FINAL REPORT

North Branch Neshaminy Creek & Lake Galena Watershed Phase I Implementation Project

September 30, 2012

Prepared by:

Aqua Link, Inc.
Pond, Lake & Stream Management & Supplies

P.O. Box 605
Doylestown, PA 18901
www.aqualinkinc.com

Bucks County Conservation District

1456 Ferry Road, Suite 704
Doylestown, PA 18901
www.bucksccd.org

FINAL REPORT

North Branch Neshaminy Creek & Lake Galena Watershed Phase One Implementation Project

PA DEP Document No. 4100053255

Prepared for:

PA DEP
P.O. Box 8555
Harrisburg, PA 17105-8555
Ph: 717.772.5807

US EPA
1200 Pennsylvania Ave, NW
Washington, DC 20460

Prepared by:

Aqua Link, Inc.
Pond, Lake & Stream Management & Supplies
P.O. Box 605
Doylestown, PA 18901
Ph: 215.230.9325
www.aqualinkinc.com

Bucks County Conservation District
1456 Ferry Road, Suite 704
Doylestown, PA 18901
Ph: 215.345.7577
www.bucksccd.org

TABLE OF CONTENTS

Cover Photograph

Photograph of completed gully stabilization project at the Baskin Farm within the Lake Galena & North Branch Neshaminy Creek Watershed

Appendices

List of Figures

1. Project Title & Type

Project Title: North Branch Neshaminy Creek & Lake Galena Phase I Implementation Project
Project Type: Watershed Restoration/Implementation Project

2. Project Funding & Schedule

This project, the North Branch Neshaminy Creek (NBNC) & Lake Galena Watershed Phase I Implementation Project, was federally funded by PA DEP and U.S. EPA through Section 319 Nonpoint Source Program of the Clean Water Act. The Bucks County Conservation District served as the Project Sponsor and Applicant for the project and retained Aqua Link to provide technical assistance in selecting project sites and to prepare the grant application and the final report. Prior to this Phase I Implementation project, Aqua Link served as the consultant to the District in developing the *Lake Galena & North Branch Neshaminy Creek Watershed Implementation Plan* (Aqua Link & Bucks County Conservation District 2009). The total amount of federal funding that was awarded for this project was $68,265. The contract between the District and DEP was executed on June 14, 2010 and the project was completed on September 30, 2012.

3. Project Location

The implemented agricultural best management practices (BMPs) for this project were implemented within the Lake Galena watershed as shown in Figure 1. The watershed is approximately 15.8 square miles (10,112 acres) in area. The coordinates of the dam of this lake are 40.3171^{o} N and 75.2038^{o} W. The entire watershed is located in New Britain, Plumstead, Doylestown and Hilltown Townships in Central Bucks County. The lake is fully contained within the boundaries of New Britain.

4. Project Overview

The primary objective of this project, the North Branch Neshaminy Creek (NBNC) & Lake Galena Watershed Phase I Implementation Project, was to improve water quality by reducing sediment and nutrients entering both surface and groundwater within North Branch Neshaminy & Lake Galena Watershed (Figure 1) via the implementation of agricultural BMPs (best management practices). Under this grant, agricultural BMPs were implemented on four different farms (Figure 2)

