



# Comprehensive Livestock Environmental Assessments and Nutrient Management Plans: Eastern United States

## FINAL REPORT

**Prepared by:**

RTI International  
3040 Cornwallis Road  
P.O. Box 12194  
Research Triangle Park, NC  
27709-2194

and

North Carolina State University  
Animal and Poultry Waste  
Management Center  
Campus Box 7608  
Raleigh, NC 27695-7608

**December 2012**

**Contract Number 83375401  
RTI Project Number 0210976**



Photo courtesy of USDA



**NC STATE UNIVERSITY**

## **ACKNOWLEDGEMENTS**

The CLEAN<sub>EAST</sub><sup>™</sup> Project is a Congressionally funded project administered through a cooperative agreement between the U.S. Environmental Protection Agency and \*RTI International. RTI expresses its appreciation to sub-agreement partner North Carolina State University and subcontractor Agri-Waste Technology, Inc., for their valuable contributions. RTI particularly acknowledges the technical services to 429 farms performed by 57 Technical Assistance Professionals who staffed the eight subcontracted firms identified in Section 2.0 of this report. RTI also extends its appreciation to the Advisory Committee on Science and Strategy for their valuable contributions.

CLEAN<sub>EAST</sub><sup>™</sup> is a common law trademark of RTI International.

\*RTI International is a trade name of Research Triangle Institute.

## Table of Contents

List of Acronyms .....	viii
Executive Summary .....	ES-1
Section 1. Introduction .....	1-1
1.1 Background .....	1-1
1.2 CLEAN <sub>EAST</sub> Project .....	1-5
1.3 Report Organization .....	1-5
1.4 Report Caveats .....	1-7
Section 2. CLEAN <sub>EAST</sub> Project Overview .....	2-1
2.1 Project Objective and Goals .....	2-1
2.2 Project Desired Outputs and Outcomes .....	2-1
2.2.1 Desired Outputs .....	2-2
2.2.2 Desired Outcomes .....	2-2
2.3 Project Technical Assistance Services Offered .....	2-2
2.4 Project Organization .....	2-3
2.4.1 Project Team Members .....	2-3
2.4.2 Advisory Committee on Science and Strategy .....	2-4
2.5 Project Data Management .....	2-5
2.6 Project Implementation .....	2-6
2.6.1 Project Initiation Phase .....	2-6
2.6.2 Pilot Project Phase .....	2-6
2.6.3 Farm Participant Technical Service Assistance Phase .....	2-7
2.6.4 Project Completion Phase .....	2-9
2.7 Project Activity Summary by Project Year .....	2-9
2.8 Project Work Products and Deliverables .....	2-11
Section 3. Project Implementation Procedures and Tools .....	3-1
3.1 Task 1—Outreach and Communication .....	3-1
3.1.1 GIS Analysis .....	3-1
3.1.2 Economic Incentives Analysis .....	3-3
3.1.3 Outreach and Communication Strategy .....	3-4
3.1.4 Outreach Implementation Tools and Activities .....	3-5
3.2 Task 2—TAP Management and Farm Visits .....	3-8
3.2.1 Subcontractor Competitive Bid Procurement .....	3-9
3.2.2 TAP Training .....	3-11
3.2.3 Farm Participation .....	3-13
3.2.4 Long-Term Tracking of Farm Participants .....	3-16
3.3 Task 3—Tool Development and Data Analysis .....	3-17
3.3.1 CLEAN <sub>EAST</sub> Project Farm Service Tools .....	3-17
3.3.2 Farm Information Analysis Procedures .....	3-19
3.3.3 Project Performance Tracking Measurements .....	3-20
3.3.4 Environmental Performance Assessment Tools .....	3-25
Section 4. Project Results .....	4-1
4.1 Farm Participant Geographic Distribution .....	4-1
4.2 Farm Participant Profile .....	4-6
4.2.1 Animal Category Distribution .....	4-6
4.2.2 Farm Size Distribution .....	4-15

4.2.3	Farm Distribution by Impaired Watershed.....	4-19
4.3	Farm Participant Baseline Animal Operations and Manure Management Practices.....	4-23
4.3.1	Housing.....	4-23
4.3.2	Manure Storage Practices.....	4-23
4.3.3	Mortality Management Methods.....	4-25
4.3.4	Nutrient Management Plans, Conservation Plans, and Grazing Plans.....	4-26
4.3.5	Onsite Manure Utilization and Land Application Equipment Calibration.....	4-27
4.3.6	Water Resources-related Practices.....	4-27
4.4	CLEAN <sub>NEAST</sub> Project Technical Services.....	4-29
4.4.1	EA and NMP Technical Services Provided.....	4-29
4.4.2	Recommended Best Management Practices (BMP) Distributions Farm Participants.....	4-29
4.4.3	BMP Environmental Benefits Results.....	4-32
4.4.4	BMP Recommendations and Implementation.....	4-36
4.5	CLEAN <sub>NEAST</sub> Project Performance Measurements Results.....	4-36
4.6	Farm Participant Response to CLEAN <sub>NEAST</sub> Project Services Provided.....	4-40
4.6.1	Farm Operator Satisfaction Survey Results.....	4-40
4.6.2	Results of Farm Contacts to Assess Project Performance.....	4-42
Section 5. Estimated Water Quality Impacts of CLEAN <sub>NEAST</sub> Recommendations: A Case Study in the Chesapeake Bay Watershed.....		
5.1	Introduction.....	5-1
5.2	Data Sources.....	5-2
5.3	Spatial Identification.....	5-2
5.4	Potential Nutrient Reductions Assumed to Achieve 100% Implementation of CLEAN <sub>NEAST</sub> -recommended BMPs.....	5-4
5.4.1	Animal Production Area BMPs.....	5-4
5.4.2	Nutrient Management Plans.....	5-5
5.4.3	Conservation Plans.....	5-6
5.4.4	Stream Access Control BMPs.....	5-6
5.4.5	Pasture BMPs.....	5-7
5.5	Conclusion.....	5-7
Section 6. Project Successes, Challenges, and Lessons Learned.....		
6.1	Project Successes.....	6-1
6.2	Project Challenges.....	6-4
6.3	Lessons Learned.....	6-6
6.3.1	Structural.....	6-6
6.3.2	Organizational.....	6-8
6.3.3	Technical.....	6-8
References.....		R-1

## List of Figures

1-1.	Key components of Animal Feeding Operations addressed through the CLEAN <sub>EAST</sub> Project's technical services. ....	1-2
2-1.	CLEAN <sub>EAST</sub> Project team organization. ....	2-4
2-2.	General CLEAN <sub>EAST</sub> Project implementation steps for farm participant selected to receive technical services. ....	2-8
3-1.	Example map prepared for GIS analysis. ....	3-3
3-2.	CLEAN <sub>EAST</sub> Project web site home page screen shot ( <a href="http://livestock.rti.org">http://livestock.rti.org</a> ). ....	3-7
3-3.	CLEAN <sub>EAST</sub> Project publication advertisement. ....	3-7
3-4.	CLEAN <sub>EAST</sub> Project brochure (excerpt). ....	3-8
3-5.	RTI, NCSU, and AWT conducted TAP training on farm visit procedures and the use of CLEAN <sub>EAST</sub> tools. ....	3-12
3-6.	Flow diagram for AAEMI NH <sub>3</sub> emissions estimation method. ....	3-28
4-1.	CLEAN <sub>EAST</sub> Project farm participant distribution by U.S. region. ....	4-3
4-2.	Distribution of farm participant EA and NMP services requests by U.S. region. ....	4-4
4-3.	Cumulative number of farm applicants accepted by the CLEAN <sub>EAST</sub> Project (October 2008 – June 2011). ....	4-5
4-4.	CLEAN <sub>EAST</sub> farm participant distribution by predominant animal category. ....	4-6
4-5.	Predominant animal category distribution by U.S. region. ....	4-7
4-6.	Predominant animal category distribution by state. ....	4-8
4-7.	Farm participants by farm size. ....	4-16
4-8.	CLEAN <sub>EAST</sub> farm size distribution by U.S. region. ....	4-17
4-9.	CLEAN <sub>EAST</sub> farm size distribution by predominant animal category. ....	4-17
4-10.	CLEAN <sub>EAST</sub> farm participants' distribution based on NPDES size categories. ....	4-18
4-11.	EPA Baseline 303(d) impaired water events from potential nutrient-related sources. ....	4-20
4-12.	CLEAN <sub>EAST</sub> farm participants' priority distribution by RTI Rating of Clean Water Act Section 303(d) impaired waters: low-priority (0–35.3%), medium-priority (35.4–77.3%), and high-priority (77.4–100%). ....	4-21
4-13.	Dairy animal density and percent of potential nutrient-related 303(d) events. ....	4-22
4-14.	Manure storage system <sup>a</sup> by primary animal category. ....	4-24
4-15.	Manure storage system <sup>a</sup> by U.S. region. ....	4-25
4-16.	Mortality management methods. ....	4-25
4-17.	Mortality management methods by animal category. ....	4-26
4-18.	Frequency of nutrient management, NRCS conservation, and grazing plans among CLEAN <sub>EAST</sub> participants when entering the project. ....	4-27
4-19.	CLEAN <sub>EAST</sub> project benefit: Farm participants increased awareness of environmental challenges their operations may face. ....	4-41
4-20.	CLEAN <sub>EAST</sub> project quality: Farm participants' views on quality of EA Reports and NMPs. ....	4-41
4-21.	Impact of CLEAN <sub>EAST</sub> based on responses to Participant Evaluation Survey. ....	4-42
4-23.	Frequency of reasons given for why EA and NMP recommendations were not implemented (Based on 212 follow-up telephone calls and 186 recommendations not implemented). ....	4-48
4-24.	Implementation of CLEAN <sub>EAST</sub> recommendations based on responses to the participant evaluation survey and follow-up telephone call or site visit. ....	4-49
5-1.	Chesapeake Bay watershed within states eligible for CLEAN <sub>EAST</sub> Project. ....	5-1
5-2.	Counties with CLEAN <sub>EAST</sub> farms and 2010 land-river segment edge of stream nitrogen (lbs/yr). ....	5-3

