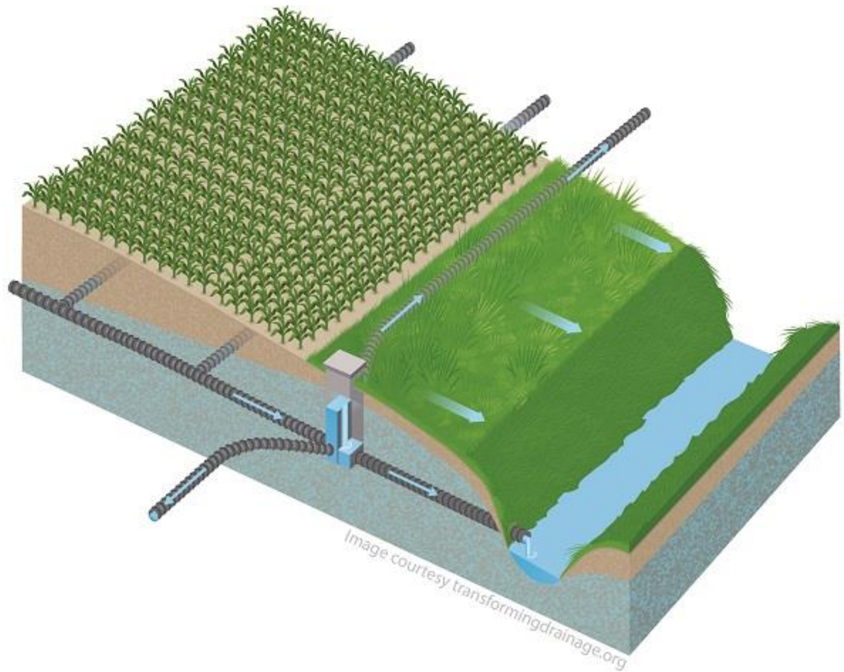

Figure 11: Saturated buffer example showing a tile drain spreading water to a riparian buffer before it enters a drainage ditch or stream channel.

12. **Streambank and Shoreline Protection, NRCS Standard 580 –** The use of plants and other natural elements to stabilize and protect the banks of streams and drainage ditches. The benefit of streambank and shoreline stabilization is the ability to maintain the flow capacity of a stream, a reduction of sediment erosion impacting downstream habitats, and improvement of the stream corridor for fish and wildlife habitat.

13. **Structure for Water Control, NRCS Standard 587 -** A structure in a water management system that conveys water, controls the direction or rate of flow, maintains a desired water surface elevation or measures water. This structure allows a farmer to control the stage, discharge, distribution, delivery and direction of water flow.

Figure 12. Structure for water control installed in a ditch to help control water level and increase nutrient removal within the ditch.

14. **Two-Stage Ditch (Open Channel), NRCS Standard 582 –** A design conversion that modifies the geometry of a ditch to establish benches within the ditch. The ditch provides a low-flow channel and then a vegetated bench that is flooded during higher flows. The vegetation provides some slowing of water flow where sediments and other heavier material in the water might settle. A two-stage ditch is an in-channel practice.

Figure 13: Two-Stage Ditch example showing the extended benches within the ditch. This two-stage ditch is located in Talbot County, MD.

15. **Wetland Restoration, NRSC Standard 657, Created Wetland, NRCS Standard 656 –** The return of a wetland to an area with hydric soils. This involves managing the drainage volume, water table volume and vegetation at a site suitable for wetland restoration. The benefits of this practice are to filter nutrients from runoff while providing fish and wildlife habitat.

Figure 14. Wetland creation adjacent to a farm field Cecil County, Sassafras River watershed.

4.0 Project Selection and Site Planning

4.1 Project Selection and Plans

The creation of a watershed plan that covers an expansive area presents the challenge of identifying projects throughout the watershed, but also providing enough project detail to adequately describe and justify the installation of the conservation practices at the field scale. Many watershed plans provide either general project suggestions that can be applied throughout the watershed without pinpointing exact locations, or, in other instances, pin point in great detail a few projects, neglecting the remainder of the watershed. To overcome this challenge a new targeting method developed by the United States Department of Agriculture (USDA) titled the Agricultural Conservation Planning Framework (ACPF), was employed that takes advantage of the latest geospatial data to evaluate the entire watershed for various different nutrient reduction practices, providing a broad range of conservation options that are precisely located at the field scale. Data used to execute the targeting method were the most recent light detection and ranging (LIDAR) derived digital elevation model (DEM), soils survey data (gSSURGO), crop data from the USDA National Agricultural Statistics Service, in addition to data layers derived through analyses performed on the aforementioned data sets. The execution of the targeting method was completed through the use of the ACPF ArcGIS toolbox that analyzed the previously described data sets to identify field-level project opportunities. Additional information on the ACPF targeting method can be obtained on the ACPF website, https://acpf4watersheds.org/.

The output from the ACPF targeting method produced a tremendous amount of suggested conservation measures (Figure 15). The ACPF outputs are parcel-based plans, using a unique field boundary (FB) identification to distinguish each parcel. Conservation practice locations are identified by the field boundary identification number to easily categorize on what parcel the practice is located. The parcel-based categorization of conservation practices allows for the practices to be suggested at the property scale and provides tailored plans for each landowner within the watershed. All practices suggested in this plan are either approved Natural Resources Conservation Service (NRCS) best management practices that have national standards or best management practices that will be approved by the Chesapeake Bay Program Agricultural Workgroup in the near future.

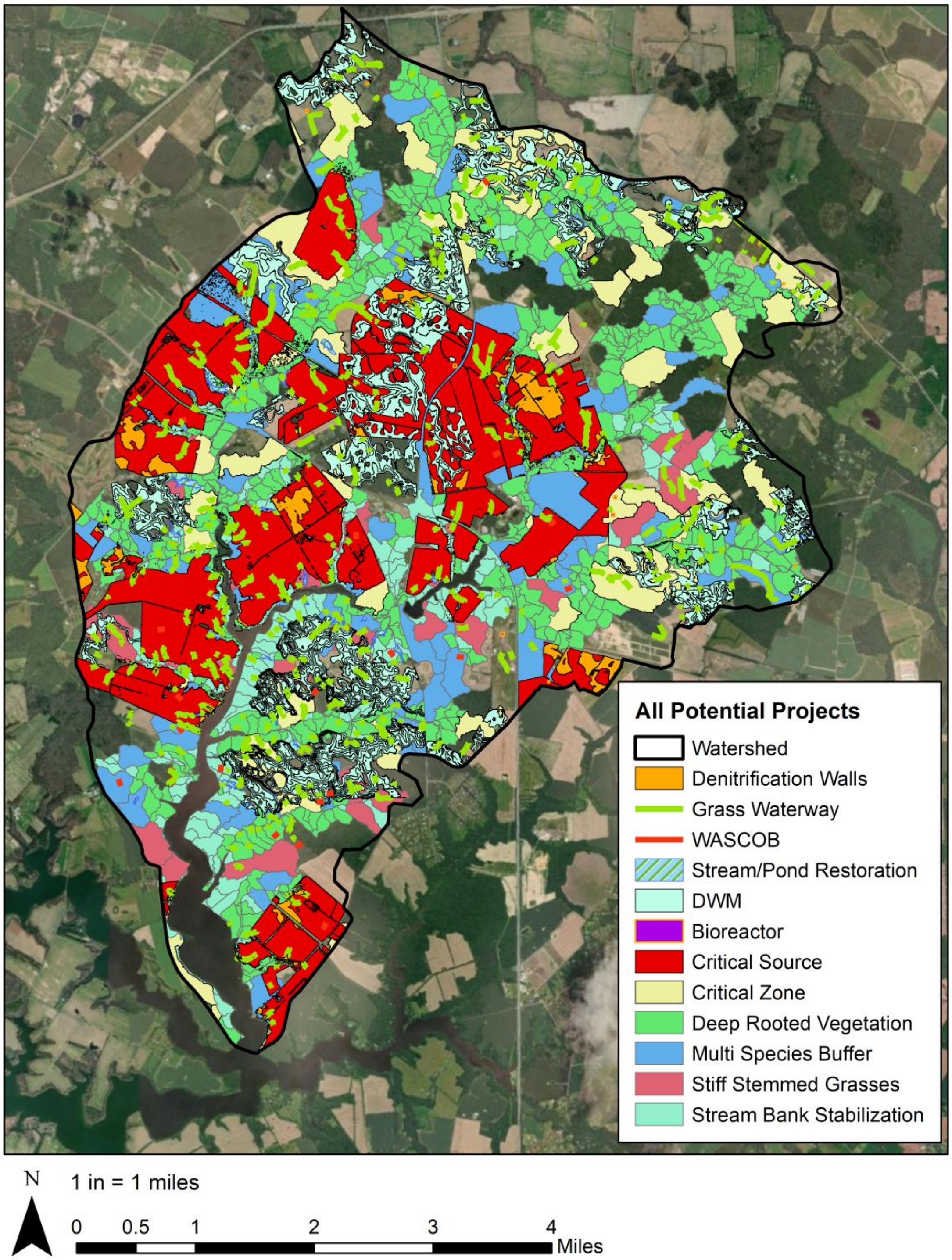

Figure 15. Watershed map of all the potential projects generated through the ACPF modeling tool. These are suggested practices to start a conversation with a landowner and are not field verified for actual implementation.

4.2 Load Reduction

The Chesapeake Bay has a Total Maximum Daily Load (TMDL) calculated for nitrogen, phosphorus, and sediment to attain certain water quality standards that all stakeholders believe will produce a healthy Chesapeake Bay. The pollution reduction goal is to reduce nitrogen by 25%, phosphorus by 24%, and sediment by 20% [6]. Using this as a guideline, the Upper Wye East Action plan will also strive to achieve the same reductions through implementation of best management practices throughout the watershed (Table 8).

Table 8. Nutrient Reduction Goals		
Current Estimated Load		
Sediment	**Nitrogen**	**Phosphorus**
4,617,949	145,682	1,789
New Load Goal		
Sediment	**Nitrogen**	**Phosphorus**
3,694,359	109,261	1,360

5.0 Upper Wye East Watershed Restoration Practices

5.1 Implementation Schedule

Table 9: Implementation Timeline – Percentage of Goals Achieved by Year

Goal	2020	2021	2022	2023	2024	2025	2026

5.2 Funding Strategy

The Upper Wye East Action Plan was designed to provide the necessary information to have discussions with landowners and partners with the goal of applying for design and implementation funds for projects. To best prepare the watershed partners for implementing the projects and strategies identified in this plan, Appendix C provides a list of funding sources that

[6] Chesapeake Bay TMDL Fact Sheet https://www.epa.gov/chesapeake-bay-tmdl/chesapeake-bay-tmdl-fact-sheet

have historically supported efforts similar to those proposed. By identifying the funder, the intended purpose of the funding, the funding limit, and the date of the last Request for Proposals for each program, partners are encouraged to plan accordingly to seek additional resources for design and implementation of these projects.