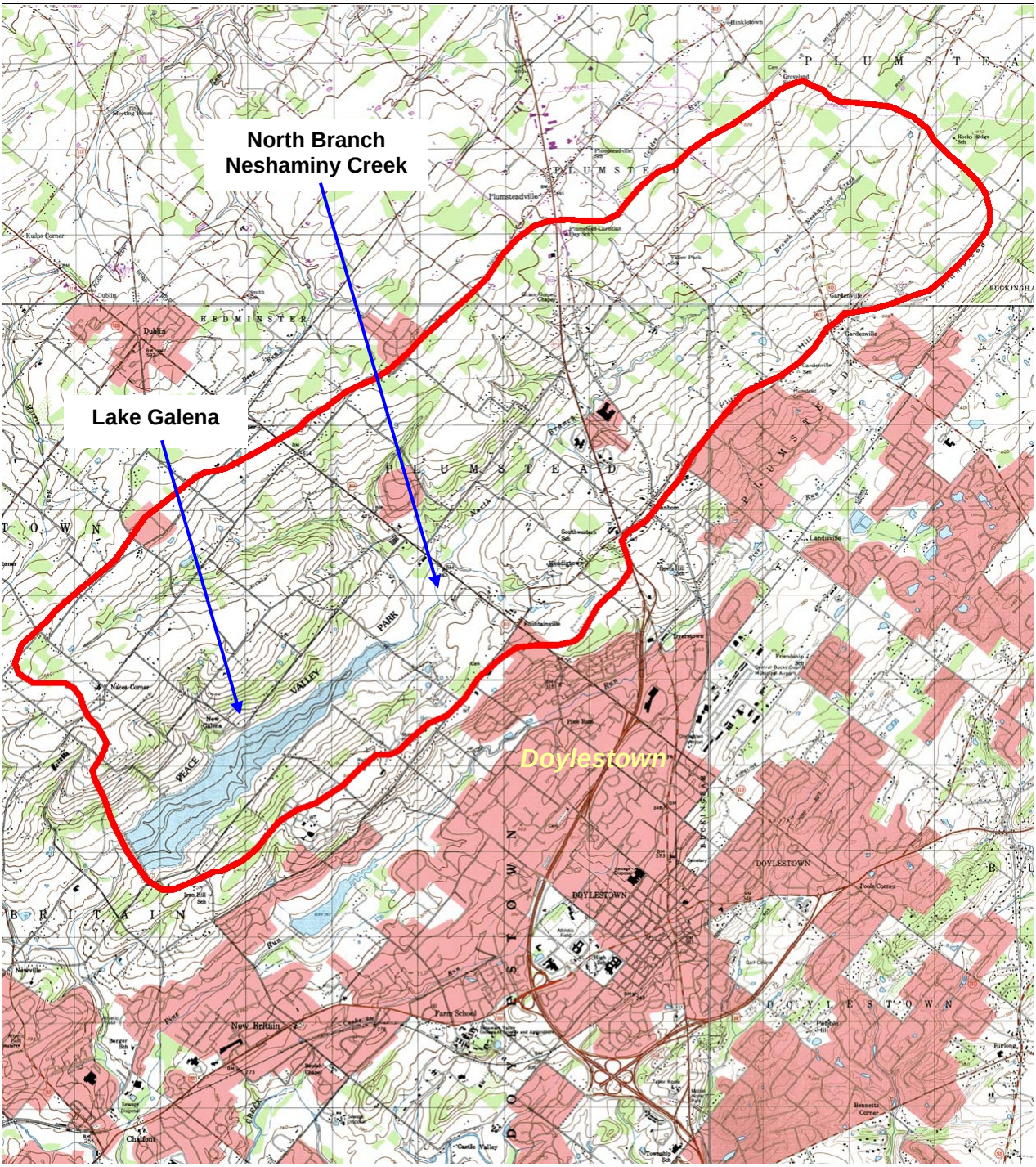

Figure 1 Lake Galena Watershed

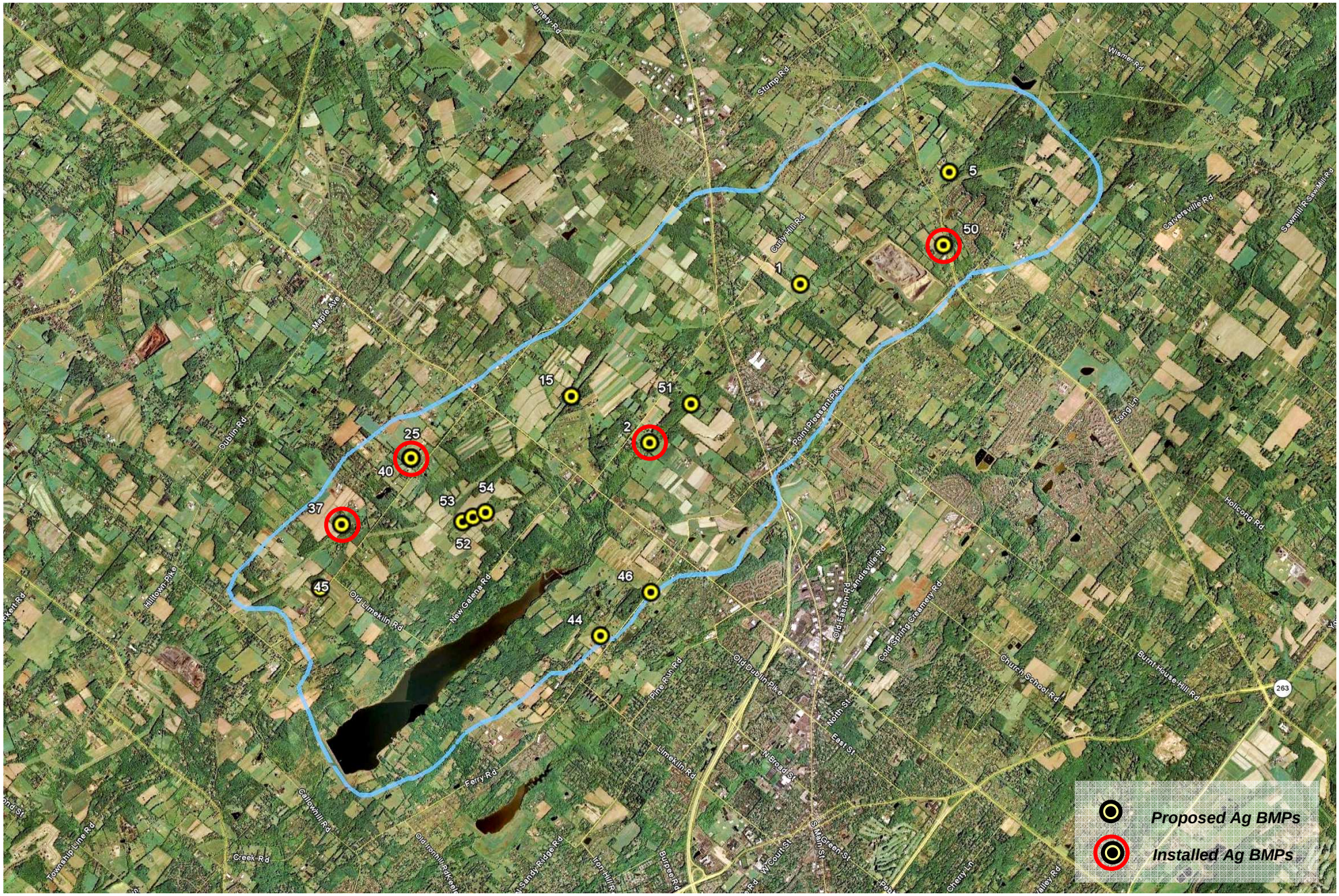

Figure 2 Locations of Installed Agricultural BMP Projects
Lake Galena Watershed

Aqua Link, Inc.
Water Resources & Watershed Management
www.aqualinkinc.com

P.O. Box 605
Doylestown, PA 18901
Ph: 215.230.9325

that were identified in *Lake Galena & North Branch Neshaminy Creek Watershed Implementation Plan* (Aqua Link & Bucks County Conservation District 2009).

As part of the WIP (watershed implementation plan) report, the District with the assistance of the USDA NRCS identified a total of twelve farms requiring agricultural BMPs. Based upon intensive field reconnaissance, the NPS problem areas identified on the aforementioned four farms have been categorized as top priorities within the Lake Galena watershed by the District and Aqua Link.

5. Best Management Practices & Load Reductions

The Bucks County Conservation District (District) along with the assistance of the USDA NRCS implemented agricultural BMPs on four different farms within the Lake Galena watershed (Figures 1 and 2). All BMPs were designed according to NRCS standards and specifications. The installed BMPs are discussed in the following subsections.

Sediment and nutrient load reductions resulting from BMP implementation for this project were estimated using EPA's Region 5 Model for gully stabilization. The results of model are presented in Appendix A of this report. Overall, the model predicted a ***total sediment load reduction of 512 tons per year*** (Appendix A). In addition, ***total phosphorus and nitrogen load reductions were estimated at 512 and 1,022 pounds per year, respectively*** (Appendix A).

5.1. Gayman Farm: Basin and Waterway Repair

Gayman Farm is referenced as Participant No. 2 as shown in Figure 2. Pictures of the project site are presented in Figure 3.