## List of Tables

1-1.	Listing of Report Appendices.....	1-6
2-1.	Summary of CLEAN <sub>EAST</sub> Project Farm Participation .....	2-9
2-2.	Summary of Key Activities Completed for CLEAN <sub>EAST</sub> Project.....	2-10
2-3.	CLEAN <sub>EAST</sub> Project Major Work Products and Deliverables .....	2-11
3-1.	Outreach Tools Developed for the CLEAN <sub>EAST</sub> Project .....	3-5
3-2.	Public Presentations, Conferences, and Meetings Attended for CLEAN <sub>EAST</sub> Project Outreach Activities.....	3-6
3-3.	CLEAN <sub>EAST</sub> Project Subcontractor Competitive Bid Activity Dates .....	3-9
3-4.	CLEAN <sub>EAST</sub> Project List of States by Region .....	3-10
3-5.	CLEAN <sub>EAST</sub> Project Technical Assistance Professional Subcontract Awards (TAPs) .....	3-11
3-6.	Training Project Sessions for the CLEAN <sub>EAST</sub> Project.....	3-12
3-7.	Tools Developed for Performing CLEAN <sub>EAST</sub> Project Farm Services.....	3-18
3-8.	CLEAN <sub>EAST</sub> Project: EPA Outputs Tracking Performance Measures.....	3-21
3-9.	CLEAN <sub>EAST</sub> Project: EPA Outcomes Tracking Performance Measures .....	3-23
3-10.	CLEAN <sub>EAST</sub> Project-Specific Activity Tracking Performance Measures .....	3-24
3-11.	NERPI Results Categories .....	3-27
4-1.	CLEAN <sub>EAST</sub> Farm Participants by U.S. Region and State.....	4-2
4-2.	CLEAN <sub>EAST</sub> Project Farm Participant Distribution by Multiple-Animal Species Farms Animal Categories.....	4-9
4-3.	Comparison of CLEAN <sub>EAST</sub> Beef Cattle Population to 2007 Ag Census Data .....	4-10
4-4.	Comparison of CLEAN <sub>EAST</sub> Dairy Cow Population to 2007 Ag Census Data.....	4-11
4-5.	Comparison of CLEAN <sub>EAST</sub> Swine Population to 2007 Ag Census Data .....	4-12
4-6.	Comparison of CLEAN <sub>EAST</sub> Poultry Population to 2007 U.S. Ag Census Data .....	4-13
4-7.	Percent of Animals Populating mid-Atlantic Region.....	4-14
4-8.	Percent of Animals Populating Southeast Region.....	4-14
4-9.	Percent of Animals Populating Midwest Region .....	4-14
4-10.	Percent of Animals Populating Northeast Region.....	4-14
4-11.	Percentage of Animal Population Served by Region .....	4-14
4-12.	Summary of CAFO Size Thresholds for All Sectors .....	4-16
4-13.	Farm Operation NPDES Size Categories by Animal Sector.....	4-18
4-14.	Accounting of Top 15 EA and NMP Categories of Recommendations <sup>a</sup> .....	4-29
4-15.	Example of Subcategory Recommendations for NRCS Code 313 .....	4-30
4-16.	Top 15 EA and NMP Recommendations by Animal Category <sup>a</sup> .....	4-31
4-17.	Top 15 EA and NMP Recommendations by Farm Size <sup>a</sup> .....	4-32
4-18.	CLEAN <sub>EAST</sub> Nutrient Environmental Release Potential Indicator Tool (NERPI).....	4-34
4-19.	CLEAN <sub>EAST</sub> Project: EPA Outputs Tracking Performance Measures.....	4-37
4-20.	CLEAN <sub>EAST</sub> Project: EPA Outcomes Tracking Performance Measures .....	4-38
4-21.	CLEAN <sub>EAST</sub> Project-Specific Activity Tracking Performance Measures .....	4-39
4-22.	TAP Environmental Assessment Recommendations Ranked by Implementation Frequency at Farms Receiving Follow-up Site Visits.....	4-43
4-23.	TAP Nutrient Management Plan Recommendations Ranked by Implementation Frequency at Farms Receiving Follow-up Site Visits.....	4-45
4-24.	Categories of TAP Recommendations with the 15 Highest Implementation Rates at Farms Receiving Follow-up Telephone Calls .....	4-47
4-25.	Categories of TAP Recommendations with the 15 Lowest Implementation Rates at Farms Receiving Follow-up Telephone Calls .....	4-47
5-1.	Animal Production Area Acreage for CLEAN <sub>EAST</sub> Farms by Animal Type .....	5-4

5-2.	Animal Production Area BMP Efficiency and Frequency of CLEAN <sub>EAST</sub> Recommendations .....	5-5
5-3.	Estimated Nutrient Reductions Achieved by Fully Implementing CLEAN <sub>EAST</sub> TAP-recommended Practices .....	5-8
5-4.	State-Level Estimated Reductions from CLEAN <sub>EAST</sub> TAP-recommended Practices Relative to Anticipated Reductions from Agricultural to Meet the TMDL .....	5-8
6-1.	Summary of Cooperative Agreement Successes, Challenges, and Lessons Learned.....	6-9

## List of Acronyms

AAEMI	Ammonia Air Emissions Mitigation Indicator Tool
ADSA	American Dairy Science Association
AFO	animal feeding operation <sup>1</sup>
APWMC	Animal and Poultry Waste Management Center
ASABE	American Society of Agricultural and Biological Engineers
AU	animal units
AWM	Animal Waste Management software
AWT	Agri-Waste Technology, Inc.
BMP	best management practice
CAFO	concentrated animal feeding operation <sup>2</sup>
CBWM	Chesapeake Bay Watershed Model
CEAP	Conservation Effects Assessment Program
CLEAN <sub>EAST</sub> <sup>TM</sup>	Comprehensive Livestock Environmental Assessment Nutrient Management Plan Project
CNMP	comprehensive nutrient management plan
CSREES	Cooperative State Research, Education, and Extension Service
CWA	Clean Water Act
EA	Environmental Assessment
EPA	U.S. Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
FY	fiscal year
GIS	geographic information systems
GPRA	Government Performance and Results Act
HUC	hydrologic cataloging unit
MMP	Manure Management Planner software
N	nitrogen
NAEMS	National Air Emissions Monitoring Study
NASS	National Agricultural Statistics Service
NAWQA	National Water Quality Assessment

---

<sup>1</sup> EPA defines an AFO as a lot or facility where the following conditions are met: animals have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period; crops, vegetation, forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility.

<sup>2</sup> EPA defines an operation as a CAFO if it meets the regulatory definition of a Large or Medium CAFO, 40 CFR parts 122.23 (b)(4) or (6), or has been designated as a CAFO, 40 CFR part 122.23(c), by the NPDES permitting authority or by EPA and may be subject to NPDES permitting requirements.

NCBA	National Cattleman’s Beef Association
NCFC	National Council of Farm Cooperatives
NCSU	North Carolina State University
NERPI	Nutrient Environmental Release Potential Indicator Tool
NH <sub>3</sub>	ammonia
NMP	nutrient management plan
NPDES	National Pollutant Discharge Elimination System
NPPC	National Pork Producers Council
NRCS	Natural Resources Conservation Service
OWM	Office of Wastewater Management
P	phosphorus
RAD	Reach Address Database
RTI	RTI International
TAP	Technical Assistance Professional
TechReg	USDA NRCS TSP Registry
TMDL	total maximum daily load
TSP	Technical Service Provider
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey

## Executive Summary

### Background

In 2007, the U.S. Environmental Protection Agency (EPA) estimated that there were 1.3 million farms holding livestock nationwide, and that approximately 238,000 of these farms were animal feeding operations (AFOs). Further, the EPA estimated that AFOs generate more than 500 million tons of manure annually. The National Pollutant Discharge Elimination System (NPDES) permit program authorizes and regulates the discharge of pollutants from point sources to waters of the United States (33 U.S.C. 1342). Section 502(14) of the Clean Water Act (CWA) includes regulation of “concentrated” animal feeding operations (CAFOs), defining CAFOs as point sources (i.e., stationary locations or fixed facilities that discharge pollutants into surface water through pipes, ditches, lagoons, wells, or stacks).



The U.S. Congress recognized the growing need for CAFOs and other AFOs to receive environmental assistance, not only to comply with NPDES regulations but also to support farm requests for cost-share funds, such as the Natural Resources Conservation Services’ Environmental Quality Incentives Program (EQIP), to implement controls for nutrient runoff from livestock and poultry operations. As a result, in fiscal year (FY) 2005 and FY 2006, Congress appropriated \$5 million and \$3 million, respectively, to be administered by the EPA for

the implementation of on-farm environmental assessments (EAs) for livestock operations.

In 2007, under the CWA, the EPA awarded two cooperative agreements for projects to develop and deploy Technical Assistance Professionals (TAPs) to assist owners and operators of beef, dairy, poultry, swine, and other livestock operations with EAs and the development of Nutrient Management Plans (NMPs). An EA “assesses” or evaluates the design and operation of the farm with respect to environmental impacts. The general purpose of an NMP is to provide the farm operator with a site-specific plan for managing manure and organic by-products in a manner that minimizes runoff and maximizes nutrient utilization. These services were provided at no cost to the farm operators who volunteered for project participation. The EPA awarded one cooperative agreement to RTI

**EPA defines AFO** as a lot or facility where the following conditions are met:

- Animals have been, are or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period.

**AND**

- Crops, vegetation, forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility.

**EPA defines CAFO** as an AFO that meets the regulatory definition of a Large or Medium CAFO (40 CFR part 122.23 (b)(4) or (6)), or has been designated as a CAFO by the NPDES permitting authority or by EPA (40 CFR part 122.23(c)) and may be subject to NPDES permitting requirements. (U.S. EPA, 2011b)

International (RTI) for the nation’s 27 states located east of the Mississippi River, and awarded the second cooperative agreement to the Environmental Resources Consortium for states located west of the Mississippi. The EPA authorized a 1-year extension to RTI in 2011 (at no additional cost) to complete farm services, data analysis, and production of this Final Report in 2012.

RTI named its project the Comprehensive Livestock Environmental Assessment and Nutrient Management Plan Project, also known as the CLEAN<sub>EAST</sub><sup>TM</sup> Project.<sup>3</sup> The Environmental Resources Consortium named its project the CLEANmp-West Project. Both projects have functioned independently since their cooperative agreements’ effective dates, but with common oversight by EPA’s Office of Wastewater Management.

## Organization

The CLEAN<sub>EAST</sub> Project was implemented and administered by RTI in collaboration with North Carolina State University (NCSU). RTI is the primary cooperative agreement recipient, with NCSU serving as a sub-agreement recipient.

RTI established an Advisory Committee on Science and Strategy to guide outreach and technical guidance for tool development. The Advisory Committee convened with a face-to-face kickoff meeting, followed by conference call meetings and email communications to review project progress every 5 to 6 months. Outcomes from the interaction of the Project Team and the Advisory Committee included the following:

- Significant input into the strategy for recruiting farm operators to participate in the project, the formats used for the EA and NMP tools, and the security procedures used to maintain the confidentiality of farm information.
- Recommendation for a pilot project to evaluate the Outreach Strategy and project tools “real-world” conditions.
- Assistance in creating public awareness about the CLEAN<sub>EAST</sub> Project in the 27 states.

RTI conducted three competitions post-award for additional team support. These included (1) a competition for agricultural engineering support for the development of the EA and NMP tools and protocols, training, and project data analyses and (2) two regionally based competitions for on-farm EA and NMP services. These three competitions resulted in the award of a total of eight subcontracts to businesses across the eastern United States.



Photo courtesy of USDA-NRCS



Photo courtesy of USDA-NRCS

<sup>3</sup> CLEAN<sub>EAST</sub> is a common law trademark of RTI International.

**Farm Information Confidentiality Security**

To encourage farm operator participation in the CLEAN<sub>EAST</sub> Project, all individual farm-specific data and reports were maintained by RTI as confidential information. The individual farm information could not be accessed by the EPA or any other third party. Distribution of the farm's final EA Report or NMP is at the sole discretion and approval of the farm operator receiving the report.

Access to confidential data collected for the CLEAN<sub>EAST</sub> Project was restricted to authorized project personnel. Data collected from an individual farm operator was assigned a randomly generated identification number to avoid disclosing a farm's identity. The information was entered into a secured confidential database.

This Final Report and all other materials produced for the EPA or for public presentation only include multi-farm aggregated data collected as part of the CLEAN<sub>EAST</sub> Project. No specific farm locations are identified, and no farm-specific information is presented in this report.

## Technical Approach

The procedures and tools used to implement the CLEAN<sub>EAST</sub> Project activities are categorized into three major tasks:

1. Outreach and Communication;
2. TAP Procurement and Training; and
3. Tool Development and Data Analysis.

These tasks were performed concurrently throughout the 5-year cooperative agreement performance period, and are described below. Activities performed within each of the three tasks varied each year as the project progressed.

### Task 1—Outreach and Communication

**GIS Analysis of Farms, Animal Density, and Impaired Waters.** RTI's focus for the CLEAN<sub>EAST</sub> Project was to recruit volunteer farm operators in strategic areas that would produce the most benefit to water and air quality through the provision of EAs and NMPs. RTI used geographic information systems (GIS) and a variety of datasets to identify livestock density, environmentally sensitive and/or impacted areas, states' policy status, and the availability of USDA-certified Technical Service Providers (TSPs) in the eastern United States. This approach allowed RTI to address multiple criteria to prioritize the geographic focus on farm recruitment and other activities in this project.

**Economic Incentives Report.** RTI prepared a qualitative analysis of the economic incentives that potentially could influence farm operator decisions regarding participation in voluntary environmental programs. We also addressed barriers to participation in such programs and identified potential features of the CLEAN<sub>EAST</sub> Project that might help overcome some of the barriers.

**Outreach Plan.** Based on the results of the GIS Analysis and Economic Incentive Analysis, as well as feedback from key stakeholders and the Advisory Committee, the CLEAN<sub>EAST</sub> Project Team selected and prioritized target audiences for promoting the project. The overall goal of this outreach effort was to increase participation in the CLEAN<sub>EAST</sub> Project by farms of the major animal categories and of all sizes, especially farms located in nutrient-impaired watersheds.

**Project Website.** RTI designed, implemented, and administered a website for the CLEAN<sub>EAST</sub> Project at <http://livestock.rti.org>, which contained audience-specific pages, geographic coverage of the project, and contact information for farm operators interested in participating. The project website had over 20,000 hits on the home page.