The first set of resources are environmental grant programs that seek to fund projects that reduce nutrient loads from entering local waterways. In general, these grants are applied for by non-profit organizations and local governments as a means of addressing issues on private and public properties. The grant programs are made available state- and nation-wide depending on the program, and therefore it is a very competitive process. To prepare the most competitive applications to fund the projects in this action plan, watershed partners are encouraged to collaborate and bring forth a diverse set of technical skills. In addition to engaging each other, partners should also engage local governments and form public-private partnerships.

The second and third set of resources provided in this Appendix B include information about the Maryland Agricultural Cost-Share Program (MACS), Conservation Reserve Enhancement Program (CREP), and the federal Environmental Quality Incentive Programs (EQIP). The resources are available directly to the farmer or landowner on whose property the project will be installed. Diverse partnerships should be formed to utilize cost-share funding when available, and then should seek any remaining funds from the previously mentioned grant programs. The cost-share opportunities listed are current as of the date of this plan.

6.0 Monitoring and Reporting Progress

Maryland has adopted the Chesapeake Bay Total Maximum Daily Load which calls for a specific amount of reduction of nitrogen, phosphorus, and sediment loads by 2025. Pursuant to this strategy, the State divided the necessary load reduction up by sector and by county. Maryland Department of the Environment and Maryland Department of Agriculture are responsible for consolidating BMP implementation information that is shared with the Chesapeake Bay Program annually. This information provides an intermediate measure of implementation progress, including the rate and type of projects being installed. ShoreRivers conducts tidal water quality monitoring of the Upper Wye East from April through October to assess nutrient and overall health of the tidal waterway. Monitoring started in This monitoring will allow for the tracking of changes in water quality

REFERENCES:

Porter, S.A, M.D. Tomer, D.E. James, J.D. Van Horn, and K.M.B. Boomer. 2018. Agricultural Conservation Planning Framework: ArcGIS Toolbox User's Manual, Ver. 3. USDA Agricultural Research Service, National Laboratory for Agriculture and the Environment, Ames, Iowa. Available: http://northcentralwater.org/acpf/

APPENDICES:

Appendix A: Maps of Best Management Practices

Project selection was completed through the ACPF targeting tool. This method generated parcel specific plans geared towards farm-scale conservation. Each parcel is identified by a field boundary identification number that is also used to identify best management practices on the property. The practices are our best recommendation based on spatial data sets and provide a basis for discussion with landowners. Specific projects can be viewed using Google Earth .kmz files generated as part of this plan. Please contact Timothy Rosen at trosen@shorerivers.org to receive these files. The next maps on the following pages represent the parcel and small subwatershed suggested best management practices shown within the entire watershed as well as ancillary watershed parameters that helped with BMP selection and location.

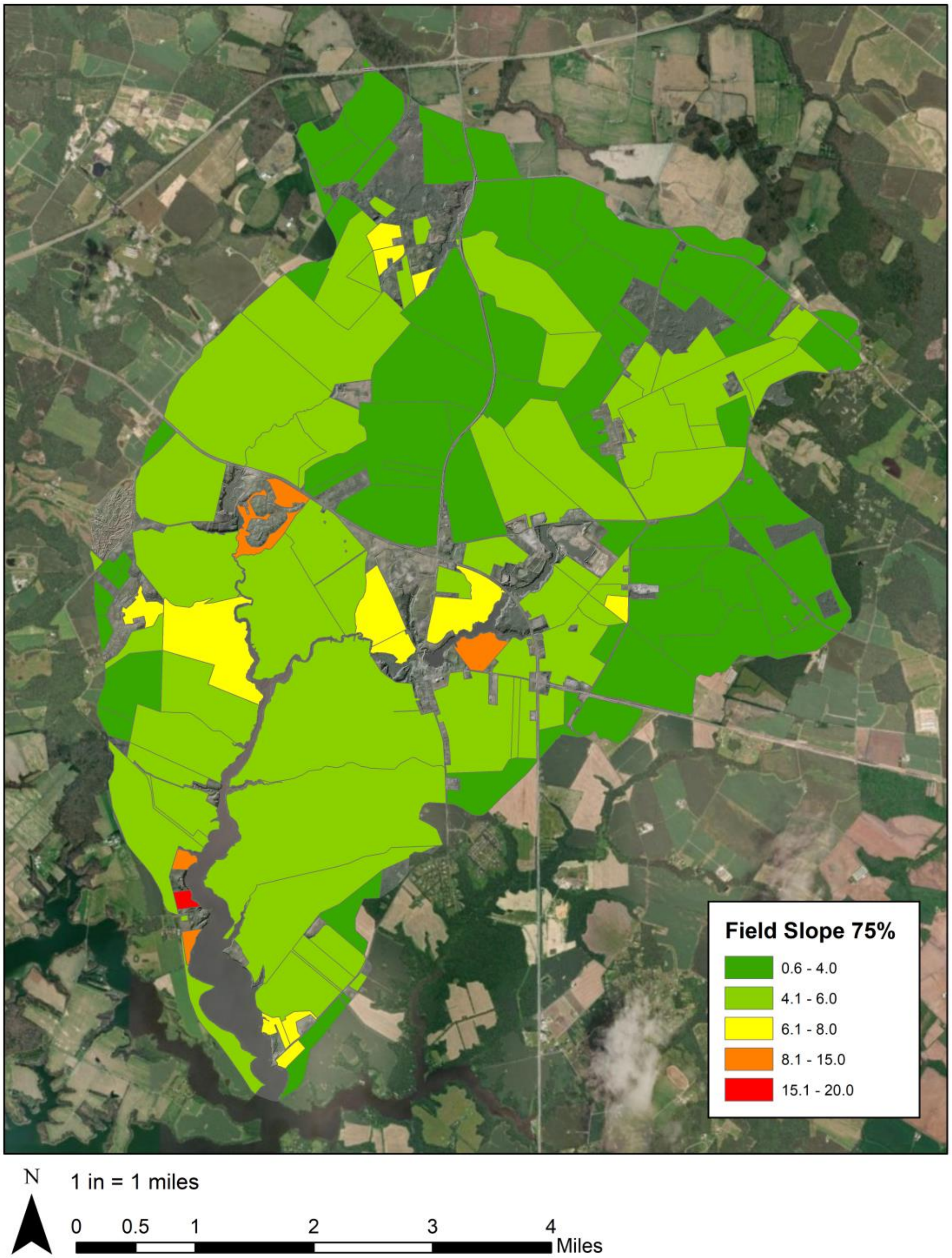

Figure 16. Slope shown by field using the 75th percentile slope. 75th percentile slope identifies the steepest portions of each field. Slope is important field characteristic because it influences how water flows across a field and determines what best management practices are best suited to reduce erosive energy or it can help identify flat fields that might have artificial drainage and could benefit from conservation drainage best management practices.

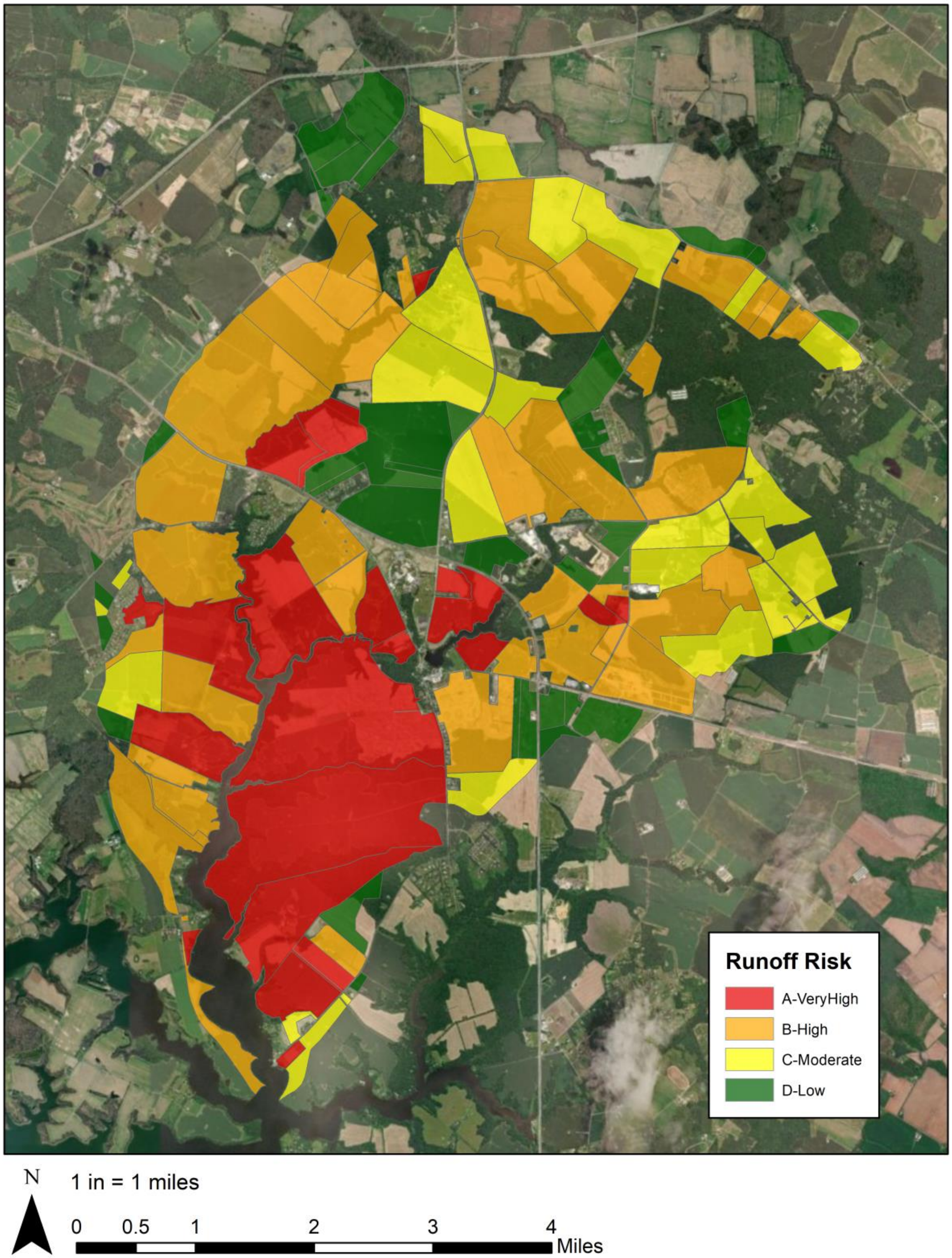

Figure 17. Per field runoff risk is based on slope and soils. Steeper sloped fields with highly erodible (sandy) soils are given a Very High runoff risk characterization. Fields with little slope and clayey soils are given Low runoff risk characterization.