Uncontrolled stormwater runoff flows onto the Gayman Property (pasture) via a corrugated metal pipe (4 by 2.75 ft) into an archie basin. Mr. Gayman installed this basin on his property in the mid 1990's to help stop erosion that was being caused by the culvert. Over the years, this basin routinely had filled will sediment, which resulted in several failures of the auxiliary spillway of the basin itself. Stormwater from the spillway of the basin discharged onto sloping pasture resulting in severe gully erosion. Prior to implementation, approximately 900 ft. of gullies with depths up to 2.5 ft. were formed on the Gayman pasture. Based upon field reconnaissance, an NRCS engineer estimated approximately 170 tons of soil were lost from just the gullied areas.

In addition, Mr. Gayman indicated that an outlet pipe from his upstream neighbor's pond outlets at the culvert's inlet resulting in periods of continuous flow during the year. The culvert is not able to carry the full flow rates and the road overtops during large storm events. One such area was approximately 230 ft. to the southwest of the culvert pipe. This area often remained saturated after storms, possibly from the road overtopping and runoff seeping through the roadbed itself. Prior to any implementation, gully erosion was observed from the saturated area to the main waterway from the archie basin.

To prevent further erosion and repair the damage to the existing pasture areas, the following practices were implemented on the Gayman farm in October 2011:

- Enlarged the existing basin by 2,425 ft^2 to promote settling and provide additional capacity to handle incoming stormwater and installed trash rack on outlet pipe to prevent clogging

- Reinforced basin auxiliary spillway by installing a rock chute 110 ft. long, 10 ft. wide and 0.9 ft. deep

- Installed a 545 ft. long, 48 ft. wide, and 0.8 ft. deep rock-centered waterway immediately after the rock chute

- Installed a 380 ft. long, 50 ft. wide and 1 ft. deep grassed waterway immediately after the rock-centered waterway where the pasture starts to flatten out,

- Installed a 250 ft. long, 15 ft. wide, and 0.6 ft. high grassed diversion to divert stormwater when the road overtops and outlet to the rock centered waterway

Grant Allocation for this Project: $43,299.55
Cash Match: n/a (landowner cost share)
Load Reductions: sediment (172 tons/yr), phosphorus (172 lb/yr), & nitrogen (344 lb/yr)

5.2. McCauley Farm: Diversion Installation

McCauley Farm is referenced as Participant No. 50 as shown in Figure 2. Pictures of the project site are presented in Figure 3.

The McCauley's lease their land to a local farmer who uses no-till and mulch till and does a corn, soybean and small grain rotation. Two crop fields are separated by a driveway to the McCauley's house. Sheetflow over the driveway had caused a gully, approximately 300 ft. long by 3 ft. wide by 1 ft. deep, within the downslope cropland.

To reduce the volume of water crossing the lower crop field and reduce the potential for a gully to reform, a 600 ft. long by 20 ft. wide by 1 ft. deep grassed diversion was constructed in November 2010 along the lower end of the upslope field. A rock-lined outlet was also constructed to discharge the water to an existing road drainage way containing riprap. The gully in the down slope crop field was then plowed, shaped as a swale, and seeded to grass.

Grant Allocation for this Project: $4,135.35
Cash Match: $1,614.65 (landowner cost share)
Load Reductions: sediment (38 tons/yr), phosphorus (38 lb/yr), & nitrogen (76 lb/yr)

5.3. Baskin Farm: Gully Stabilization

Baskin Farm is referenced as Participant No. 40 as shown in Figure 2. Pictures of the project site are presented in Figure 3.

Mr. Baskin is the owner/operator of a 25-acre beef and hay farm in the watershed and had severe gully erosion in his pasture. The gully was approximately 400 ft. long by 7 ft. wide and 2 ft. deep. Based upon field reconnaissance, it was estimated that 90 tons of fertile soils had been lost due to excessive erosion. In addition, the banks of the gully were grazed to the edge by livestock.

The initial conceptual plan was to construct a meandering, bioengineered channel, regrading the vertical banks to a 3:1 slope and stabilizing the channel through a combination of brushmattresses and live stake material. However, hydraulic calculations completed by NRCS engineers during the design review prohibited certification of this approach; consequently the concept was changed to a rock-lined waterway construction.

Following plan revisions, the following practices were installed on the Baskin farm in July 2011 (waterway construction) and completed in October 2011 (buffer installation) to prevent further erosion of the existing pasture areas:

- Constructed a 395 ft. long and 4ft wide meandering, trapezoidal channel and cut back the existing vertical banks to a 4:1 slope

- Reinforced the channel bottom and sides with R4 riprap stone 1.5 ft. deep across the bottom and up to a 2 yr-24 hr flow height on the banks (varied from 1.5 - 2ft. along channel length)

- Installed a vegetated buffer, overall width 35 ft.