**Additional Outreach Activities.** Other activities to convey information about the project, its tools, its progress, and its results included production and distribution of literature and press releases; presentation and attendance at 22 conferences/meetings and scheduled small group or individual meetings; and email and telephone communication.

## Task 2—Technical Assistance Professional (TAP) Management and Farm Visits

**Procurement and Training of Eight Subcontractors with USDA NRCS Technical Service Provider Registrations.** To support the Project Team’s completion of the activities required to implement the CLEAN<sub>EAST</sub> Project, RTI used a competitive bid procurement process to subcontract firms after award of the cooperative agreement. Fifty-seven (57) staff across eight subcontractors were trained in one of six sessions to serve as TAPs and deliver project EA and NMP assistance to farms.

**CLEAN<sub>EAST</sub> Project Enrollment.** Farm operators interested in volunteering and receiving CLEAN<sub>EAST</sub> services were required to complete and submit a CLEAN<sub>EAST</sub> Participation Form and to submit this application to RTI. All farm operator applicants for the CLEAN<sub>EAST</sub> Project were added to the confidential Farm Participant Database, and their Participation Forms were stored and managed as confidential.

**TAP Assignment and Farm Visit.** Each farm applicant selected to participate in the CLEAN<sub>EAST</sub> Project (farm participant) was assigned to an NRCS-registered, CLEAN<sub>EAST</sub>-trained TAP. RTI assigned an appropriate TAP for each farm participant based on the TAP’s state TSP registration, previous experience with the livestock type, and the state or location of the farm.

**EA Report and NMP Production and Review.** TAPs prepared and delivered draft EA Reports and NMPs to their farm participants for review. Upon receipt of comments, the TAPs finalized and delivered the final work products (i.e., EA Report, updated NMP, or new NMP) to the farm participants. The TAPs also sent copies of these work products to RTI, along with completed project tools. RTI staff then entered select farm information and data from the tools and reports into its confidential Farm Participant Database for analysis.

**Farm Follow-up Activities.** At the end of each on-farm site visit, the assigned TAP discussed follow-up activities with each farm participant. The project follow-up activities that could be performed included a Participant Evaluation Survey and the option for the farm participant to request a follow-up site visit. In the final year, approximately 13% of the farms received follow-up visits to determine the



**The CLEAN<sub>EAST</sub> Project included training and deployment of 57 Technical Assistance Professionals.**

degree to which farms had implemented CLEAN<sub>EAST</sub> TAP recommendations. Approximately 50% of the farm participants were telephoned to collect similar status information on implementation.

### Task 3—Tool Development and Data Analysis

***Farm Operation Introductory Profile.*** The Project Team developed a Farm Operation Introductory Profile for completion by all farm participants, regardless of the type of CLEAN<sub>EAST</sub> Project service they requested. The profile asked farm participants to provide background information about the farm, such as the number and categories of animals, and the farm's land application practices. Farm participants were instructed to review the profile questions prior to the TAP's site visit to ensure they understood the type of information the TAP would need during the visit. The farm participants then returned the profile to the TAP. During the site visit, the TAP helped the farm participant complete any missing profile information.

***Farm Operation On-Site Environmental Assessment Tool.*** This tool was designed to consist of a series of worksheets for the TAP to collect information needed to evaluate potential environmental issues. Separate worksheets addressed the following topics:

- General facility information
- Overall farm appearance
- Animal categories and numbers
- Confinement buildings
- Sheds, lots, and pastures
- Manure storage and treatment methods
- Conservation practices
- Land management and tillage practices
- Mortality management
- Water quality and quantity management
- Chemical storage and handling
- Facility emergency management plans
- Records and sampling

The RTI Team developed the CLEAN<sub>EAST</sub> Farm Operation Introductory Profile to collect baseline farm operation information.

The RTI Team developed the Environmental Assessment Tool for CLEAN<sub>EAST</sub> Technical Assistance Professionals to use on-farm.

***Nutrient Management Plan (NMP) Protocol for Technical Assistance Professionals.*** This guideline document described the technical approach used by the TAP to prepare a new NMP and update an existing NMP. The NMP Protocol used existing software tools supplemented with the Farm Operation Introductory Profile and the Farm Operation Profile Supplement (NMP Supplement). Three types of tools were used for preparing the NMP: (1) nutrient management planning software; (2) state-specific phosphorus index software; and (3) soil erosion estimation software.

***Farm Operation Profile Supplement (NMP Supplement).*** This supplemental questionnaire to the Farm Operation Introductory Profile was developed by RTI and used by TAPs for conducting on-site interviews with farm participants requesting NMP assistance. TAPs used the tool to collect additional information about the farm to support preparation of an NMP or NMP update.

***The Nutrient Environmental Release Potential Indicator Tool (NERPI).*** This tool provided a gross measure of the change in the amount of nitrogen (N) and phosphorus (P) potentially available for release into the environment following implementation of the CLEAN<sub>EAST</sub> TAP-recommended BMPs. The potential release values are derived from the NMPs prepared for the farm operations participating in the CLEAN<sub>EAST</sub> Project.

***The Ammonia Air Emissions Mitigation Indicator Tool (AAEMI).*** This indicator tool performs a simplified nitrogen mass balance to calculate ammonia (NH<sub>3</sub>) air emissions from each of three emission sources at a farm: animal confinement areas or housing, manure treatment/storage, and land application.

## Results

Four hundred twenty-nine (429) farm participants of all sizes and major animal categories across 20 eastern states volunteered and received technical assistance from the CLEAN<sub>EAST</sub> Project. The project was a success as measured by the overall achievement of the defined project-specific performance indicators, and by the farm participants' responses regarding the services they received from the project.

A summary of the farm participation in the CLEAN<sub>EAST</sub> Project is presented in **Table ES-1**, and the distribution by state is shown in **Figure ES-1**. It should be noted that RTI elected to record 419 of the 429 farm participants' records in the Farm Participant Database. The results presented reflect those 419 operations' EAs and NMPs.

**The RTI Team developed the Farm Operation Profile Supplement for CLEAN<sub>EAST</sub> Technical Assistance Professionals to use on-farm to augment existing nutrient management planning tools.**

Table ES-1. Summary of CLEAN<sub>EAST</sub> Project Farm Participation

CLEAN <sub>EAST</sub> Project Farm Operator Participation	Total Number of Farms	Number of Farms with reports in CLEAN <sub>EAST</sub> Database
Farm operators selected as farm participants to receive technical services	429	419
Farm participants' geographic distribution	—	--
▪ Farm participants located in mid-Atlantic states	169	169
▪ Farm participants located in midwestern states	133	133
▪ Farm participants located in northeastern states	38	38
▪ Farm participants located in southern states	89	79
Farm participants receiving EA assistance <sup>a</sup>	297	287
Farm participants receiving NMP assistance <sup>a</sup>	393	392

<sup>a</sup> Some farm participants requested both EA and NMP assistance.

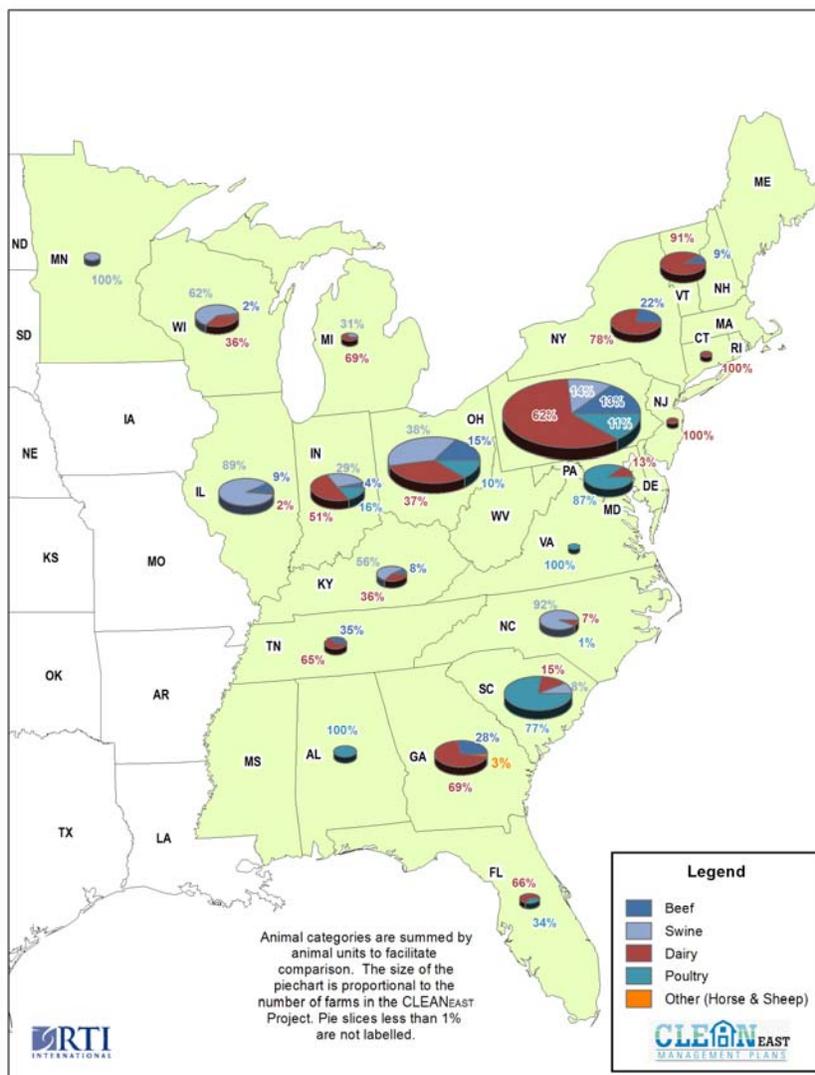
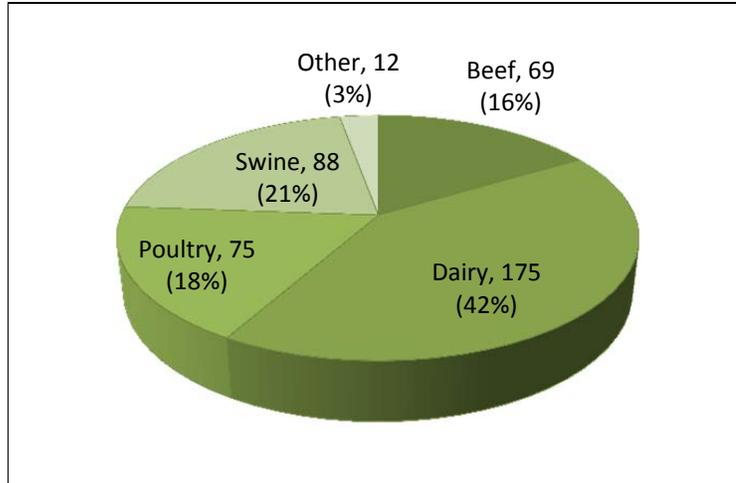


Figure ES-1. The CLEAN<sub>EAST</sub> Project received volunteer farm applications in 20 of 27 states for beef, swine, dairy, poultry and other animal categories.

## Participation Profile

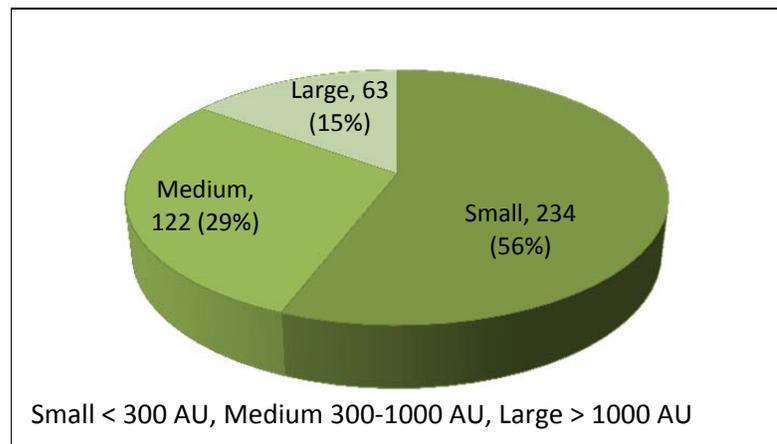
The CLEAN<sub>EAST</sub> Project met the condition of the EPA’s cooperative agreement that AFOs that received project assistance include “facilities in all major animal sectors of the livestock industry (e.g., poultry, dairy, cattle, and swine).” **Figure ES-2** shows the farm participant distribution by animal category based on the predominant animal category at the farm.