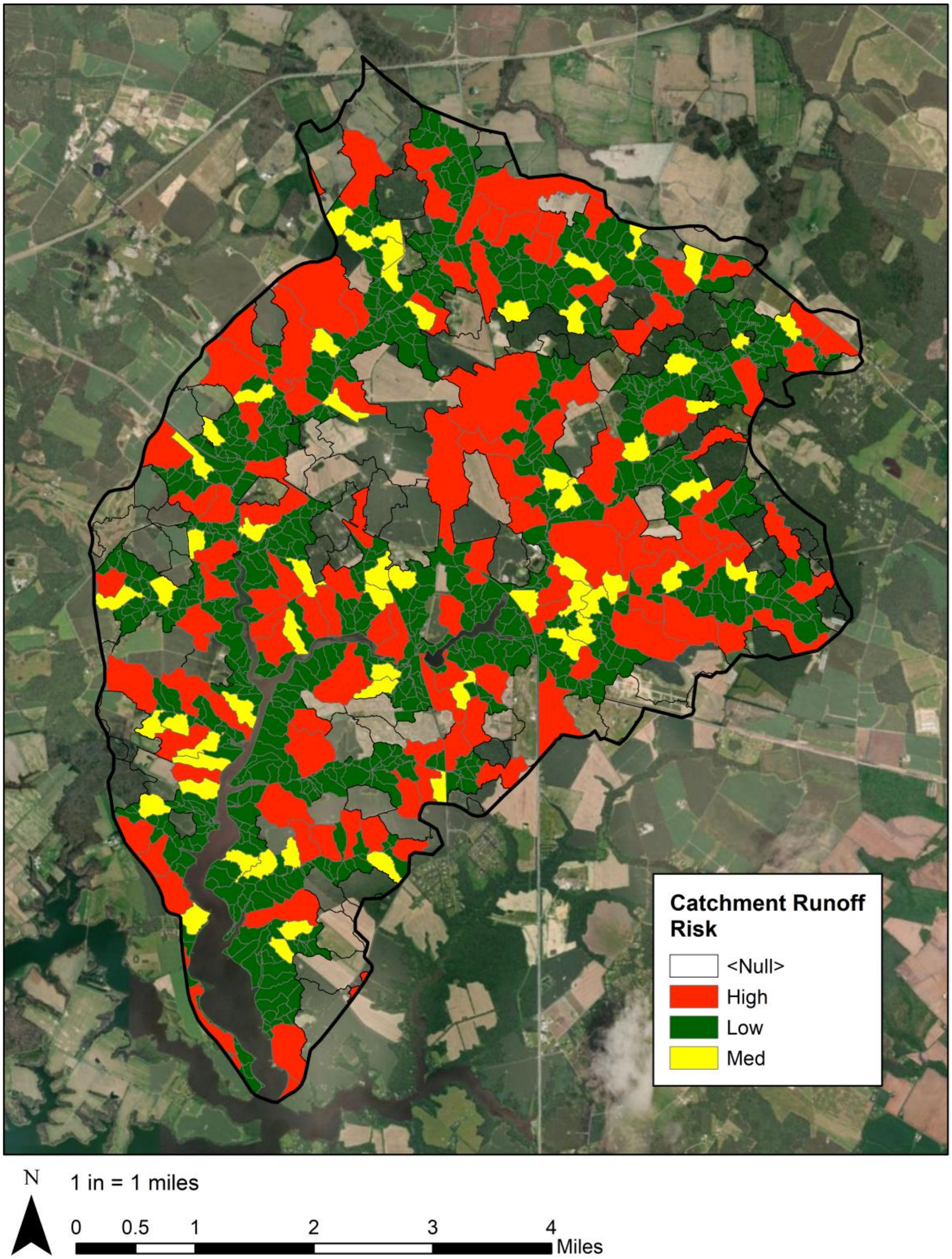

Figure 18. Subwatershed runoff risk assessment. The subwatersheds represent surface flowpaths greater than 5 acres bordering a perennial stream. Runoff risk for the subwatersheds is based on slope and soils. This analysis is related to field runoff risk, but allows for pinpointing distinct flowpaths that might have erosion issues.

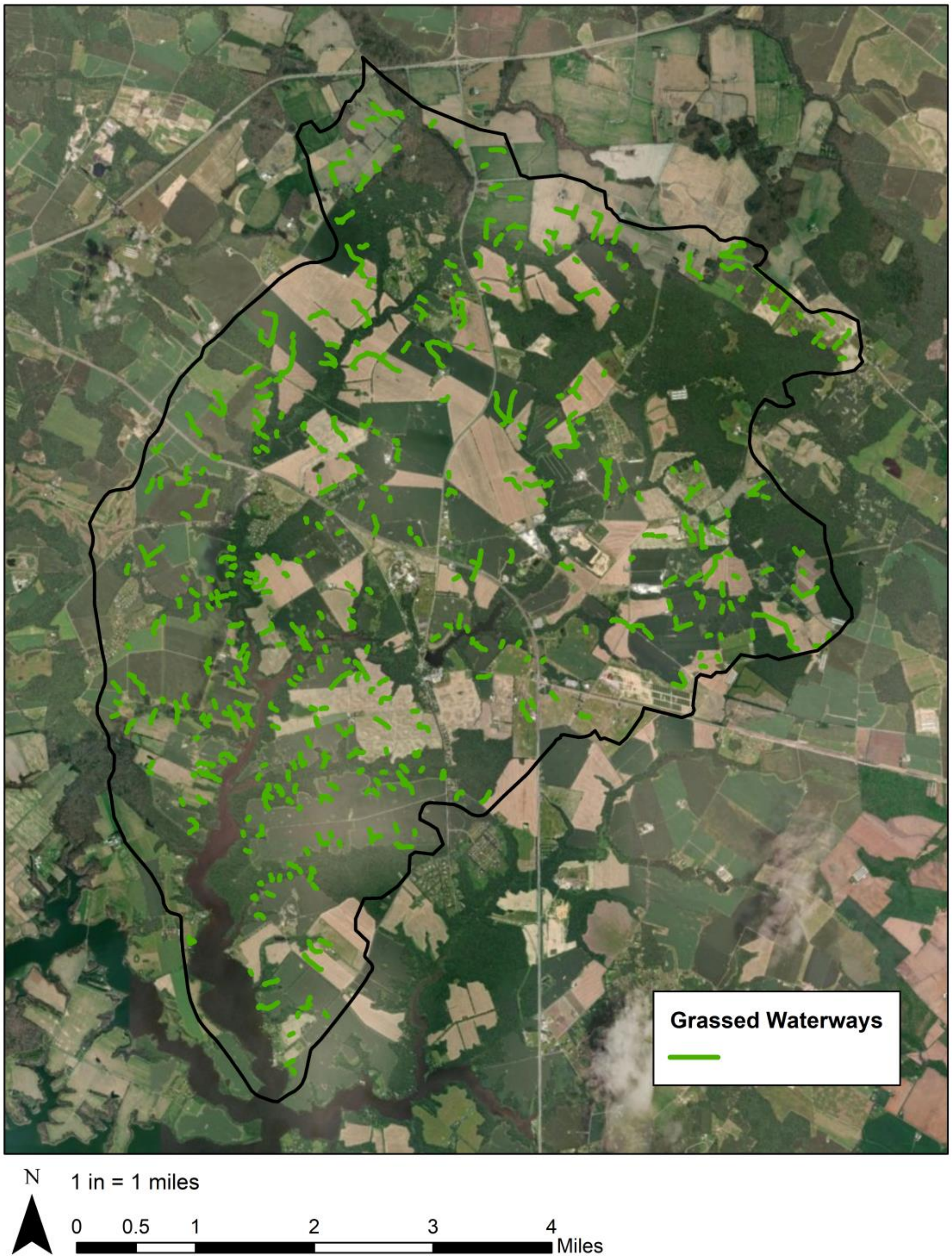

Figure 19. Grassed waterways are an important best management practice to reduce sediment and nutrient transport from fields to receiving waters. The grass helps stabilize the waterway and buffer against gully formation.

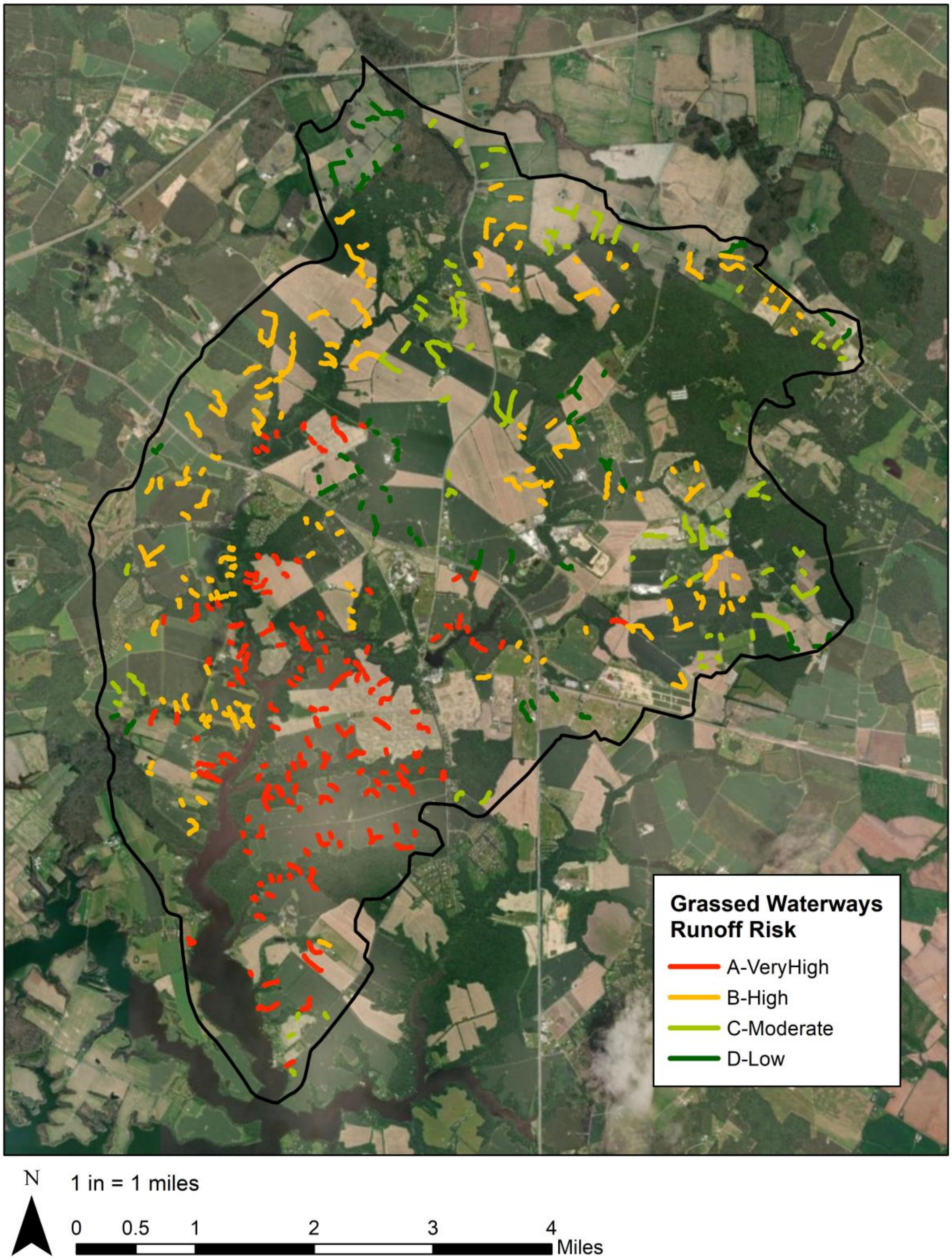

Figure 20. This map depicts grass waterways ranked by the runoff risk associated with the field that the grass waterway is located. This provides better direction on which grass waterways are priority for implementation.