- Installed fencing to exclude livestock from the waterway and buffer

Grant Allocation for this Project: $13,629.65
Cash Match: $1,260.50 (TreeVitalize Watersheds grant funded by Aqua PA)
Load Reductions: sediment (234 tons/yr), phosphorus (234 lb/yr), & nitrogen (468 lb/yr)

5.4. Pennview Farm: Diversion Installation

Pennview Farm is referenced as Participant No. 37 as shown in Figure 2. Pictures of the project site are presented in Figure 3.

Penn View Farms is owned and operated by Paul and John Hockman. The Hockman's utilize a mulch till/minimum till system with corn, soybean and hay in the rotation on a few rented fields at 157 Upper Church Road, Chalfont, PA. Stormwater runoff from a 16-acre watershed flows over one of the fields along Old Limekiln Road. The accumulation of stormwater concentrates in an old excavated ditch along the field edge. The unstable ditch was approximately 2 ft. wide by 1 ft. deep and there was evidence of severe soil erosion to the crop field and roadside gutter.

To reduce the volume of water crossing the crop field and thereby reduce the potential for accelerated erosion to occur, a 460 ft. long by 16 ft. wide by 1 ft. deep grassed diversion was constructed in July 2012 above this field. In addition, a 45 ft. long by 20 ft. wide by 1 ft. deep rock chute was constructed to outlet to an existing road drainage way that contains large riprap. The eroding ditch in the down slope crop field was then plowed, shaped to match natural grade, and seeded to grass.

Grant Allocation for this Project: $750.45
Cash Match: $1,698.57 (operator cost share)
Load Reductions: sediment (68 tons/yr), phosphorus (68 lb/yr), & nitrogen (134 lb/yr)

1. Participant No. 2 – Archie Basin Prior to Implementation

2. Participant No. 2 – Severe Gully Erosion Prior to Implementation

3. Participant No. 2 – Stabilized Archie Basin after Implementation

4. Participant No. 2 – Gully Stabilization after Implementation

Figure 3 Photographs of Implemented Best Management Practices

5. Participant No. 50 – Diversion during Construction

6. Participant No. 50 – Diversion after Implementation

7. Participant No. 40 – Gully Erosion prior to Implementation

8. Participant No. 40 – Stabilized Gully after Implementation

Figure 3 Photographs of Implemented Best Management Practices

9. Participant No. 37 – Diversion during Construction

10. Participant No. 37 – Diversion after Implementation

Figure 3 Photographs of Implemented Best Management Practices

APPENDIX A

Estimated Sediment & Nutrient Load Reductions

North Branch Neshaminy Creek & Lake Galena **Aqua Link, Inc.**
Phase I Implementation Project

Estimated Load Reductions - Region 5 Modeling Results

Load Reductions	*Gayman*	*McCauley*	*Baskin*	*Pennview*	*Totals*
Sediment (ton/yr)	172	38	234	68	512
Phosphorus (lb/yr)	172	38	234	68	512
Nitrogen (lb/yr)	344	76	468	134	1,022

10/3/2012

Gayman Farm

Gully Stabilization

These may include:

Grade Stabilization Structure
Grassed Waterway
Critical Area Planting in areas with gullies
Water and Sediment Control Basins

Please select a soil textural class:

○ Sands, loamy sands	○ Silty clay loam, silty clay
○ Sandy loam	○ Clay loam
○ Fine sandy loam	○ Clay
○ Loams, sandy clay loams, sandy clay	○ Organic
◉ Silt loam	

Please fill in the gray areas below:

Parameter	Gully	Example	
Top Width (ft)	2.5	**15**	
Bottom Width (ft)	2	**4**	
Depth (ft)	2	**5**	
Length (ft)	900	**20**	
Number of Years	1	**5**	
Soil Weight (tons/ft3)	0.0425	**0.05**	
Soil P Conc (lb/lb soil)* USER	0.0005	**0.0005**	*
Soil N Conc (lb/lb soil)* USER	0.001	**0.001**	*