Approximately 97% of the farm participants were in the dairy, swine, poultry, and beef animal categories. The largest animal category served by the CLEAN<sub>EAST</sub> Project was dairy, representing 42% (175 farms) of the farm participants, followed by swine at 21% (88 farms), poultry at 18% (75 farms), and beef at 16% (69 farms).



**Figure ES-2. CLEAN<sub>EAST</sub> farm participant distribution by predominant animal category.**

**Figure ES-3** shows that 15% (63) of the CLEAN<sub>EAST</sub> farm operations were categorized as “large,” with greater than 1,000 animal units (AU)<sup>4</sup> per operation; 29% (122) were “medium,” with 300 to 1,000 AUs per operation; and 56% (234) of farm participants had less than 300 AUs per operation and were categorized as “small.” This distribution infers that the number of participants seeking services were less likely to be CAFOs for NPDES permitting purposes and more likely to be AFOs. It is possible that these smaller operations were either responding to state-level NMP requirements and guidance or were seeking the opportunity for first-time NMPs or EAs at no-cost. The distribution of operations by size can be further observed by animal category and by region (**Figure ES-4 and ES-5**).



**Figure ES-3. CLEAN<sub>EAST</sub> farm participant distribution by farm size.**

<sup>4</sup> Animal Unit (AU). An animal unit is equivalent to 1,000 pounds of live animal weight. See Section 4.0 of this report for additional information.

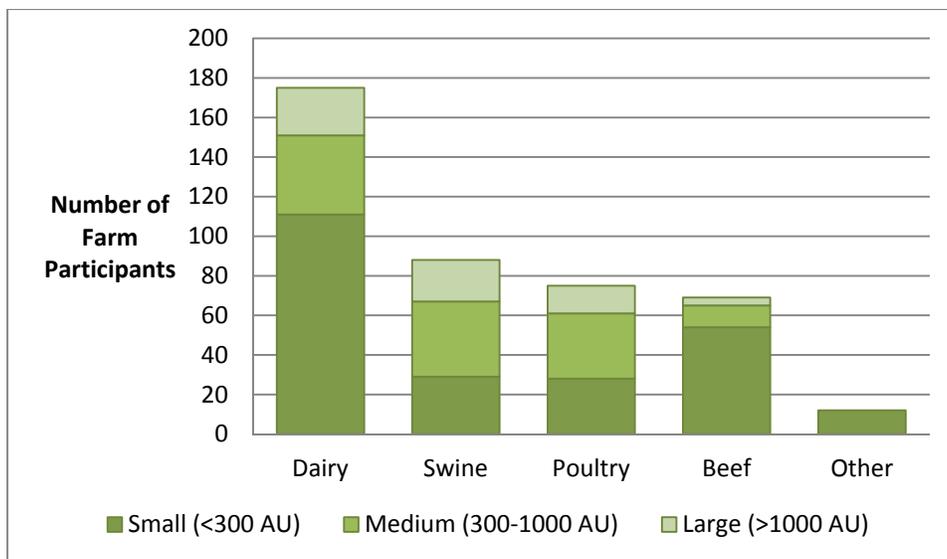


Figure ES-4. Farm size distribution by predominant animal category.

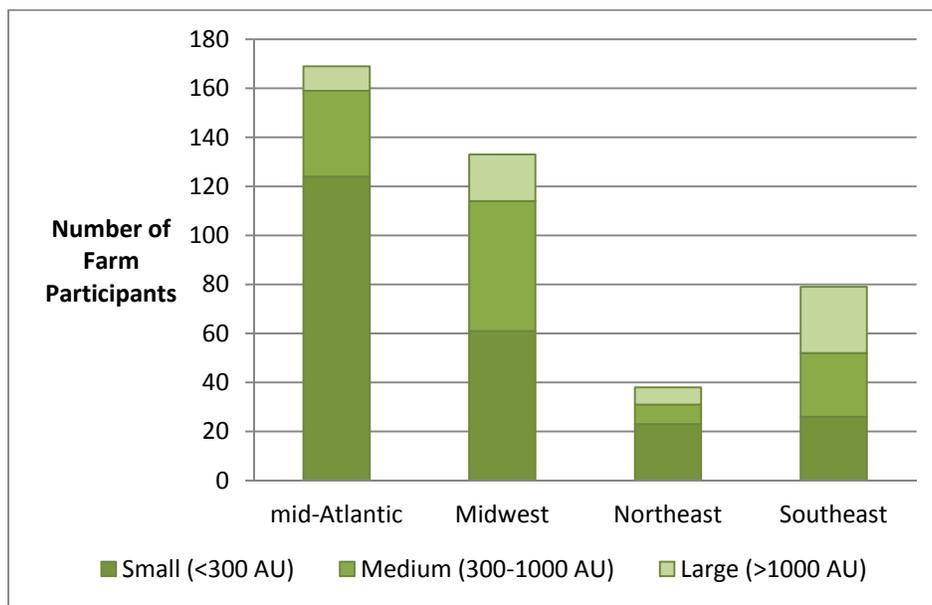


Figure ES-5. Farm size distribution by U.S. region.

## Development of Environmental Assessment Reports and Nutrient Management Plans

Farm participants had the option of requesting an EA, an NMP, or both an EA and an NMP. In the EPA’s 2007 solicitation to provide EAs and NMPs, the Agency appeared to place equal emphasis on providing EAs and NMPs with no stated preference in numeric goals. In response, RTI’s 2007 proposal established the goal of performing 500 EAs and developing 320 NMPs. Upon completion of the project’s farm services, the CLEAN<sub>EAST</sub> Project Team had performed 297 EAs and 393 NMPs (261 of the 429 farm participants requested both EAs and NMPs). This difference in demand versus proposed goals was attributed, in part, to the 2008 Final CAFO Rule and the subsequent need for NMPs. The CLEAN<sub>EAST</sub>

Project delivered 285 (66% of 429 farms served) new NMPs and 108 (25% of farms served) NMP updates. EA Reports were provided to 297 (69%) participants.

### Assessment of Environmental Benefits

In addition to measuring environmental benefits from farm participation and EAs and NMPs delivered, the recommendations TAPs made to farm participants indicate benefits to water and air quality, presuming farms fully implement the TAP recommendations.

**TAP Recommendations.** A total of 1,637 recommendations were made to farm participants. The 15 most frequently cited TAP recommendation categories in the project's EA Reports and NMPs are presented in **Table ES-2**. (A complete list of recommendations and frequencies is provided in **Appendix T**) TAP recommendations were categorized based on NRCS BMP Codes ([http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/technical/alphabetical/nrcps/?&cid=nrcs143\\_026849](http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/technical/alphabetical/nrcps/?&cid=nrcs143_026849)) or by general practices if an NRCS BMP Code could not be applied.

**Table ES-2. Accounting of Top 15 EA and NMP Categories of Recommendations<sup>a</sup>**

NRCS BMP Code <sup>b</sup>	Recommendation Category	Frequency of TAP Recommendation to Farm Participant
313	Waste Storage Facility	289
	▪ Waste Storage Facility (Increase Capacity or Add New Facility)	136
	▪ Waste Storage Facility (Operation & Maintenance)	123
	▪ Waste Storage Facility (Install Permanent Marker)	20
	▪ Milk Parlor Wastewater Treatment	9
	▪ Waste Storage Facility (Liner)	1
590	Nutrient Management Modifications	225
	▪ Nutrient Management (Combination of Applying Setbacks, Method, Rates, Timing, Sampling and Setbacks)	95
	▪ Nutrient Management (Sampling)	85
	▪ Nutrient Management (Application Timing)	30
	▪ Nutrient Management (Application Rates)	10
	▪ Nutrient Management (Application Method)	5
748	Recordkeeping	128
558	Roof Runoff Structure	115
561	Heavy Use Area Protection	83
472	Access Control/Livestock Exclusion Area	60
316	Animal Mortality Facility	59
317	Composting Facility	59
N/A	Calibrate Application Equipment	57
359	Waste Treatment Lagoon	48
635	Vegetative Treatment Area	47
528	Prescribed Grazing	31
710	Secondary Containment (Fuel)	31
312	Improve Leachate Collection	30
N/A	Miscellaneous Repair	25

<sup>a</sup> More than one practice may be recommended at a single operation.

<sup>b</sup> NRCS Practice code that most closely matches the TAP recommendation

Farm participants often received multiple recommendations within one BMP category, in which case, each individual recommendation was included in the final tabulation. The most frequent recommendations involved waste storage facilities (289) (e.g., installation, modification, operation), nutrient management modifications (225) (e.g., modifying application timing, sampling, and rates), recordkeeping (128), roof runoff structure (115), and heavy-use area protection (83). With the exception of recordkeeping, these recommendations have the direct benefit of minimizing or mitigating nutrient-laden runoff. Recordkeeping practices heighten awareness of resource conservation, potentially leading to better manure management practices. Other notable recommendations were access control/fencing (stream exclusion), vegetative treatment area (plant nutrient uptake), and improving animal mortality and composting practices.

**Nutrient Release Reduction Potential.** For the 133 (34%) farm participants to which the NERPI could be applied quantitatively, results showed that a significant number (85%) of the 133 farms could achieve reductions in N and/or P if CLEAN<sub>EAST</sub> NMPs were fully implemented. The results should be treated as general approximations, presuming each farm operation fully implements the CLEAN<sub>EAST</sub> TAP NMP recommendations.

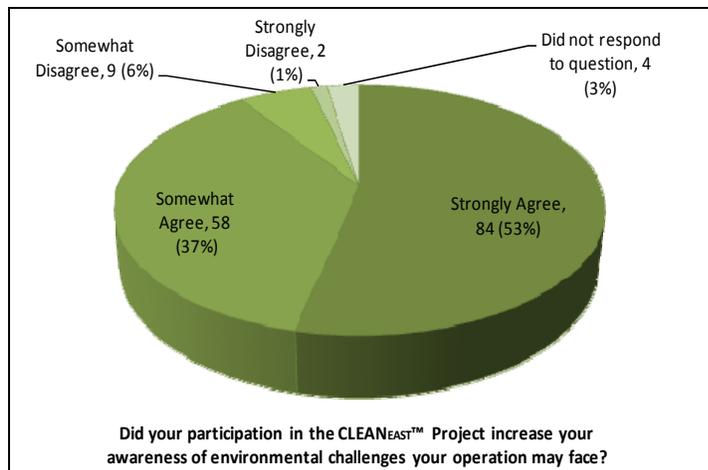
**Chesapeake Bay Watershed Case Study.** One hundred and four (24%) of the 429 CLEAN<sub>EAST</sub> farm participants were located within the Chesapeake Bay watershed. Since Bay restoration efforts have resulted in the extensive generation of water quality data and the development of water quality models, the availability of these resources enabled RTI to assess the potential water quality benefits to the Bay of the 104 volunteer farm participants. The primary data sources for this case study were the Chesapeake Bay Watershed Model (CBWM) Phase 5.3.2 and information supplied by the 104 CLEAN<sub>EAST</sub> farm participants located within the Bay watershed and/or gathered by RTI TAPs.

Based on the CBWM and methodology described in **Section 5** of this Final Report, RTI estimates that if the 104 CLEAN<sub>EAST</sub> farm participants fully implement the TAP recommendations, then those farm participants would reduce their nitrogen runoff to surface waters by 94,137 pounds and phosphorus runoff by 7,877 pounds, which, in turn, equals a reduction of 57,865 pounds of nitrogen and 3,910 pounds of phosphorus delivered to the Bay. These nutrient reductions represent a small fraction of the reductions required to achieve the Chesapeake Bay total maximum daily load (TMDL) goal because fewer than 1% of farms with livestock operations in the Chesapeake Bay watershed participated in the CLEAN<sub>EAST</sub> Project. However, if these farm participants are assumed to be representative of the total livestock and poultry farm population (55,600) in the Bay watershed, and if it is assumed that each of the 55,600 farms achieved the level of N and P reductions estimated for the farm participants, then those reductions would achieve 78% of the N goal and 39% of the P goal for the entire watershed's agricultural sector (comprised of 83,775 farms).