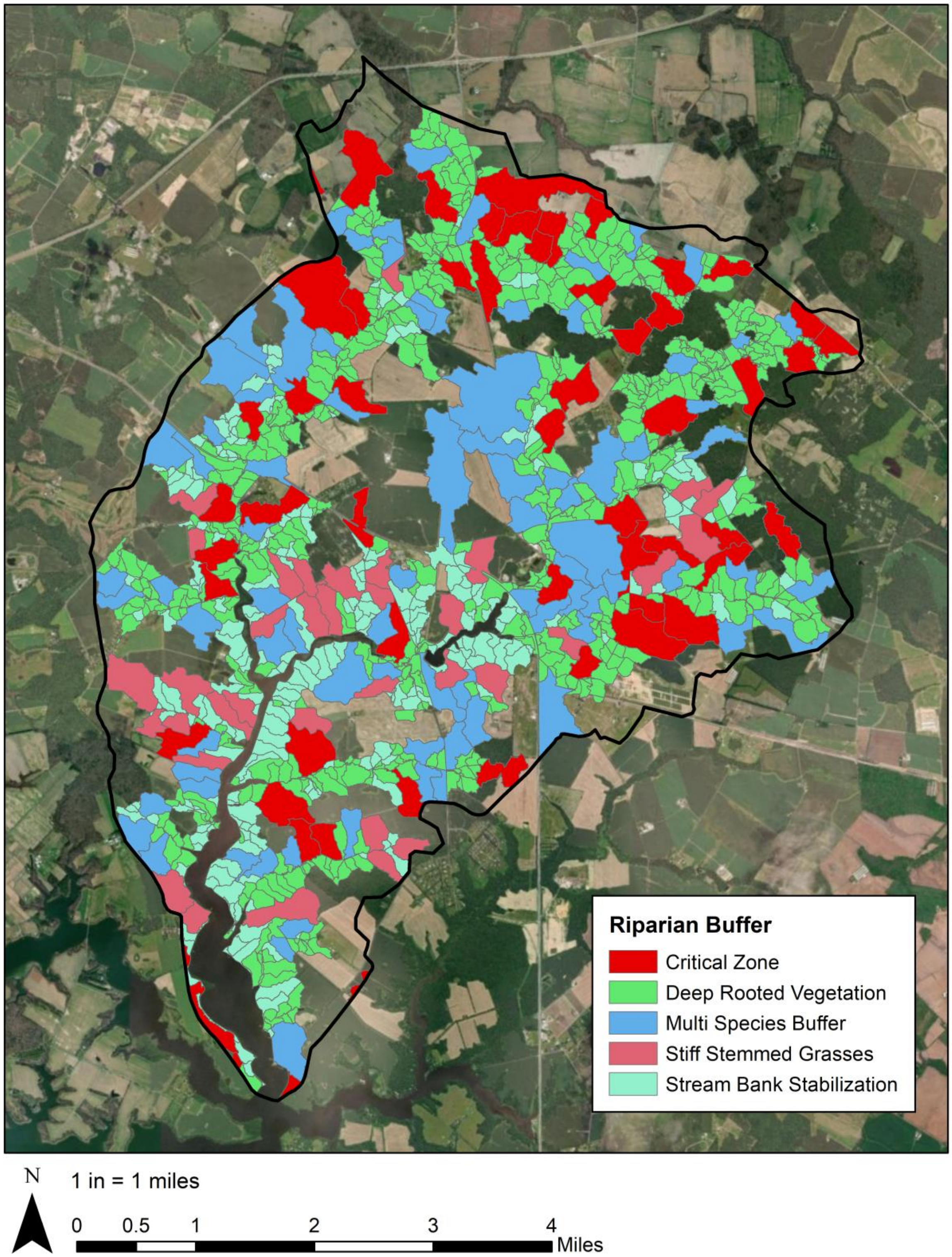

Figure 21. This map depicts suggested riparian buffer best management practices and plantings per subwatershed to mitigate impacts from overland flow to the receiving stream. Critical zones are areas that have high denitrification potential and receive a lot of overland flow.

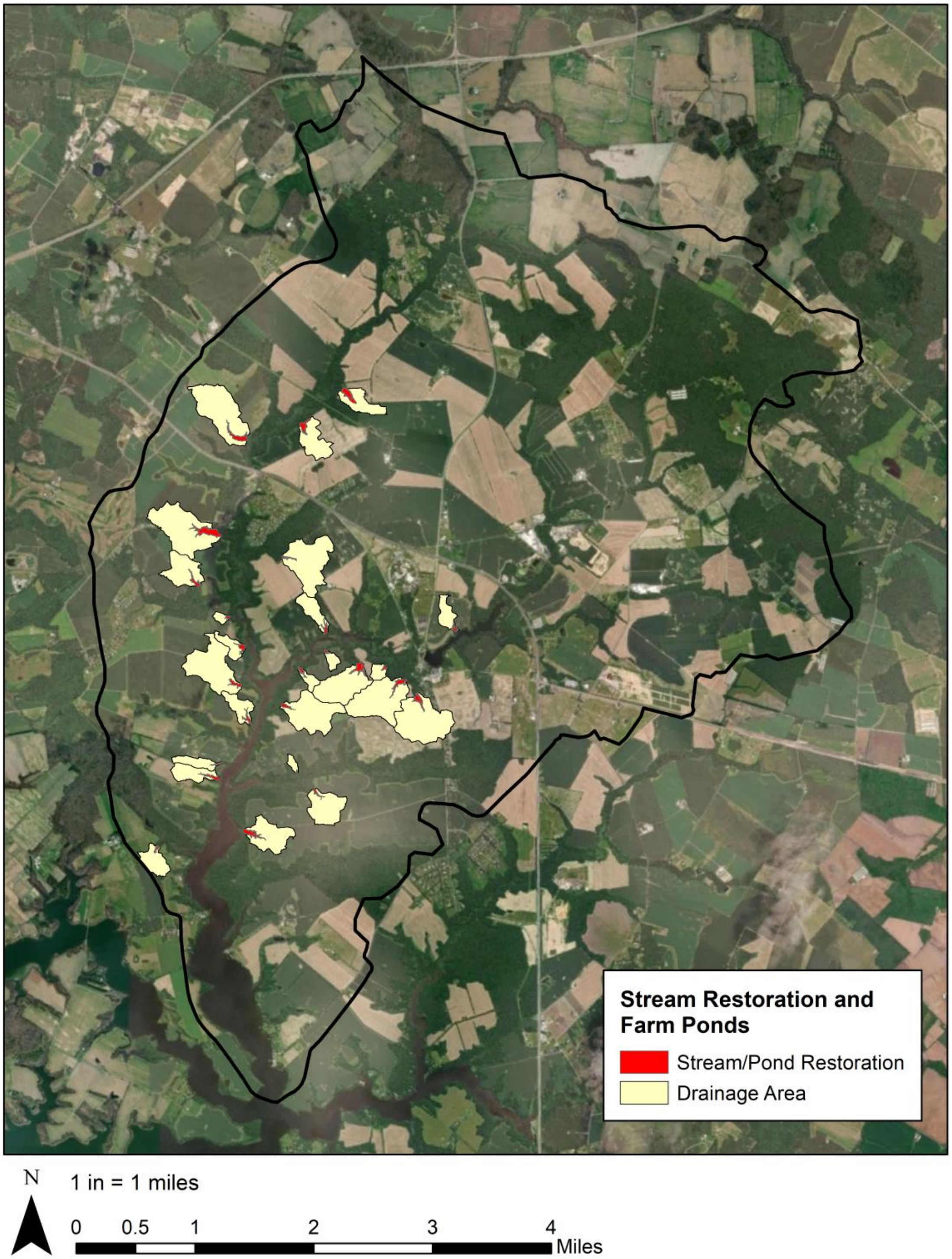

Figure 22. This map depicts areas that the model identified as good potential for farm pond creation. After closer inspection many of the areas were in forested ravines, which would be suited to stream restoration and stormwater BMPs. Drainage areas for each site are between 5 and 100 acres.