* If not using the default values, users must provide input (in red) for Total P and Total N soil concentrations

Estimated Load Reductions

	BMP Efficiency*	Gully	Example
Sediment Load Reduction (ton/year)	1.0	172.1	**10**
Phosphorus Load Reduction (lb/year)		172.1	**8**
Nitrogen Load Reduction (lb/yr)		344.3	**16**

10/3/2012

McCauley Farm

Gully Stabilization

These may include:

Grade Stabilization Structure
Grassed Waterway
Critical Area Planting in areas with gullies
Water and Sediment Control Basins

Please select a soil textural class:

○ Sands, loamy sands	○ Silty clay loam, silty clay
○ Sandy loam	○ Clay loam
○ Fine sandy loam	○ Clay
○ Loams, sandy clay loams, sandy clay	○ Organic
◉ Silt loam	

Please fill in the gray areas below:

Parameter	Gully	Example	
Top Width (ft)	4	**15**	
Bottom Width (ft)	2	**4**	
Depth (ft)	1	**5**	
Length (ft)	300	**20**	
Number of Years	1	**5**	
Soil Weight (tons/ft3)	0.0425	**0.05**	
Soil P Conc (lb/lb soil)* USER	0.0005	**0.0005**	*
Soil N Conc (lb/lb soil)* USER	0.001	**0.001**	*

* If not using the default values, users must provide input (in red) for Total P and Total N soil concentrations

Estimated Load Reductions

	BMP Efficiency*	Gully	Example
Sediment Load Reduction (ton/year)	1.0	38.3	**10**
Phosphorus Load Reduction (lb/year)		38.3	**8**
Nitrogen Load Reduction (lb/yr)		76.5	**16**

10/3/2012

Baskin Farm

Gully Stabilization

These may include:

Grade Stabilization Structure
Grassed Waterway
Critical Area Planting in areas with gullies
Water and Sediment Control Basins

Please select a soil textural class:

o Sands, loamy sands	o Silty clay loam, silty clay
o Sandy loam	o Clay loam
o Fine sandy loam	o Clay
o Loams, sandy clay loams, sandy clay	o Organic
(•) Silt loam	

Please fill in the gray areas below:

Parameter	Gully	Example	
Top Width (ft)	8	**15**	
Bottom Width (ft)	6.67	**4**	
Depth (ft)	1.9	**5**	
Length (ft)	395	**20**	
Number of Years	1	**5**	
Soil Weight (tons/ft3)	0.0425	**0.05**	
Soil P Conc (lb/lb soil)* USER	0.0005	**0.0005**	*
Soil N Conc (lb/lb soil)* USER	0.001	**0.001**	*

* If not using the default values, users must provide input (in red) for Total P and Total N soil concentrations

Estimated Load Reductions

	BMP Efficiency*	Gully	Example
Sediment Load Reduction (ton/year)	1.0	234.0	**10**
Phosphorus Load Reduction (lb/year)		234.0	**8**
Nitrogen Load Reduction (lb/yr)		467.9	**16**

10/4/2012

PennView Farm

Gully Stabilization

These may include:

Grade Stabilization Structure
Grassed Waterway
Critical Area Planting in areas with gullies
Water and Sediment Control Basins

Please select a soil textural class:

○ Sands, loamy sands	○ Silty clay loam, silty clay
○ Sandy loam	○ Clay loam
○ Fine sandy loam	○ Clay
○ Loams, sandy clay loams, sandy clay	○ Organic
◉ Silt loam	

Please fill in the gray areas below:

Parameter	Gully	Example	
Top Width (ft)	2	**15**	
Bottom Width (ft)	1	**4**	
Depth (ft)	1	**5**	
Length (ft)	1050	**20**	
Number of Years	1	**5**	
Soil Weight (tons/ft3)	0.0425	**0.05**	
Soil P Conc (lb/lb soil)* USER	0.0005	**0.0005**	*
Soil N Conc (lb/lb soil)* USER	0.001	**0.001**	*

* If not using the default values, users must provide input (in red) for Total P and Total N soil concentrations

Estimated Load Reductions

	BMP Efficiency*	Gully	Example
Sediment Load Reduction (ton/year)	1.0	66.9	**10**
Phosphorus Load Reduction (lb/year)		66.9	**8**
Nitrogen Load Reduction (lb/yr)		133.9	**16**