## Farm Participant Satisfaction

Upon completion of service to each farm, the participant was asked to complete a Participant Evaluation Survey regarding satisfaction. A total of 157 farm operations (or 37% of participating farms) completed and returned the survey to RTI. An analysis of survey responses indicated that 90% of respondents strongly agreed (53%) or somewhat agreed (37%) that the process increased their awareness of the environmental challenges their operations may face (**Figure ES-6**). In addition, 93% strongly

agreed that the CLEAN<sub>EAST</sub> TAP who assisted the farm provided a high-quality final work product (discussed later in Chapter 4, **Figure 4-20**) (i.e., EA Report, NMP update, new NMP). RTI did not analyze the specific reasons that led respondents to “strongly agree” or “somewhat agree” that the process increased their awareness of the environmental challenges their operations may face.



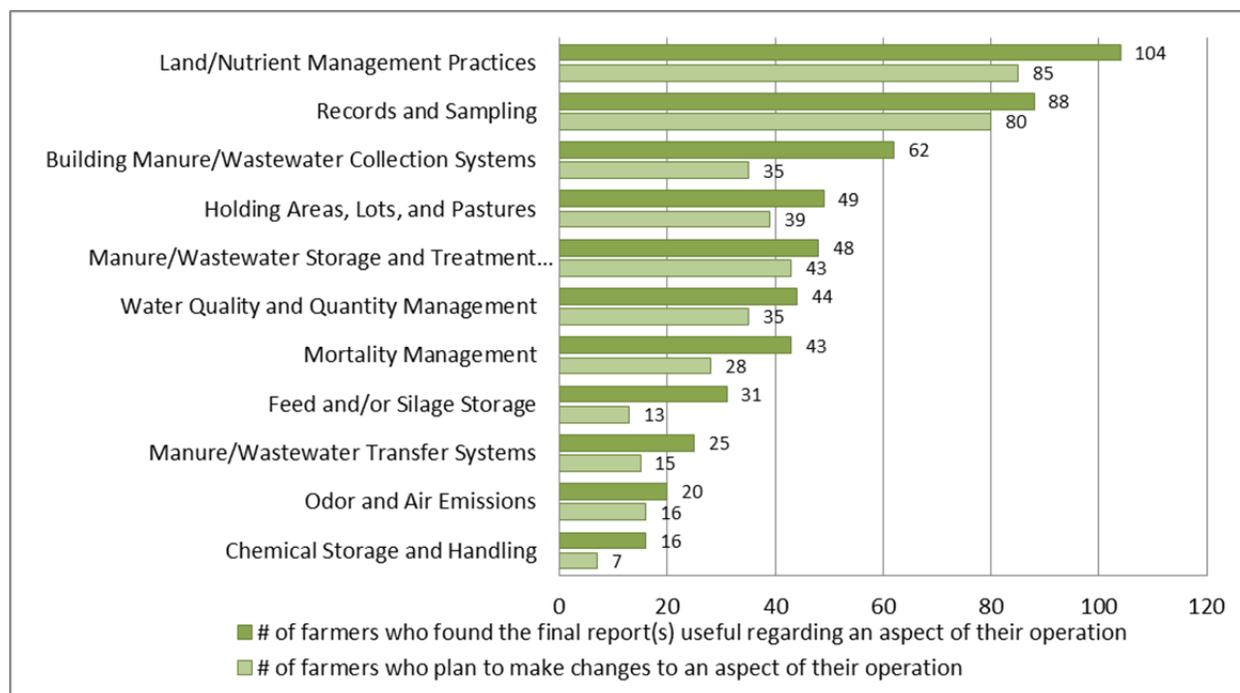
**Figure ES-6. Ninety percent of farm participants Strongly or Somewhat agreed that participation in the CLEAN<sub>EAST</sub> Project increased their awareness of environmental challenges they may face.**

Note: 37% of participants responded to the survey questionnaire.

In addition, respondents indicated the usefulness of TAP recommendations. For example, **Figure ES-7** shows participants indicated (1) whether they found the EA or NMP useful regarding an aspect of their operation, and (2) if they intended to adopt the TAP recommended changes regarding that area of the operation. Regarding farm participants' intent to make changes based on a TAP recommendation, they expressed intent 40% or more of the time. For 6 out of 11 aspects of operations, farm participants expressed their intent to implement TAP recommendations 80% or more of the time. Depending on the TAP recommendation, intentions to adopt ranged from

approximately 40% (e.g., feed and/or silage storage and chemical storage and handling) to more than 90% (e.g., records and sampling, manure/wastewater storage and treatment).

Follow-up site visits and telephone calls were conducted near the close of the project, and these follow-up contacts included 105 of the 157 participants who returned their survey. **Section 4.6.2.3 (Figure 4-24)** provides information from the follow-up telephone calls or site visits on the number of farm participants that actually implemented a recommendation related to a given aspect of their operation.



**Figure ES-7. Impact of CLEAN<sub>EAST</sub> based on responses to Participant Evaluation Survey.**

Note: 37% of participants responded to the survey questionnaire.

### Implementation of CLEAN<sub>EAST</sub> TAP Recommendations

The project team was able to follow up with a portion of the farm participants to determine the degree to which TAP recommendations had been implemented. These follow-ups consisted of telephone calls to 212 farm participants and follow-up site visits to 56 farm participants. Based on the analysis of discussions with farm participants in follow-up telephone calls to 212 farm participants, approximately 50% of the TAP recommendations have been implemented as of September 2012. **Table ES-3** provides the list of the most frequent recommendations implemented to date at the farms receiving follow-up telephone calls. **Table ES-4** provides the list of the most frequent recommendations implemented to date at the 56 sites visited. Based on the analysis of follow-up visits with the 56 farm participants, 58% of the TAP recommendations have been implemented as of September 2012. It is important to note that a BMP can be recommended more than one time at a single farm operation (e.g., there may be more than one manure storage unit per farm).

**Table ES-3. BMP Categories of TAP Recommendations with the 15 Highest Implementation Rates at Farms Receiving Follow-up Telephone Calls**

NRCS BMP code <sup>a</sup>	Common practices recommended by CLEAN <sub>EAST</sub> TAPs	Frequency recommended at farms receiving follow-up telephone call	No. of farms implementing BMP (confirmed by follow-up telephone call)	% Implemented
560	Access Roads	1	1	100%
N/A	Clean-Up Spilled Feed	4	4	100%
328	Conservation Crop Rotation	2	2	100%

(continued)

**Table ES-3. BMP Categories of TAP Recommendations with the 15 Highest Implementation Rates at Farms Receiving Follow-up Telephone Calls (continued)**

NRCS BMP code <sup>a</sup>	Common practices recommended by CLEAN <sub>EAST</sub> TAPs	Frequency recommended at farms receiving follow-up telephone call	No. of farms implementing BMP (confirmed by follow-up telephone call)	% Implemented
340	Cover Crop	3	3	100%
342	Critical Area Planting	4	4	100%
554	Drainage Water Management	1	1	100%
393	Filter Strip	5	5	100%
329	Residue And Tillage Management, No-Till/Strip Till	3	3	100%
587	Structure For Water Control	1	1	100%
748	Recordkeeping	34	29	85%
332	Contour Buffer Strips (Land Application Setbacks)	6	5	83%
359	Waste Treatment Lagoon	16	13	81%
N/A	Lot Runoff Control Measures	5	4	80%
590	Nutrient Management (Application Method)	9	7	78%
528	Prescribed Grazing	8	6	75%

<sup>a</sup> NRCS Best Management Practice code that most closely matches the TAP recommendation.

**Table ES-4. BMP Categories of TAP NMP Recommendations with the 15 Highest Implementation Rates at Farms Receiving Follow-up Site Visits<sup>a</sup>**

NRCS BMP code <sup>b</sup>	Common Practices Recommended by CLEAN <sub>EAST</sub> TAPs	Frequency Recommended at Farms Receiving Follow-Up Site Visit	No. of Farms Implementing BMP (confirmed by follow-up site visit)	% Implemented
N/A	Third-Party Applicator Agreement	6	6	100%
359	Waste Treatment Lagoon	5	5	100%
554	Drainage Water Management	4	4	100%
629	Waste Treatment	3	3	100%
561	Heavy-Use Area Protection	2	2	100%
362	Diversion	1	1	100%
393	Filter Strip	1	1	100%
560	Access Roads	1	1	100%
587	Structure for Water Control	1	1	100%
614	Watering Facility	1	1	100%
558	Roof Runoff Structure	20	18	90%
313	Waste Storage Facility	71	58	82%
316	Animal Mortality Facility	30	24	80%
317	Composting Facility	10	8	80%
412	Grassed Waterway	13	10	77%

<sup>a</sup> Complete table is in **Section 4**, Table 4-23

<sup>b</sup> NRCS Best Management Practice code that most closely matches the TAP recommendation.

## Outputs and Outcomes

The EPA is required by legislative directives of the Government Performance and Results Act (GPRA) to ensure that work the Agency funds through assistance agreements achieves environmental benefits for the U.S. taxpayer. To meet these directives, the EPA tracks the environmental results achieved by projects funded under assistance agreements using a set of project-specific performance measures. The CLEAN<sub>EAST</sub> Project provided measurable performance parameters for tracking in its May 2009 *Project Performance and Results Tracking Strategy* (see **Appendix K**). **Tables ES-5 through ES-7** summarize the performance measures in terms of outputs, outcomes, and project-specific activities tabulated in the May 2009 strategy and presented in **Sections 3 and 4** of this Final Report.

**Table ES-5. Summary of CLEAN<sub>EAST</sub> Project Outputs Results**

Desired Output	Project Output
Recruit farm owners to voluntarily participate in the CLEAN <sub>EAST</sub> Project.	<ul style="list-style-type: none"> <li>• EAs requested by applicants: 352</li> <li>• NMPs requested by applicants: 544</li> <li>• 429 farm operations received CLEAN<sub>EAST</sub> services.</li> </ul>
Perform Environmental Assessments (EAs) and prepare new or update existing Nutrient Management Plans (NMPs) for livestock and poultry operations potentially impacting water bodies in states served by the CLEAN <sub>EAST</sub> Project.	<ul style="list-style-type: none"> <li>• Tool developed (see <b>Appendix G</b>). Tool is available on CLEAN<sub>EAST</sub> web site for public use.</li> <li>• Protocol developed (see <b>Appendix J</b>). Protocol is available on CLEAN<sub>EAST</sub> web site for public use.</li> <li>• 297 EAs performed and reports delivered to farm participants.</li> <li>• 108 NMP Updates performed and reports delivered to farm participants.</li> <li>• 285 New NMPs written and delivered to farm participants.</li> <li>• Services provided in 20 of 27 states. Services were not requested in 7 states.</li> </ul>
Compile a database of non-confidential information from farm visits for assessing extent of adverse impacts before and after CLEAN <sub>EAST</sub> services.	<ul style="list-style-type: none"> <li>• Database increased the understanding of farm participants overall but did not statistically represent the general AFO population.</li> </ul>
Expand availability of trained professionals capable of performing EAs and preparing NMPs for livestock and poultry operations potentially impacting water bodies.	<ul style="list-style-type: none"> <li>• Eight TAP consulting companies.</li> <li>• Six training sessions.</li> <li>• RTI trained 57 TAPs to perform EAs and prepare NMPs consistent with the CLEAN<sub>EAST</sub> Project..</li> <li>• TAPs were NRCS-registered TSPs and were CLEAN<sub>EAST</sub> trained and available to serve in 20 of the 27 states served by the project. (TAPs were NRCS-registered for portion of the remaining 7 states as well.)</li> </ul>