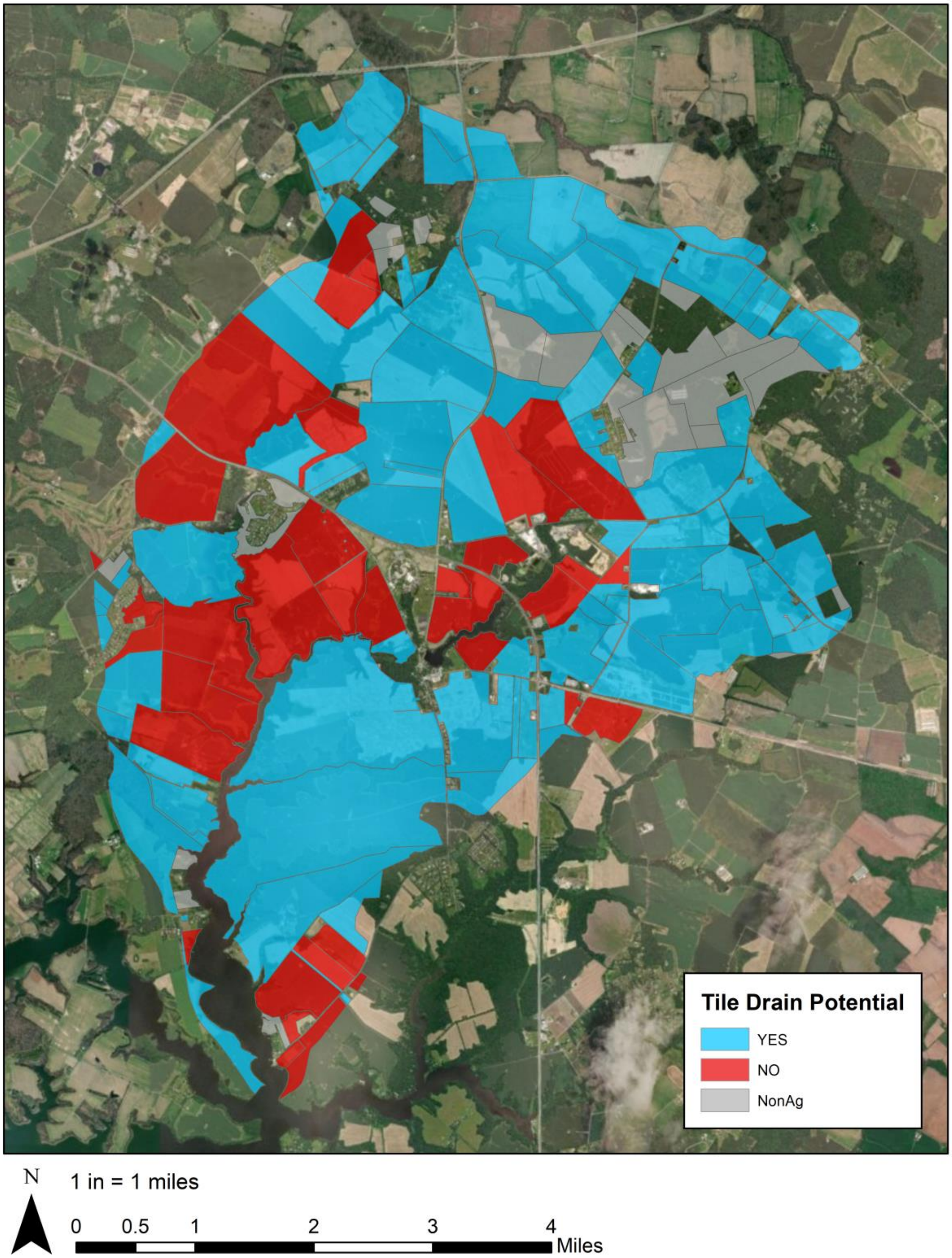

Figure 23. Tile drainage is used to help drain surface and subsurface water from farm fields to increase productivity and allow better trafficability. Many fields do not have a good record of tile drainage, thus this map depicts the models best guess of where tile drainage might exist based on soils > 40% hydric or >= 90% of the field < 5% slope

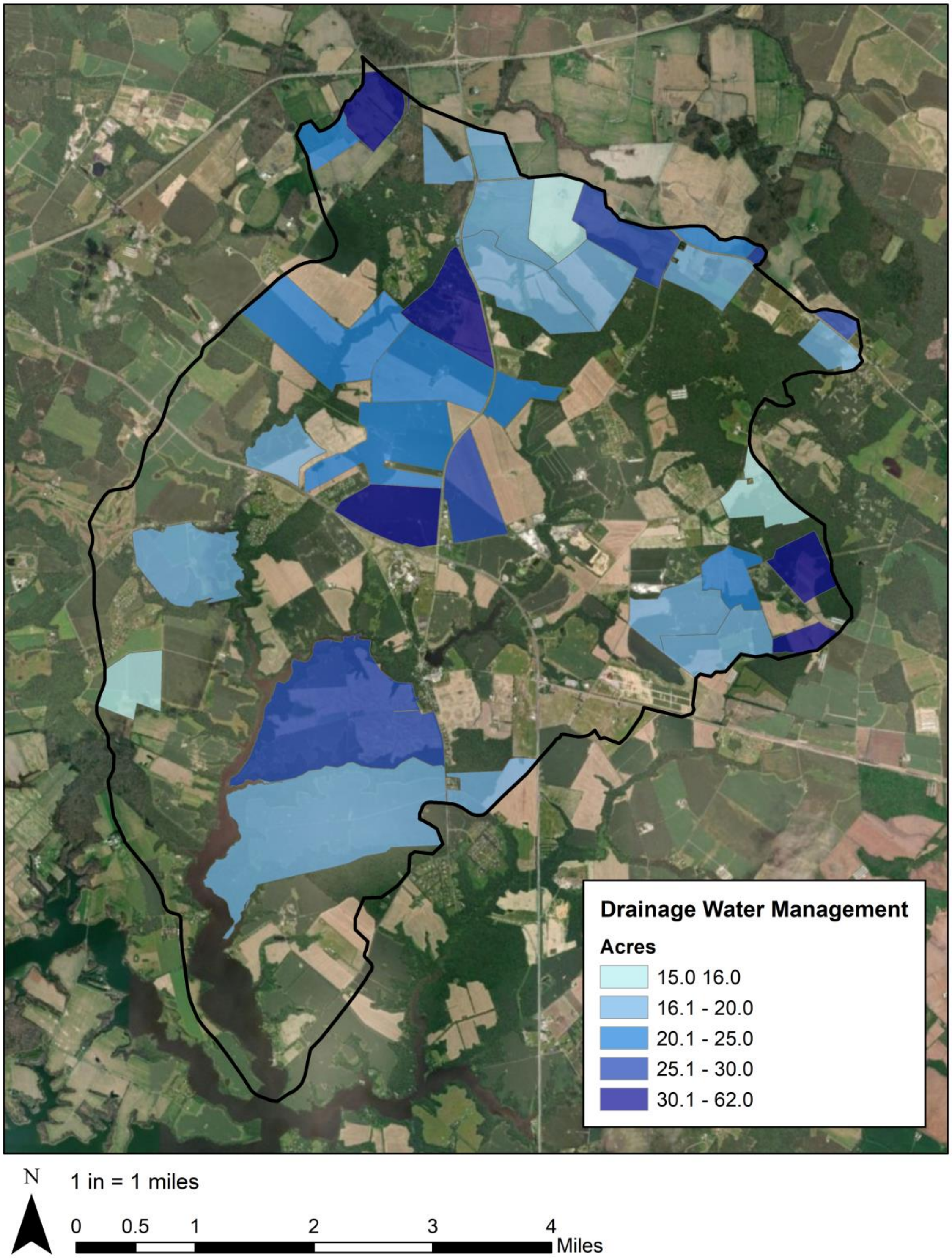

Figure 24. This map identifies fields that have the potential for drainage water management. These fields were selected based flat slopes and the model indicating that tile drainage might exist. Acres represents the acreage within the field that has the potential to be managed.

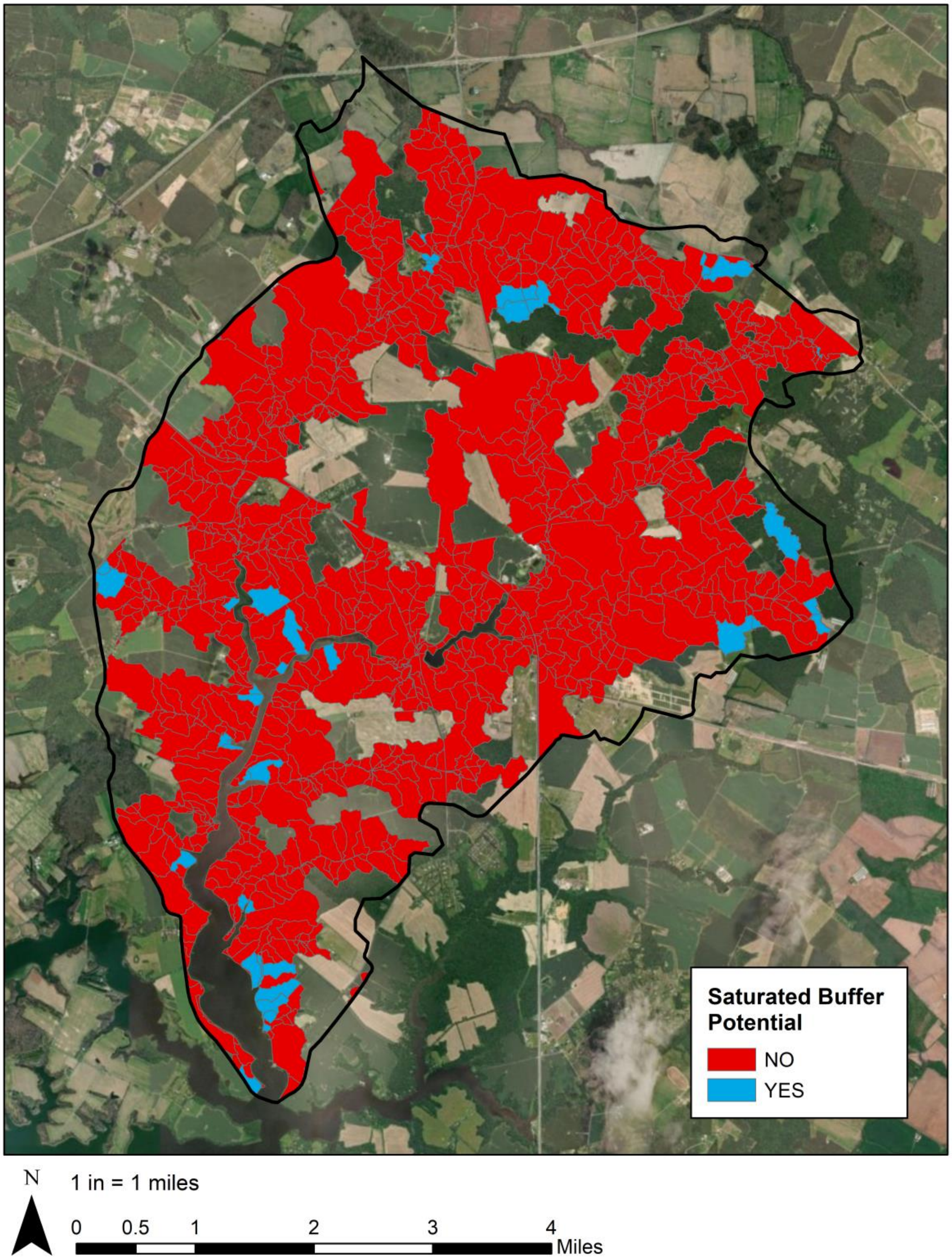

Figure 25. Saturated buffers are an outlet BMP for drainage tile. Locations were selected based on the potential of tile drainage being present, correct soils (organic), and slope to make a saturated buffer effective.