Table ES-6. Summary of CLEAN<sub>EAST</sub> Project Outcomes Results

Desired Outcome	Project Outcome
Increased number of partially or fully restored nutrient-impaired water bodies.	<ul style="list-style-type: none"> <li>▪ 72% of participants were in counties designated with a High-TMDL CLEAN<sub>EAST</sub> Project rating.</li> <li>▪ Based on the Chesapeake Bay case study provided in <b>Section 5</b>, if these Bay-area farm participants are assumed to be representative of the total livestock and poultry farm population (55,600) in the Bay watershed, and it is assumed each non-participating farm achieved the level of nitrogen (N) and phosphorus (P) reductions estimated for the farm participants, then those reductions would achieve 78% of the nitrogen-reduction goal and 39% of the phosphorus-reduction goal for the entire watershed's agricultural sector (comprised of 83,775 farms).</li> </ul>
Mitigation of adverse impacts from livestock and poultry operations on the environment as a result of implementing EAs and NMPs.	<ul style="list-style-type: none"> <li>▪ The NERPI could be applied to 133 of 393 farm participants. Of these 133 farms, 85% were predicted to have decreases in N and/or P after full implementation of CLEAN<sub>EAST</sub> NMPs. See <b>Section 4.4.3.1</b></li> </ul>
Increased knowledge of environmental impacts and methods to mitigate adverse impacts from livestock and poultry operations	<ul style="list-style-type: none"> <li>▪ Percent distribution of farm participants: <ul style="list-style-type: none"> <li>– Dairy: 42%</li> <li>– Swine: 21%</li> <li>– Poultry: 18%</li> <li>– Beef: 16%</li> <li>– Other: 3%</li> </ul> </li> <li>▪ Example findings on management practices: <ul style="list-style-type: none"> <li>– 76% of farm participants keep animals in holding areas or lots.</li> <li>– Dry manure or litter storage systems were the most frequent storage methods reported.</li> <li>– Composting was the most common mortality management method (47% of participants).</li> </ul> </li> <li>▪ BMPs in use were captured by responses in the Farm Operation Introductory Profile and EA tools. The data summary is in <b>Appendix T</b>.</li> <li>▪ The most common TAP recommendation overall fell under the Waste Storage Facility BMP Code 313.</li> </ul>

Table ES-7. Summary of CLEAN<sub>EAST</sub> Project-Specific Tracking Objectives Results

Tracking Objective	Project Result
Awareness of technical services offered by CLEAN <sub>EAST</sub> Project by potential farm participants.	<ul style="list-style-type: none"> <li>▪ Over 20,000 hits on the project website home page. <ul style="list-style-type: none"> <li>– 135 Phone calls via the toll-free number.</li> <li>– 40 emails via the dedicated email address.</li> </ul> </li> <li>▪ Participants' source of CLEAN<sub>EAST</sub> information: <ul style="list-style-type: none"> <li>– TAPs: 242</li> <li>– Local extension agent: 129</li> <li>– Local conservation district: 37</li> <li>– NRCS Office: 11</li> </ul> </li> <li>▪ 577 CLEAN<sub>EAST</sub> Project applicants.</li> <li>▪ 297 EAs; 393 NMPs (285 New NMPs plus 108 NMP updates).</li> </ul>

(continued)

**Table ES-7. Summary of CLEAN<sub>EAST</sub> Project-Specific Tracking Objectives Results (continued)**

Tracking Objective	Project Result
Timeliness of CLEAN <sub>EAST</sub> Project to provide requested technical services to farm participants.	<ul style="list-style-type: none"> <li>▪ Average number of days between assigning TAP to farm participant and delivery of Final Report:                             <ul style="list-style-type: none"> <li>– EA: 173 days</li> <li>– NMP: 216 days</li> </ul> </li> <li>▪ Time span includes farm participant's response time to provide soil and manure analyses, as well as time to formally approve draft report(s).</li> </ul>
Quality of EAs and NMPs prepared for farm participants.	<ul style="list-style-type: none"> <li>▪ RTI/NCSU reviewed the first two to three NMPs and EA Reports drafted by each TAP subcontractor. Subcontractor management was responsible for reviewing remaining reports for technical quality and adherence to project guidance and templates prior to finalizing the report.</li> <li>▪ RTI/NCSU's review of TAP recommendations for implementation was not feasible since RTI/NCSU staff were not on-farm.</li> </ul>
Evaluation of individual TAP performance in delivering CLEAN <sub>EAST</sub> Project technical services.	<ul style="list-style-type: none"> <li>▪ Feedback from farm participants' surveys regarding satisfaction with TAP's timeliness and quality of reports delivered.</li> <li>▪ Review of periodic subcontractor progress reports.</li> <li>▪ Telephone calls with select farm participants. Telephone calls with select TAPs and their subcontractor representative.</li> </ul>
Satisfaction of farm participants with technical services received from the CLEAN <sub>EAST</sub> Project.	<ul style="list-style-type: none"> <li>▪ 90% of respondents strongly agreed or somewhat agreed that the process increased their awareness of environmental challenges the operation may face. 93% strongly agreed that the CLEAN<sub>EAST</sub> TAP who assisted the farm provided a high-quality final report.</li> </ul>
	<ul style="list-style-type: none"> <li>▪ EA and NMP reports did not include NH<sub>3</sub> air emissions BMPs. A survey of TAPs revealed (1) no existing regulations require the use of NH<sub>3</sub> reducing BMPs, (2) guidance to TSPs and funding support to farm operators focused on water quality-related BMPs, (3) certain NH<sub>3</sub>-reducing BMPs can conflict with water quality BMPs, (4) TAPs were reluctant to recommend NH<sub>3</sub> reducing BMPs because of cost, (5) a portion of the TAPs had not received training on NH<sub>3</sub> issues and applicable BMPs.</li> <li>▪ Based on the analysis of discussions with farm participants in the follow-up site visits, approximately 70% of the TAP NMP recommendations have been implemented; Forty-four percent (44%) of the TAP EA recommendations have been implemented.</li> </ul>

### Conclusions—Successes, Challenges, and Lessons Learned

The CLEAN<sub>EAST</sub> Project's successes in achieving Congress's intent for use of the project funding are presented in **Table ES-8**, consistent with the cooperative agreement's programmatic conditions.

In conclusion, the CLEAN<sub>EAST</sub> Project was a success as measured by the overall achievement of the defined project-specific performance indicators and by the responses provided by the farm participants regarding the services they received from the project.



**Table ES-8. Summary of Cooperative Agreement Successes, Challenges, and Lessons Learned**

<b>Successes</b>
The no-cost, voluntary approach for implementing a farm assistance project was successful given 429 farms received technical services consisting of 297 EAs and 393 NMPs.
The no-cost, voluntary approach for implementing a farm assistance project was successful given key stakeholder support and a vote of confidence from the NRCS, regulatory, TSP, and growers' communities.
Farm assistance tools developed by the Project Team demonstrated their utility both in the field and in final analyses and reporting.
90% of responding farm participants were satisfied with CLEAN <sub>EAST</sub> services overall.
RTI's sub-agreement partnership arrangement with NCSU was effective and efficient.
The CLEAN <sub>EAST</sub> Project's Advisory Committee on Science and Strategy proved valuable on outreach and tools.
72% of participants were in counties designated with a high-priority watershed CLEAN <sub>EAST</sub> Project rating.
Based on the Chesapeake Bay case study presented in <b>Section 5</b> , if the Bay-area CLEAN <sub>EAST</sub> farm participants are assumed to be representative of the total livestock and poultry farm population (55,600) in the Bay watershed, and it is assumed each non-participating farm achieved the level of nitrogen (N) and phosphorus (P) reductions estimated for the farm participants, then those reductions would achieve 78% of the N-reduction goal and 39% of the P-reduction goal for the entire watershed's agricultural sector (comprised of 83,775 farms).
The Nutrient Environmental Release Potential Indicator Tool (NERPI) could be applied to 133 of 393 farm participants. 85% of the 133 farms were predicted to have decreases in N and/or P after full implementation of CLEAN <sub>EAST</sub> NMPs. See <b>Section 4.2.3.1</b> .
<b>Challenges</b>
Identification of TAPs residing in certain CLEAN <sub>EAST</sub> Project states. (Addressed by subcontracting NRCS-registered TAPs based in nearby states or TAPs with prior experience in state.)
Recruiting farm operators in certain regions and animal sectors. (Addressed by reaching out to local soil and water conservation agents.)
Motivating farm operators to request EAs. (Addressed benefits of EA through calls with farm applicants and outreach activities; sought state and local officials' support for the tool.)
Motivating farm operators to request NMPs if they were not required to have NMPs. (Addressed benefits of NMPs through calls with farm applicants and outreach activities.)
<b>Lessons Learned – Structural</b>
EPA's structuring the project into three tasks [(1) Outreach and Communication, (2) TAP Management and Farm Visit, and (3) Tool Development and Data Analysis] worked reasonably well from a staffing, execution, and logistics perspective.
Structurally, the creation and provision of two basic services—EAs and NMPs—was manageable.
The Agency decision to exclude soil and manure sampling from the cooperative agreement's scope proved to be a scheduling impediment because farm participants may not have up-to-date samples, cost of analysis, and/or knowledge on how to sample, etc. Recommend inclusion in the future.
The scope of work's absence of tracking farms' implementation of TAP recommendations reduced the certainty of the benefits of the project. Recommend including implementation verification in the future.
<b>Lessons Learned – Organizational</b>
Despite CLEAN <sub>EAST</sub> and its western United States counterpart taking different approaches to conducting competition for TAPs and, in turn, assigning TAPs to participating farms, CLEAN <sub>EAST</sub> 's approach was successful for RTI.
<b>Lessons Learned – Technical</b>
Adapting the existing USDA-NRCS' AWM model software to build NERPI resulted in limited applicability. AWM's design was moderately relevant, being intended for design engineering AFOs rather than mass balance modeling.
NRCS-registered TSPs can benefit from additional training and technical guidance in reducing air emissions. TAPs were not inclined to recommend air emission-reducing BMPs due, in part, to limited training and guidance, as well as cost to the farm participant.

## Section 1. Introduction

The **Comprehensive Livestock Environmental Assessment Nutrient Management Plan Project** (henceforth referred to as the **CLEAN<sub>EAST</sub><sup>TM</sup> Project**) provided technical services to owners and operators of beef, dairy, swine, poultry, or other livestock operations in the eastern United States. The project developed and deployed tools and professional assistance to farm operators to raise their awareness of environmental impacts and, in turn, to plan farm practices that maximize nutrient utilization and minimize environmental impact. Funding for the CLEAN<sub>EAST</sub> Project was appropriated by the U.S. Congress and was administered through a cooperative agreement between the U.S. Environmental Protection Agency (EPA) and RTI International (RTI). Farm operators located in the 27 states east of the Mississippi River were eligible to apply for and receive technical service from the CLEAN<sub>EAST</sub> Project.<sup>6</sup> Participation in the CLEAN<sub>EAST</sub> Project was voluntary, and the technical service was provided at no cost to project participants (i.e., farm participants). This section presents background information on the need for and origin of the CLEAN<sub>EAST</sub> Project; an overview of the organization of the report; and important caveats about the project that the report reader should consider.