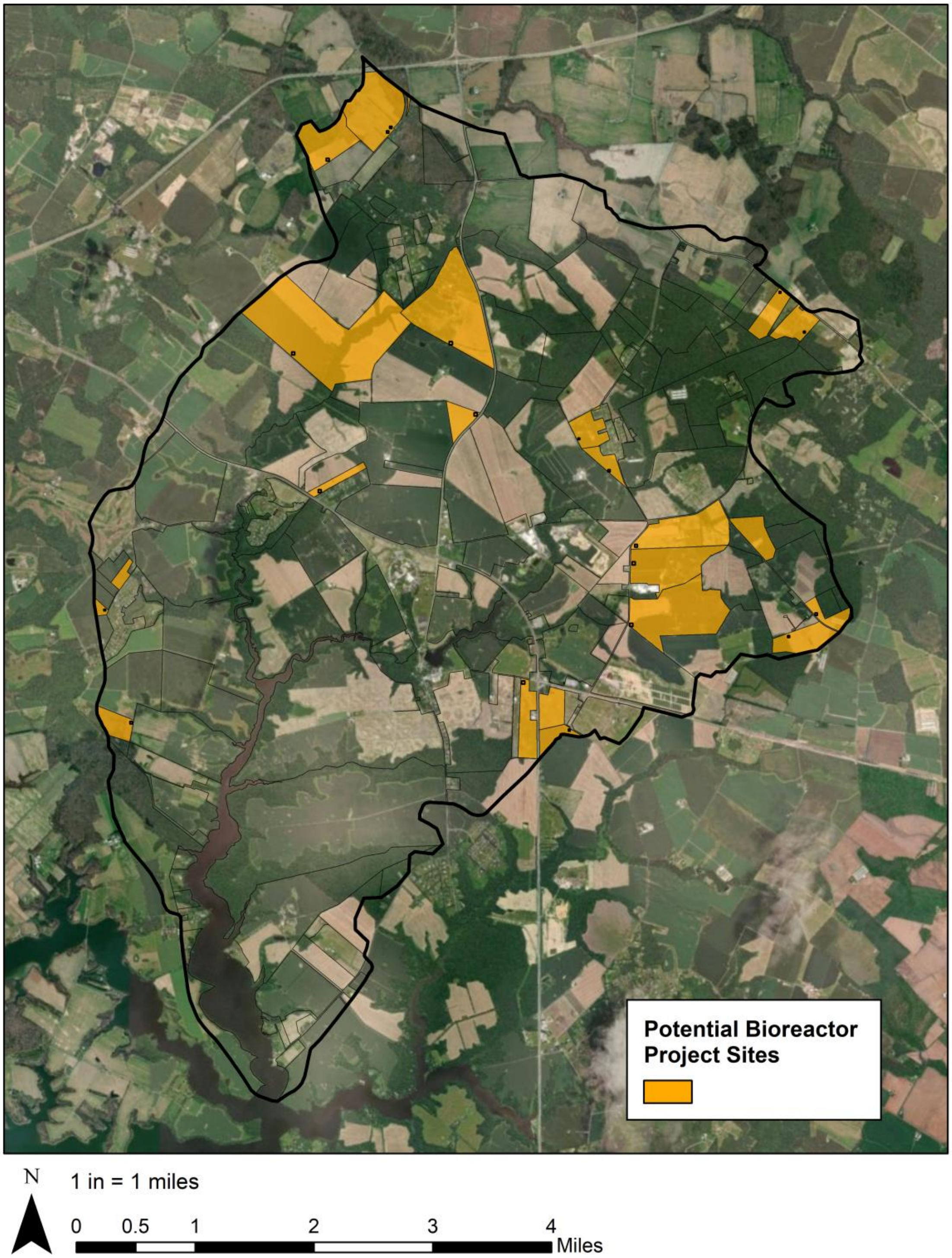

Figure 26. Denitrifying (woodchip) bioreactors are an outlet BMP for tile drainage. Locations were selected based on the potential for a field to have tile drainage and drainage areas >10 acres but <100.

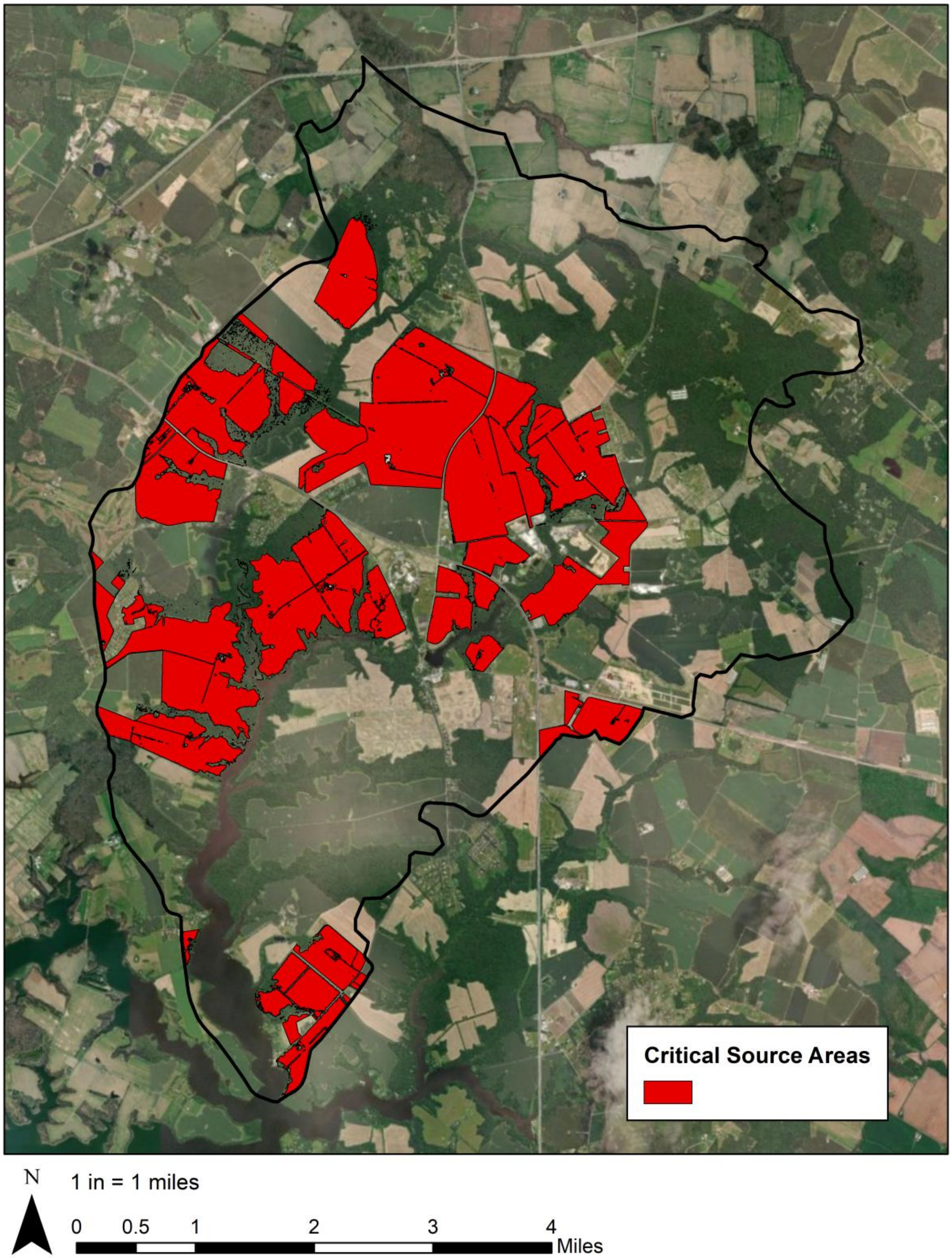

Figure 27. Critical source areas are farm fields that have the potential to have high nitrogen loss to the subsoil and low natural denitrification potential. It is critical that these fields use the latest cover cropping techniques and utilize advanced nutrient management to reduce nitrogen application.

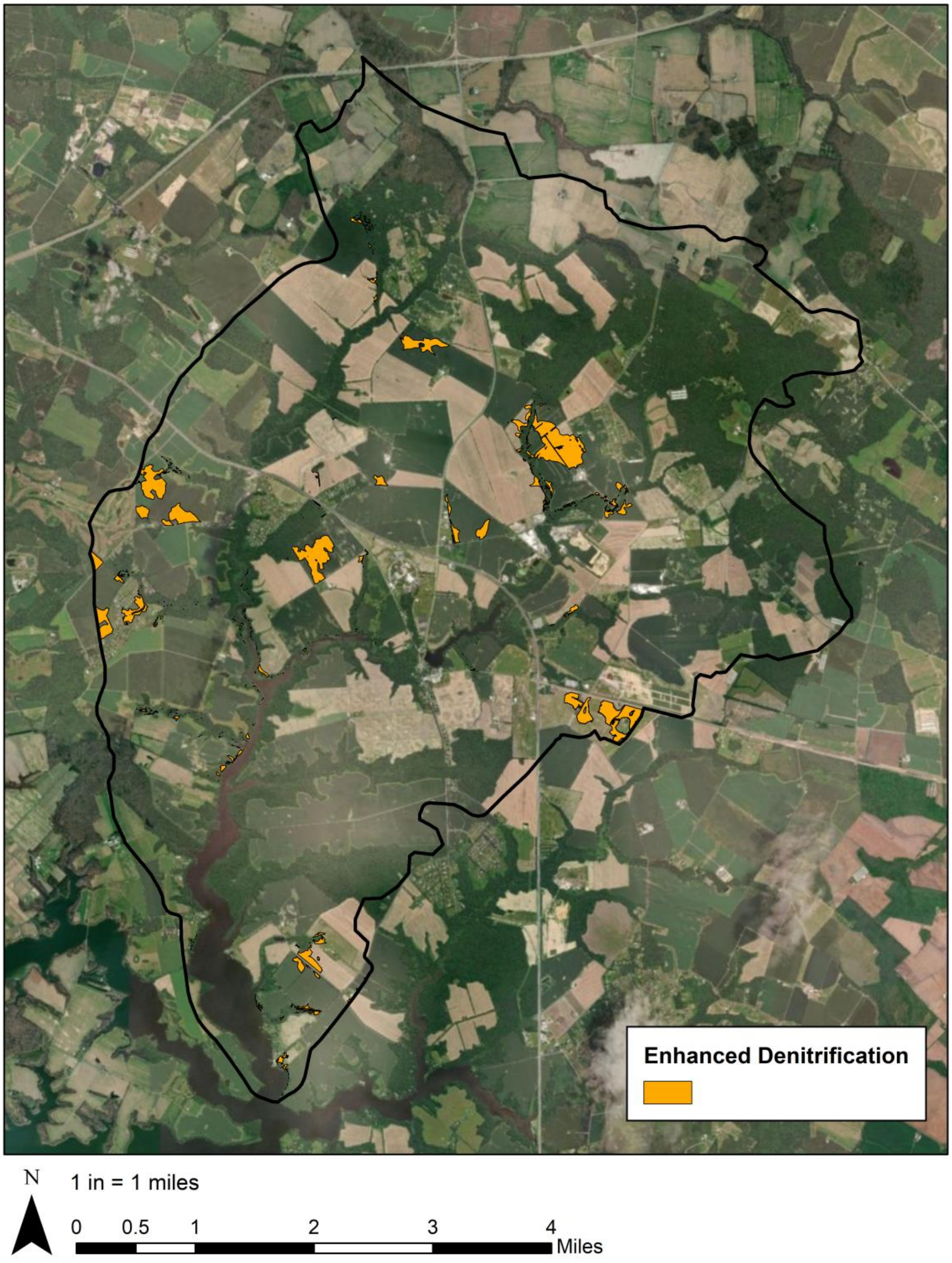

Figure 28. Enhanced denitrification references amending the soil profile with sawdust to create a "curtain" that shallow groundwater must pass through. The added carbon creates an environment that facilitates denitrification. Enhanced dentification sites were selected based on proximity to critical source areas and have a height above the stream channel <9 feet (proxy for highwater table).