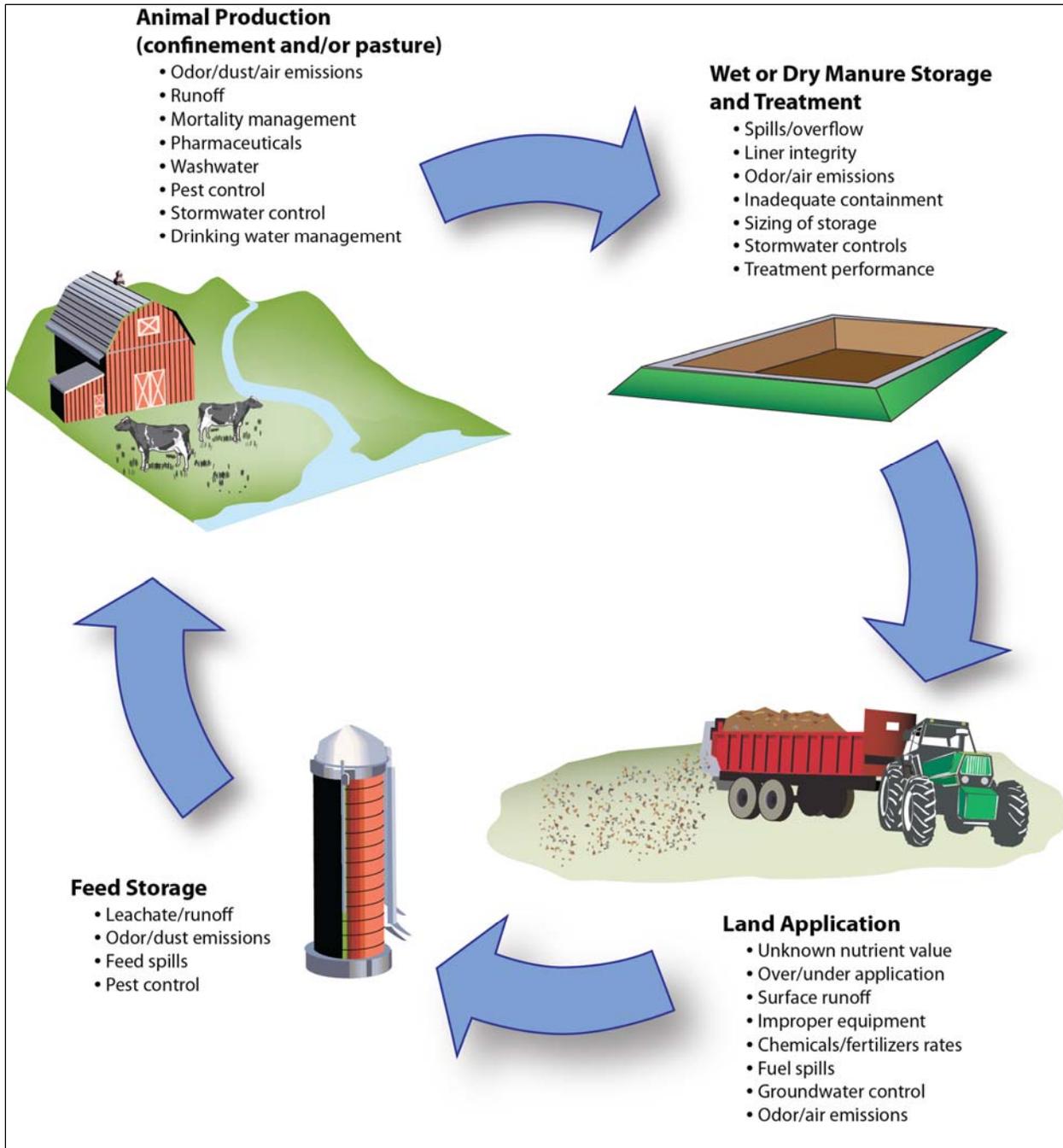


### 1.1 Background

The EPA established the National Pollutant Discharge Elimination System (NPDES) permitting program under the authority of Section 502(14) of the Clean Water Act (CWA). The discharge of pollutants from point sources to waters of the United States is regulated under 40 CFR part 122. EPA defines AFOs as, “operations where animals have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period and where vegetation is not sustained in the confinement area during the normal growing season.” (Code of Federal Regulations Title 40, Section 122.23). AFOs congregate animals, feed, manure and urine, dead animals, and production operations on a small land area. Feed is brought to the animals rather than the animals grazing or otherwise seeking feed in pastures, fields, or on rangeland (U.S. Environmental Protection Agency [EPA], 2012b) (**Figure 1-1**). AFOs that meet the regulatory definitions of “large” or are otherwise designated by EPA as concentrated animal feeding operations (CAFOs) are specifically included in the EPA’s regulatory definition of a “point source” from which pollutants are or may be discharged into surface waters and may be subject to NPDES permitting requirements.

<sup>5</sup> CLEAN<sub>EAST</sub> is a common law trademark name of RTI International.

<sup>6</sup> Farms located in the western United States were able to participate in a similar, but independent, EPA cooperative agreement project called the CLEAN<sub>mp</sub>-West Project, which was implemented and administered by the Environmental Resources Consortium.



**Figure 1-1. Key components of Animal Feeding Operations addressed through the CLEAN<sub>EAST</sub> Project’s technical services.**

The NPDES CAFO Rules were developed to control discharges of nutrients from larger AFOs to surface waters. The EPA first issued national effluent guidelines and standards for feedlots in 1974 (41 FR 11458, February 14, 1974), followed by an original set of NPDES Rules for CAFOs in 1976 (41 FR 11458, March 18, 1976). Since that time, the EPA has promulgated a series of revisions to the NPDES CAFO Rules by issuing revised rules in 2003 (68 FR 7176, February 12, 2003); subsequent amendments to these rules in 2008 (73 FR 70418, November 30, 2008); and most recently, additional amendments in

2012 (77 FR 44494, July 30, 2012). These regulatory revisions further the CWA objectives of restoring and maintaining the nation's waters by responding to the rapid growth of the intensive livestock and poultry industry and by addressing court decisions resulting from litigation of certain provisions of the CAFO Rules.

In addition to the federal NPDES CAFO Rules, documented releases from AFOs to surface water bodies and incidents of adverse environmental impacts have led to the adoption and implementation of state regulations applicable to AFOs. Over time, many states have chosen to receive delegated authority from the EPA for administering the NPDES permitting program for farms in their jurisdictions, and in some circumstances, states have adopted additional permitting requirements. As a condition of NPDES permits, the farm operators are required to develop nutrient management plans (NMPs), which consist of farm-specific, prescribed practices to minimize nutrient runoff. In addition to the EPA's requirement for NMPs for CAFOs, the U.S. Department of Agriculture's (USDA's) Natural Resources Conservation Service (NRCS) provides guidelines on the development of comprehensive nutrient management plans (CNMPs) for CAFOs, as well as the development of Nutrient Management Plans (NMPs) for AFOs. Any farm, regardless of size, can develop and implement a CNMP. While the meaning of NMP is not entirely consistent between the EPA and USDA, the overall goals of both agencies' plans are the same: to minimize runoff and maximize nutrient utilization.

The NRCS' Environmental Quality Incentives Program (EQIP) provides cost-share funds to address the growing need of AFOs to receive environmental assistance, including the development of NMPs and CNMPs, to comply with the NPDES CAFO Rules to control nutrient runoff from livestock and poultry operations. In addition, the U.S. Congress appropriated \$5 million in funding the fiscal year (FY) 2005 federal budget, with an additional \$3 million appropriated in the FY 2006 federal budget, for the EPA to administer the implementation of on-site farm environmental assessments for livestock and poultry operations.



Photo courtesy of USDA-NRCS

In 2007, the EPA estimated that there were 1.3 million farms holding livestock nationwide, and that approximately 238,000 of these farms were AFOs. Further, the EPA estimated that those AFOs generated more than 500 million tons of manure annually. With the growing number of AFOs and the pressures on farm operators to manage increasing tonnages of manure while protecting air and water quality, the EPA designed a project concept to assist farm operators by raising their awareness of environmental impacts from their facilities and to help them understand how best to address such impacts. To implement this project concept using the congressionally appropriated funding, the EPA solicited applications (EPA Funding Opportunity Number EPA-OW-OWM-07-01) from state water pollution control agencies, interstate agencies, other public or nonprofit private agencies, institutions, organizations, and individuals to

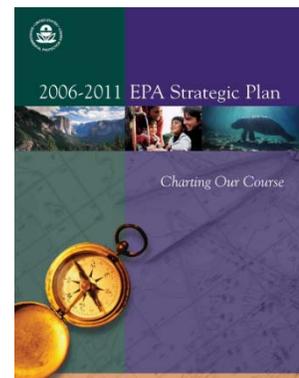
*“conduct voluntary comprehensive environmental assessments and develop and review nutrient management plans (NMPs) for livestock operations. The goal of this project [was] to provide confidential no-cost technical assistance to livestock operations*

*nationwide that will help the operators of these facilities prevent water discharges and reduce air emissions by identifying environmental challenges and learning ways of addressing the environmental challenges. The principal parameters for evaluation at these sites will be nitrogen and phosphorus and their component species (e.g., NH<sub>3</sub>, NO<sub>x</sub>, PO<sub>4</sub>, etc.). Livestock facilities to be assessed include operations in all animal sectors throughout the United States.”*

From the applications submitted in response to this solicitation, the EPA awarded two cooperative agreements in 2007 to provide technical assistance to farm operators with preparing environmental assessments (EAs) and NMPs. One cooperative agreement was awarded to RTI for a project serving the 27 states located east of the Mississippi River (CLEAN<sub>EAST</sub>), and a second cooperative agreement was awarded to the Environmental Resources Coalition for a project serving the states located west of the Mississippi River (CLEAN<sub>mp-West</sub>). These two cooperative agreements functioned as completely independent projects but with common oversight by the EPA’s Office of Wastewater Management (OWM). The EPA specified the following conditions for the services offered by the two projects funded under the cooperative agreements:

- Principal parameters of focus are nitrogen and phosphorus and their component species (e.g., ammonia [NH<sub>3</sub>], nitrogen oxides, phosphates).
- Animal operations that receive technical assistance include facilities in all major animal sectors of the livestock industry (e.g., poultry, dairy, cattle, swine) throughout the United States.
- Livestock operations do not need to possess or apply for a NPDES permit in order to receive technical assistance through the cooperative agreement.
- The results of these assessments are not to be used as the basis for imposing NPDES permit requirements.
- The assessments should provide an overview of air-related impacts relating to the livestock operation (e.g., nutrient deposition via air releases or particulate matter levels in the air from land application). The objective is to help operators ensure that all pathways that affect water quality are considered and to ensure that management of nutrients to protect water quality will not result in adverse impacts on air quality and vice versa.
- NMPs should be consistent with the requirements in the EPA’s NPDES CAFO Rules, as well as any related state regulations. However, the facilities for which NMPs are developed or reviewed under the CLEAN<sub>EAST</sub> Project need not possess or be seeking permit coverage under the NPDES permitting program.

In addition, the EPA outlined its specification for EA and NMP tools to be developed for project implementation and the respective reports to be produced for each farm participant. The EPA stated in its solicitation that it expected the projects to directly support Goal 2: Clean and Safe Water; Objective 2.2: Protect Water Quality; Sub-Objective 2.2.1: Improve Water Quality on a Watershed Basis, of the *2006–2011 EPA Strategic Plan: Charting Our Course* (U.S. EPA, 2006). This goal includes restoring and



maintaining watersheds and their aquatic ecosystems and oceans to protect human health, support economic and recreational activities, and provide healthy habitat for fish, plants, and wildlife. In particular, by enabling livestock operations to manage wastes appropriately, the cooperative agreements will support one of the key strategic targets for Goal 2, which is to “reduce levels of phosphorus contamination in rivers and streams” (U.S. EPA, 2006).

## 1.2 CLEAN<sub>E</sub>AST Project

In September 2007, RTI was awarded the *Comprehensive Environmental Assessments and Nutrient Management Plans for Livestock Operations* cooperative agreement with the EPA to implement a technical services project for farm operators in the eastern United States according to the specifications described in **Section 1.1**. Under this cooperative agreement, RTI initiated the project on October 1, 2007, and named it the “CLEAN<sub>E</sub>AST Project.” The initial cooperative agreement performance period of 4 years was extended an additional year by a no-cost extension approved by the EPA in 2011 to allow completion of farms services and data analysis. RTI also received a 3-month no-cost extension in 2012 to finalize this report.

RTI implemented and administered the CLEAN<sub>E</sub>AST Project in collaboration with North Carolina State University (NCSU), under a sub-agreement with RTI, and with Technical Assistance Professionals (TAPs) under subcontract to RTI. To encourage farm operator participation in the CLEAN<sub>E</sub>AST Project, RTI has maintained all individual, farm-specific data and reports as confidential information. The individual EA Reports and NMPs prepared by the TAPs are for the sole use of and distribution by the farm participant requesting technical services. **Section 2** of this Final Report presents a comprehensive overview of the CLEAN<sub>E</sub>AST Project activities completed during the 5-year performance period for the cooperative agreement.

North Carolina State University and its Animal and Poultry Waste Management Center were RTI's sub-agreement partner on the CLEAN<sub>E</sub>AST Project.



**NC STATE UNIVERSITY**

## 1.3 Report Organization

This Final Report documents the activities performed by RTI and its Project Team members during the cooperative agreement performance period for the CLEAN<sub>E</sub>AST Project and presents the project's results for achieving the desired outputs and outcomes identified by the cooperative agreement. The remainder of this report is organized according to the following five major sections listed below, with additional supporting documentation and data presented in a series of appendices.