Appendix B: Funding Sources

Funder	Grant Program	Grant Purpose	Last RFP Due Date	Grant Limit or Range	Notes
Chesapeake Bay Trust	Non-Tidal Wetland Restoration	Implement cost-effective wetland projects to provide valuable wetland functions, including habitat for a wide range of species and improved water quality, flood attenuation, recharge of groundwater, and aesthetics in the State's local watersheds	1-June-17 mandatory site visit. 6-Jul-17 Proposal	$500,000, or greater upon approval $7,000-$9,000 Per acre Easement acquisition value available*	All proposed projects must acknowledge and confirm the ability to adhere to Performance Standards and Monitoring (attached to this RFP) *A recent appraisal is needed to show eligibility for easement acquisition funding.
Chesapeake Bay Trust	Outreach & Restoration	Supports outreach and community engagement activities that increase stewardship ethic of natural resources and on-the-ground restoration activities that demonstrate restoration techniques and engage Maryland citizens in the restoration and protection of the Chesapeake Bay rivers.	Sep-19	$5,001-$75,000 depending on the track*	*Track 1: Outreach: up to $30,000 for projects focused on education and awareness as project outcomes, up to $50,000 for behavior change projects. Track 2: Restoration: up to $50,000 for implementation projects Track 3: Outreach and Restoration: up to $75,000 for projects that combine restoration and outreach elements to measurably build knowledge within the community served.
Chesapeake Bay Trust & Maryland Dept of Natural Resources	Watershed Assistance Grant Program	Supports design assistance, watershed planning and programmatic development associated with protection and restoration program and project that lead to improved water	Aug-19	$5,001 - $200,000	

Funder	Grant Program	Grant Purpose	Last RFP Due Date	Grant Limit or Range	Notes
		quality in the Maryland portion of the Chesapeake Bay watershed.			
National Fish and Wildlife Foundation	Chesapeake Bay Stewardship Fund – Small Watershed Grant (SWG)	Projects that promote community-based efforts to protect and restore the diverse natural resources of the Chesapeake Bay and its tributary rivers and streams. SWG Implementation grants are awarded for projects that result in direct, on-the-ground actions to protect and restore water quality, species, and habitats in the Bay watershed; SWG Planning and Technical Assistance grants are awarded for projects that enhance local capacity to more efficiently and effectively implement future on-the-ground actions through assessment, planning, design, and other technical assistance-oriented activities.	May-19	$20,000-$200,000 depending on the program**	*Prior to 2017, the deadline for this grant was early May. **SWG Implementation program will range from $20,000-$200,000 for two year projects and requires a one-third non-federal match. SWG Planning and Technical Assistance grants will not exceed $50,000 for a one year project.
National Fish and Wildlife Foundation	Chesapeake Bay Stewardship Fund – Innovative Nutrient & Sediment Reduction	A program designed to accelerate the implementation of water quality improvements specifically through the collaborative and coordinated efforts of sustainable, regional-scale partnerships and networks of practitioners with a shared focus on water quality restoration and protection.	May-19	$750,000 - $1 million	These grants encourage non-federal matching contributions equal to the grant request. All 2018 INSR-RSI grants must be completed within three years of grant award.

Funder	Grant Program	Grant Purpose	Last RFP Due Date	Grant Limit or Range	Notes
	Grant (INSR)				
Maryland Department of the Environment	319 Nonpoint Source Program	Provides financial assistance to local and state entities for the implementation of nonpoint source best management practices and program enhancements as a means of controlling the loads of pollutants entering the state's waterways.	Every summer		§319(h) Grant funds can pay for planning, design, construction, monitoring and analysis. However, the majority of §319(h) Grant funding in Maryland is intended for implementation of projects that will: Reduce or eliminate water quality impairments listed in the Maryland's List of Impaired Water (303(d) List), particularly in watersheds where Total Maximum Daily Loads (TMDLs) have been approved; and result in quantifiable or measurable improvements in water quality and habitat, including, pollutant load reductions for impairments addressed in TMDLs or identified in the 303(d) List. A prerequisite for §319(h) funding of implementation projects (any project involving in-the-ground construction) is EPA acceptance of a watershed plan.
Maryland Dept of Natural Resources	Chesapeake & Atlantic Coastal Bays Trust Fund	Fund the most cost-effective, efficient nonpoint nutrient and sediment reduction project proposals in geographic targeted areas of the State. The Trust Fund encourages projects that will achieve the greatest reduction per dollar invested	Fall 19	Typically $100,000-$750,000	

Maryland Agricultural Water Quality Cost-Share Program (MACS)					
Code	**Practice Name**	**Notes**	**Unity Type**	**Unit Cost**	**Limit**
340	Cover Crops	Applications accepted June 21 to July 17. Payments are no longer offered for harvested cover crops.	Acre	$75	$22.5 mill state-wide
412	Grassed Waterway	Cost-share authorized for Site preparation, grading, shaping, filling, and lime, fertilizer and seed for establishing a permanent vegetative cover, filter cloth, mulch and/or erosion control matting plus anchoring materials	Total	87.5%	$50,000
391	Riparian Forest Buffer	Required 35'-100' buffer	Total	87.5%	$50,000
390	Riparian Herbaceous Cover	Required 35'-100' buffer	Total	87.5%	$50,000
587	Structure for Water Control		Total	87.5%	$50,000
657	Wetland Restoration	Practice must meet standards and applied on farmland	Total	87.5%	$50,000

NRCS Environmental Quality Incentive Program (EQIP).					
Code	**Practice Name**	**Component**	**Unity Type**	**Unit Cost**	**Share Rate**
630	Vertical Drain	Sand Filled Pit	CuYd	$63.39	100
630	Vertical Drain	HU-Sand Filled Pit	CuYd	$76.07	100
340	Cover Crop	Cover Crop - Adaptive Management	Ea	$1,885.28	100
340	Cover Crop	HU-Cover Crop - Adaptive Management	Ea	$2,262.33	100
340	Cover Crop	Cover Crop - Basic (Organic and Non-organic)	ac	$63.47	100

NRCS Environmental Quality Incentive Program (EQIP).					
340	Cover Crop	HU-Cover Crop - Basic (Organic and Non-organic)	ac	$76.16	100
340	Cover Crop	Cover Crop - Basic Organic	ac	$76.34	100
340	Cover Crop	HU-Cover Crop - Basic Organic	ac	$91.61	100
340	Cover Crop	Cover Crop - Multiple Species (Organic and Non-organic)	ac	$74.18	100
605	Denitrifying Bioreactor	Denitrifying Bioreactor	CuYd	$36.83	100
605	Denitrifying Bioreactor	HU-Denitrifying Bioreactor	CuYd	$44.19	100
554	Drainage Water Management	Drainage Water Management (DWM)	Ea	$80.76	100
554	Drainage Water Management	HU-Drainage Water Management (DWM)	Ea	$96.91	100
130	Drainage Water Management Plan - Written	DWMP - Tile Map Available	no	$2,049.37	100
130	Drainage Water Management Plan - Written	HU-DWMP - Tile Map Available	no	$2,459.25	100
130	Drainage Water Management Plan - Written	DWMP - No Tile Map Available	no	$2,444.86	100
130	Drainage Water Management Plan - Written	HU-DWMP - No Tile Map Available	no	$2,933.83	100
412	Grassed Waterway	Grass Waterway with Stone Checks	ac	$5,032.97	100
412	Grassed Waterway	HU-Grass Waterway with Stone Checks	ac	$5,987.68	100
412	Grassed Waterway	Waterway, small, 0.2 Acres or less	sq ft	$0.11	100
412	Grassed Waterway	HU-Waterway, small, 0.2 Acres or less	sq ft	$0.14	100
412	Grassed Waterway	Waterway, over 0.2 acres	ac	$3,516.21	100

NRCS Environmental Quality Incentive Program (EQIP).					
412	Grassed Waterway	HU-Waterway, over 0.2 acres	ac	$4,167.58	100
449	Irrigation Water Management	1st Year, Computer Record Keeping System	ac	$223.04	100
449	Irrigation Water Management	HU-1st Year, Computer Record Keeping System	ac	$267.64	100
449	Irrigation Water Management	Annual Crops, Vegetables, 1st Year	ac	$47.77	100
449	Irrigation Water Management	HU-Annual Crops, Vegetables, 1st Year	ac	$57.33	100
449	Irrigation Water Management	Annual Crops, Vegetables, 1st Year, with Data Logger	ac	$95.33	100
449	Irrigation Water Management	HU-Annual Crops, Vegetables, 1st Year, with Data Logger	ac	$114.39	100
449	Irrigation Water Management	Annual Crops, Vegetables, 2nd and 3rd Year	ac	$25.81	100
449	Irrigation Water Management	HU-Annual Crops, Vegetables, 2nd and 3rd Year	ac	$30.97	100
449	Irrigation Water Management	Basic IWM 30 acres or less	ac	$21.66	100
449	Irrigation Water Management	HU-Basic IWM 30 acres or less	ac	$25.99	100
449	Irrigation Water Management	Basic IWM over 30 acres	ac	$11.68	100
449	Irrigation Water Management	HU-Basic IWM over 30 acres	ac	$14.01	100
449	Irrigation Water Management	Field Crops, Grains, 1st Year	ac	$13.38	100
449	Irrigation Water Management	HU-Field Crops, Grains, 1st Year	ac	$16.05	100
449	Irrigation Water Management	Field Crops, Grains, 1st Year, with Data Logger	ac	$32.40	100
449	Irrigation Water Management	HU-Field Crops, Grains, 1st Year, with Data Logger	ac	$38.88	100
449	Irrigation Water Management	Field Crops, Grains, 2nd and 3rd Year	ac	$6.72	100
449	Irrigation Water Management	HU-Field Crops, Grains, 2nd and 3rd Year	ac	$8.06	100
590	Nutrient Management	Adaptive NM	Ea	$2,045.66	100

NRCS Environmental Quality Incentive Program (EQIP).					
590	Nutrient Management	HU-Adaptive NM	Ea	$2,454.80	100
590	Nutrient Management	Basic NM with Manure and/or Compost (Non-Organic/Organic)	ac	$14.00	100
590	Nutrient Management	HU-Basic NM with Manure and/or Compost (Non-Organic/Organic)	ac	$16.81	100
590	Nutrient Management	Basic NM with Manure Injection or Incorporation	ac	$26.61	100
590	Nutrient Management	HU-Basic NM with Manure Injection or Incorporation	ac	$31.93	100
590	Nutrient Management	Basic Precision NM (Non-Organic/Organic)	ac	$38.27	100
590	Nutrient Management	HU-Basic Precision NM (Non-Organic/Organic)	ac	$45.93	100
590	Nutrient Management	Small Farm NM (Non-Organic/Organic)	Ea	$217.16	100
590	Nutrient Management	HU-Small Farm NM (Non-Organic/Organic)	Ea	$260.59	100
104	Nutrient Management Plan - Written	Nutrient Management CAP Less Than or Equal to 100 Acres (Not part of a CNMP)	no	$1,766.27	100
104	Nutrient Management Plan - Written	HU-Nutrient Management CAP Less Than or Equal to 100 Acres (Not part of a CNMP)	no	$2,119.53	100
104	Nutrient Management Plan - Written	Nutrient Management CAP 104- 101-300 Acres (Not part of a CNMP)	no	$2,355.03	100
104	Nutrient Management Plan - Written	HU-Nutrient Management CAP 104- 101-300 Acres (Not part of a CNMP)	no	$2,826.04	100
104	Nutrient Management Plan - Written	Nutrient Management CAP 104 Greater Than 300 Acres (Not part of a CNMP)	no	$2,943.79	100
104	Nutrient Management Plan - Written	HU-Nutrient Management CAP 104 Greater Than 300 Acres (Not part of a CNMP)	no	$3,532.55	100

NRCS Environmental Quality Incentive Program (EQIP).					
104	Nutrient Management Plan - Written	Nutrient Management CAP 104 Less Than or Equal to 100 Acres (Element of a CNMP)	no	$2,943.79	100
104	Nutrient Management Plan - Written	HU-Nutrient Management CAP 104 Less Than or Equal to 100 Acres (Element of a CNMP)	no	$3,532.55	100
104	Nutrient Management Plan - Written	Nutrient Management CAP 104 - 101-300 Acres (Element of a CNMP)	no	$4,121.31	100
104	Nutrient Management Plan - Written	HU-Nutrient Management CAP 104 - 101-300 Acres (Element of a CNMP)	no	$4,945.57	100
104	Nutrient Management Plan - Written	Nutrient Management CAP 104 Greater Than 300 Acres (Element of a CNMP)	no	$5,004.44	100
104	Nutrient Management Plan - Written	HU-Nutrient Management CAP 104 Greater Than 300 Acres (Element of a CNMP)	no	$6,005.33	100
104	Nutrient Management Plan - Written	Nutrient Management CAP Less Than or Equal to 100 Acres (Not part of a CNMP)	no	$1,766.27	100
104	Nutrient Management Plan - Written	HU-Nutrient Management CAP Less Than or Equal to 100 Acres (Not part of a CNMP)	no	$2,119.53	100
104	Nutrient Management Plan - Written	Nutrient Management CAP 104- 101-300 Acres (Not part of a CNMP)	no	$2,355.03	100
782	Phosphorous Removal System	Ditch	Ea	$3,452.45	100
782	Phosphorous Removal System	HU-Ditch	Ea	$4,142.94	100
391	Riparian Forest Buffer	Bareroot, hand planted with tube	ac	$2,909.57	100
391	Riparian Forest Buffer	HU-Bareroot, hand planted with tube	ac	$3,439.61	100
391	Riparian Forest Buffer	Large container, hand planted	ac	$4,690.10	100

NRCS Environmental Quality Incentive Program (EQIP).					
391	Riparian Forest Buffer	HU-Large container, hand planted	ac	$5,472.49	100
391	Riparian Forest Buffer	Small container, hand planted	ac	$2,482.51	100
391	Riparian Forest Buffer	HU-Small container, hand planted	ac	$2,927.13	100
604	Saturated Buffer	Saturated Buffer	ft	$6.27	100
604	Saturated Buffer	HU-Saturated Buffer	ft	$7.52	100
580	Streambank and Shoreline Protection	Bioengineered	sq ft	$0.99	100
580	Streambank and Shoreline Protection	HU-Bioengineered	sq ft	$1.19	100
580	Streambank and Shoreline Protection	Bioengineered with Toe Protection	sq ft	$2.79	100
580	Streambank and Shoreline Protection	HU-Bioengineered with Toe Protection	sq ft	$3.35	100
580	Streambank and Shoreline Protection	Geotextile Wrapped	sq ft	$24.43	100
580	Streambank and Shoreline Protection	HU-Geotextile Wrapped	sq ft	$29.32	100
580	Streambank and Shoreline Protection	Structural small, banks less than 4 ft	CuYd	$90.72	100
580	Streambank and Shoreline Protection	HU-Structural small, banks less than 4 ft	CuYd	$108.87	100
580	Streambank and Shoreline Protection	Structural, >5 ft bank	CuYd	$89.08	100

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580	Streambank and Shoreline Protection	HU-Structural, >5 ft bank	CuYd	$106.90	100
580	Streambank and Shoreline Protection	Vegetative	sq ft	$0.61	100
580	Streambank and Shoreline Protection	HU-Vegetative	sq ft	$0.73	100
587	Structure for Water Control	Basin, earthen	LnFt	$22.57	100
587	Structure for Water Control	HU-Basin, earthen	LnFt	$27.09	100
587	Structure for Water Control	CMP Turnout	Ea	$749.09	100
587	Structure for Water Control	HU-CMP Turnout	Ea	$898.90	100
587	Structure for Water Control	Commercial Inline Flashboard Riser	InFt	$3.34	100
587	Structure for Water Control	HU-Commercial Inline Flashboard Riser	InFt	$4.01	100
587	Structure for Water Control	Concrete Turnout Structure	Ea	$2,873.05	100
587	Structure for Water Control	HU-Concrete Turnout Structure	Ea	$3,447.66	100
587	Structure for Water Control	Concrete Turnout Structure - Small	Ea	$1,086.26	100
587	Structure for Water Control	HU-Concrete Turnout Structure - Small	Ea	$1,303.51	100
587	Structure for Water Control	Culvert <30 inches CMP	InFt	$2.33	100
587	Structure for Water Control	HU-Culvert <30 inches CMP	InFt	$2.79	100
587	Structure for Water Control	Culvert <30 inches HDPE	InFt	$2.17	100
587	Structure for Water Control	HU-Culvert <30 inches HDPE	InFt	$2.60	100
587	Structure for Water Control	Flap Gate	ft	$1,379.61	100

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587	Structure for Water Control	HU-Flap Gate	ft	$1,655.53	100
587	Structure for Water Control	Flap Gate w/ Concrete Wall	CuYd	$924.98	100
587	Structure for Water Control	HU-Flap Gate w/ Concrete Wall	CuYd	$1,109.98	100
587	Structure for Water Control	Forestland Waterbar	Ea	$119.07	100
587	Structure for Water Control	HU-Forestland Waterbar	Ea	$142.89	100
587	Structure for Water Control	Gated Pipe	ft	$10.80	100
587	Structure for Water Control	HU-Gated Pipe	ft	$12.96	100
587	Structure for Water Control	Grated Dropbox	Ea	$941.61	100
587	Structure for Water Control	HU-Grated Dropbox	Ea	$1,129.93	100
587	Structure for Water Control	Inlet Flashboard Riser, Metal	InFt	$2.78	100
587	Structure for Water Control	HU-Inlet Flashboard Riser, Metal	InFt	$3.33	100
587	Structure for Water Control	Inline Flashboard Riser, Metal	InFt	$2.94	100
587	Structure for Water Control	HU-Inline Flashboard Riser, Metal	InFt	$3.52	100
587	Structure for Water Control	In-Stream Structure for Water Surface Profile	ft	$207.10	100
587	Structure for Water Control	HU-In-Stream Structure for Water Surface Profile	ft	$248.52	100
587	Structure for Water Control	Rock Checks for Water Surface Profile	Ton	$46.83	100
587	Structure for Water Control	HU-Rock Checks for Water Surface Profile	Ton	$56.19	100
587	Structure for Water Control	Slide Gate	ft	$1,587.75	100
587	Structure for Water Control	HU-Slide Gate	ft	$1,905.30	100
587	Structure for Water Control	Trench Drain with grate	Ea	$1,254.65	100

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587	Structure for Water Control	HU-Trench Drain with grate	Ea	$1,505.57	100
587	Structure for Water Control	Water Bar	Ea	$645.96	100
587	Structure for Water Control	HU-Water Bar	Ea	$775.15	100
657	Wetland Restoration	Depression Sediment Removal (Pothole)	Ea	$2,275.12	100
657	Wetland Restoration	HU-Depression Sediment Removal (Pothole)	Ea	$2,730.15	100
657	Wetland Restoration	Drain Tile Plug	ft	$1.46	100
657	Wetland Restoration	HU-Drain Tile Plug	ft	$1.75	100
657	Wetland Restoration	Estuarine Fringe Levee Removal	ac	$12.89	100
657	Wetland Restoration	HU-Estuarine Fringe Levee Removal	ac	$15.47	100
657	Wetland Restoration	Hydrologic restoration with embankment or ditch plug	ft	$22.73	100
657	Wetland Restoration	HU-Hydrologic restoration with embankment or ditch plug	ft	$27.27	100
657	Wetland Restoration	Riverine Channel and Floodplain Restoration	ac	$363.67	100
657	Wetland Restoration	HU-Riverine Channel and Floodplain Restoration	ac	$436.41	100
657	Wetland Restoration	Riverine Levee Removal	CuYd	$2.58	100
657	Wetland Restoration	HU-Riverine Levee Removal	CuYd	$3.09	100
658	Wetland Creation	Wetland Creation	ac	$2,664.13	100
658	Wetland Creation	HU-Wetland Creation	ac	$3,196.95	100
659	Wetland Enhancement	Depression Sediment Removal and Ditch Plug	ac	$1,164.91	100
659	Wetland Enhancement	HU-Depression Sediment Removal and Ditch Plug	ac	$1,346.02	100
659	Wetland Enhancement	Enhanced wetland Topography	ac	$1,026.65	100

NRCS Environmental Quality Incentive Program (EQIP).					
659	Wetland Enhancement	HU-Enhanced wetland Topography	ac	$1,180.10	100
659	Wetland Enhancement	Estuarine Fringe Levee Removal	ac	$272.27	100
659	Wetland Enhancement	HU-Estuarine Fringe Levee Removal	ac	$274.85	100
659	Wetland Enhancement	Mineral Flat	ac	$270.84	100
659	Wetland Enhancement	HU-Mineral Flat	ac	$273.13	100
659	Wetland Enhancement	Riverine Channel and Floodplain Restoration	ac	$623.05	100
659	Wetland Enhancement	HU-Riverine Channel and Floodplain Restoration	ac	$695.79	100
659	Wetland Enhancement	Riverine Levee Removal and Floodplain Features	ac	$570.72	100
659	Wetland Enhancement	HU-Riverine Levee Removal and Floodplain Features	ac	$632.99	100