- **Section 2: CLEAN<sub>E</sub>AST Project Overview.** This section presents an overview of the CLEAN<sub>E</sub>AST Project from both a mission and operational perspective. It highlights and describes activities completed during the 5-year performance period, project objectives, goals, and desired outputs and outcomes. A background discussion about the project organization, staff roles and farm data management is also presented.
- **Section 3: Project Implementation Procedures and Tools.** This section presents detailed descriptions of procedures and tools developed and used to perform the specific project activities

introduced in **Section 2**. The section is organized by the project’s three major tasks: (1) Outreach and Communication, (2) TAP Management and Farm Visits, and (3) Tool Development and Data Analysis.

- **Section 4: Project Results.** This section presents project results in an aggregated, non-confidential format that includes information on the farm participants profiled by geographic distribution; animal category; farm size; baseline operating conditions before CLEAN<sub>EAST</sub> services; and distribution of participants from an impaired watershed perspective. The section presents data summaries of the technical services provided; project performance measurement results, such as output and outcome tracking; and farm participants’ responses to CLEAN<sub>EAST</sub> services provided, such as the degree to which TAP recommendations have been implemented to date.
- **Section 5: Chesapeake Bay Watershed Case Study.** This section provides a case study analysis of the benefits potentially achieved in the six-state Chesapeake Bay watershed for farms that participated in the CLEAN<sub>EAST</sub> Project.
- **Section 6: Project Successes, Challenges, and Lessons Learned.** This section presents the conclusions by the CLEAN<sub>EAST</sub> Project Team drawn from the analysis and interpretation of the project results. Recommendations based on the Project Team’s experiences implementing the CLEAN<sub>EAST</sub> Project are offered for future voluntary programs to farm operators.
- **Appendices:** The appendices contain a variety of documents produced over the course of the project, as well as non-confidential data summaries that support the results presented in **Section 4**. **Table 1-1** lists the appendices in this report.

**Table 1-1. Listing of Report Appendices**

Appendix	Title
A	CLEAN <sub>EAST</sub> Advisory Committee Members
B	<i>Factors Influencing Livestock Producer Participation in Voluntary Environmental Programs</i> (Economic Incentives report)
C	<i>A GIS Analysis of Livestock and Environmental Data to Support Outreach Planning</i> (GIS Analysis report)
D	<i>Comprehensive Environmental Assessments and Nutrient Management Plans for Livestock and Poultry Operations: Outreach Plan 2007-2011</i> (Outreach Plan)
E	Participation Form
F	<i>Farm Operation Introductory Profile</i> (Farm Profile)
G	<i>Farm Operation On-Site Environmental Assessment Tool</i> (EA Tool)
H	<i>Farm Operation On-Site Environmental Assessment Report</i> template (EA Report template)
I	<i>Farm Operation Profile Supplement</i> (NMP Supplement)
J	<i>Nutrient Management Plan (NMP) Protocol for Technical Assistance Professionals</i> (NMP Protocol)
K	<i>Program Performance and Results Tracking Strategy</i>
L	<i>Agenda and Table of Contents</i> for Training Sessions
M	<i>Participant Evaluation Survey</i>
N	<i>CLEAN<sub>EAST</sub> Project Performance Site Visit Guide and Project Performance Site Visit Report</i> template

(continued)

Table 1-1. Listing of Report Appendices (continued)

Appendix	Title
O	<i>Project Performance Call Worksheet</i> example
P	Contacts Listing (Example State and Local Government Contacts)
Q	<i>Quality Assurance (QA) Plan</i>
R	Nutrient Environmental Release Potential Indicator Tool (NERPI)
S	Ammonia Air Emissions Mitigation Indicator Tool (AAEMI)
T	Supplemental Information for Section 4 Project Results

## 1.4 Report Caveats

In reviewing the information, results, and findings of the CLEAN<sub>EAST</sub> Project presented in this report, the reader should consider the following general caveats about how the project was implemented and the specific tools that were developed for the project:

- Upon startup of the CLEAN<sub>EAST</sub> Project in October 2007, RTI began building the Project Team via competitions for an engineering support subcontract and on-farm technical services subcontracts. In addition, RTI established an Advisory Committee on Science and Strategy and conducted Outreach Strategy planning, project logistics planning, and farm EA and NMP tools development. In December 2008, as RTI began recruiting volunteer farm participants for the project, the EPA issued amendments to the NPDES CAFO Rules (73 FR 70418, November 30, 2008). These amendments, along with additional rules in states such as Pennsylvania, led to an increased number of farms requiring NPDES permits, as well as an increased need for preparing and implementing NMPs. Thus, the original proposed projection of EAs and NMPs to be completed by the CLEAN<sub>EAST</sub> Project shifted toward a greater demand by farms participants for NMPs than EAs.
- The farm operators who participated in the CLEAN<sub>EAST</sub> Project volunteered to do so, and therefore, the results cannot necessarily be considered representative of all farms with livestock and poultry operations in the eastern United States. First, there is the potential that those farm operators who received CLEAN<sub>EAST</sub> Project services were, in some cases, being proactive in requesting and implementing NMPs when not required by state or federal regulations; thus, they may operate their farms differently than the general farm population. However, this possibility has not been validated. Second, a study population of volunteer farm operations is not considered a statistically representative subset of farm population in the 27 states served by the CLEAN<sub>EAST</sub> Project. For example, farms from 20 of the 27 states volunteered for the project. Seven states' farms chose not to volunteer and participate (i.e., Delaware, Maine, Massachusetts, Mississippi, New Hampshire, Rhode Island, and West Virginia). Third, farm size and animal categories—while diverse in the project—may not be statistically representative of the variety of farms found in the 27 states.
- The Nutrient Environmental Release Potential Indicator Tool (NERPI) was developed for the CLEAN<sub>EAST</sub> Project to assess potential water quality impacts at participating farms following complete implementation of TAP recommendations. The tool was adapted from the NRCS

Animal Waste Management (AWM) software program and should only be construed as a general method of indicating potential for nutrient runoff. The AWM software was originally developed for design engineering; however, after considering available software, RTI determined that AWM was the most suitable software available for predicting “potential” nutrient runoff. This tool is discussed further in **Section 3.3.4.1**.

- The Ammonia Air Emissions Mitigation Indicator Tool (AAEMI) was developed for the CLEAN<sub>EAST</sub> Project to assess air quality impacts at participating farms following implementation of TAP recommendations. The tool uses NH<sub>3</sub> emission factors primarily based on the EPA’s National Emission Inventory of Ammonia Emissions from Animal Agricultural Operations dating to 2004. More up-to-date information may become available, such as data collected (and currently undergoing review) during the National Air Emissions Monitoring Study,<sup>7</sup> to derive emission factors. The tool is developed so that it can be updated to enter new emission factors and other input parameters. As site-specific information becomes available for an increasing number of AFOs, tools such as AAEMI can be used to measure and compare the potential changes in NH<sub>3</sub> emissions from AFOs that result from alternative or site-specific control measures. This tool is discussed further in **Section 3.3.4.2**.
- This report describes that farm participants were asked for feedback on their satisfaction with services by completing a Participant Evaluation Survey and returning their responses to RTI. Thirty-seven percent (37%) of all farm participants responded to this request. Therefore, the report on customer satisfaction represents a subset of the population served.
- States’ requirements and guidelines for NMPs (and their own EAs, in some cases) resulted in RTI needing to produce reports that were intended to satisfy states’ requirements and reports. Therefore, the project’s reports are not entirely consistent in depth and breadth (e.g., some states may require mortality management).
- As described in **Section 3.1.1** and **Appendix C**, geographic information systems (GIS) maps reflect water quality impairments as of 2002. While the EPA does provide more recent data on impaired waters, RTI (with EPA’s consent) selected the 2002 reporting year to use as a baseline due to improved reporting by states and improved accuracy/availability of state-submitted geospatial data.

---

<sup>7</sup> The National Air Emissions Monitoring Study was established in 2006 by a voluntary Air Compliance Agreement between the EPA and the pork, dairy, egg, and broiler industries to collect air emissions data at select AFO sites to (1) accurately assess emissions from livestock operations and compile a database for estimation of emission rates, and (2) promote a national consensus for emissions-estimation methods/procedures from livestock operations. For more information see <https://engineering.purdue.edu/~odor/NAEMS/index.htm>.

## Section 2. CLEAN<sub>EAST</sub> Project Overview

The purpose of this section is to present an overview of the CLEAN<sub>EAST</sub> Project from both a mission and operational perspective. (For an in depth discussion of the project activities, including the technical approach and tools developed, please refer to **Section 3**. A full discussion of project results is presented in **Section 4**.)

This section describes the project in terms of

- Objective and goals;
- Desired outputs and outcomes;
- Technical assistance services offered;
- Organizational structure;
- Project data management;
- Phases of project implementation through completion;
- A 5-year chronology of project highlights; and
- Project work products and deliverables.

### 2.1 Project Objective and Goals

The objective of the CLEAN<sub>EAST</sub> Project was to improve environmental quality in potentially impaired watersheds in the 27 states east of the Mississippi River by providing confidential, no-cost EA and NMP assistance to volunteer farm operators with beef, dairy, swine, poultry, or other livestock operations. An EA “assesses” or evaluates the design and operation of the farm with respect to environmental impacts. An NMP provides the farm operator with a site-specific plan for managing manure and organic by-products.

The goal of the CLEAN<sub>EAST</sub> Project was to provide technical assistance to farm operators by

- Developing effective tools and standardized protocols for conducting a comprehensive EA, for nutrient management planning; and in turn, for preparing EA Reports and NMPs;
- Recruiting farm operators to volunteer for confidential farm assessments; and
- Managing a team of TAPs to conduct confidential farm assessments.

### 2.2 Project Desired Outputs and Outcomes

The EPA's policy for tracking environmental results from projects funded by EPA cooperative agreements is specified in *EPA Order 5700.7 Environmental Results under EPA Assistance Agreements* (U.S. EPA, 2005a). As defined by this EPA Order, outputs and outcomes are distinctly different types of performance parameters, and specific performance measurement parameters are selected and then evaluated to determine the level to which each project output and outcome is achieved.

### 2.2.1 Desired Outputs

The term “output” is defined by EPA Order 5700.7 to mean an environmental activity, effort, and/or associated work product related to an environmental goal or objective that will be produced or provided over a period of time or by a specified date. Outputs may be quantitative or qualitative, but they must be measurable during an assistance agreement funding period. The desired outputs identified for the CLEAN<sub>EAST</sub> Project are the following:

- Recruit farm operators to voluntarily participate in the CLEAN<sub>EAST</sub> Project;
- Perform site-specific EAs and prepare NMPs for livestock and poultry operations that potentially could impact water bodies in the states served by CLEAN<sub>EAST</sub> Project;
- Compile a database of non-confidential information from farm visits for assessing the extent of adverse environmental impacts; and
- Expand the availability of trained professionals capable of performing EAs and preparing NMPs for livestock and poultry operations potentially impacting water bodies.

See Table 3-8 for additional information on EPA outputs.

### 2.2.2 Desired Outcomes

The term “outcome” is defined by EPA Order 5700.7 to mean the result, effect, or consequence that will occur from carrying out an environmental project or activity that is related to an environmental or programmatic goal or objective. Outcomes may be environmental, behavioral, health-related, or programmatic in nature; must be quantitative; and may not necessarily be achievable within an assistance agreement funding period. The desired outcomes identified for the CLEAN<sub>EAST</sub> Project are the following:

- Increased number of partially or fully restored nutrient-impaired water bodies;
- Mitigation of adverse water and air impacts from livestock and poultry operations as a result of participating farm operators implementing the best management practices (BMPs) recommended by TAPs in the site-specific EAs and NMPs; and
- Increased knowledge of environmental impacts and methods to mitigate adverse impacts from livestock and poultry operations.

See Table 3-9 for additional information on EPA outcomes.

## 2.3 Project Technical Assistance Services Offered

Qualified TAPs provided technical services to farm operators volunteering to participate in the CLEAN<sub>EAST</sub> Project. Each TAP used for the CLEAN<sub>EAST</sub> Project was a USDA NRCS-registered Technical Service Provider (TSP), with certifications and expertise specific to the state where the assigned farm was located. The technical services offered by the CLEAN<sub>EAST</sub> Project were the following:

- **EA Assistance.** For EA, the TAP conducted an on-site environmental review of the farm participant’s operation using questionnaire tools developed specifically for the project, and then

prepared recommendations that the farm participant could implement to address any identified environmental issues.

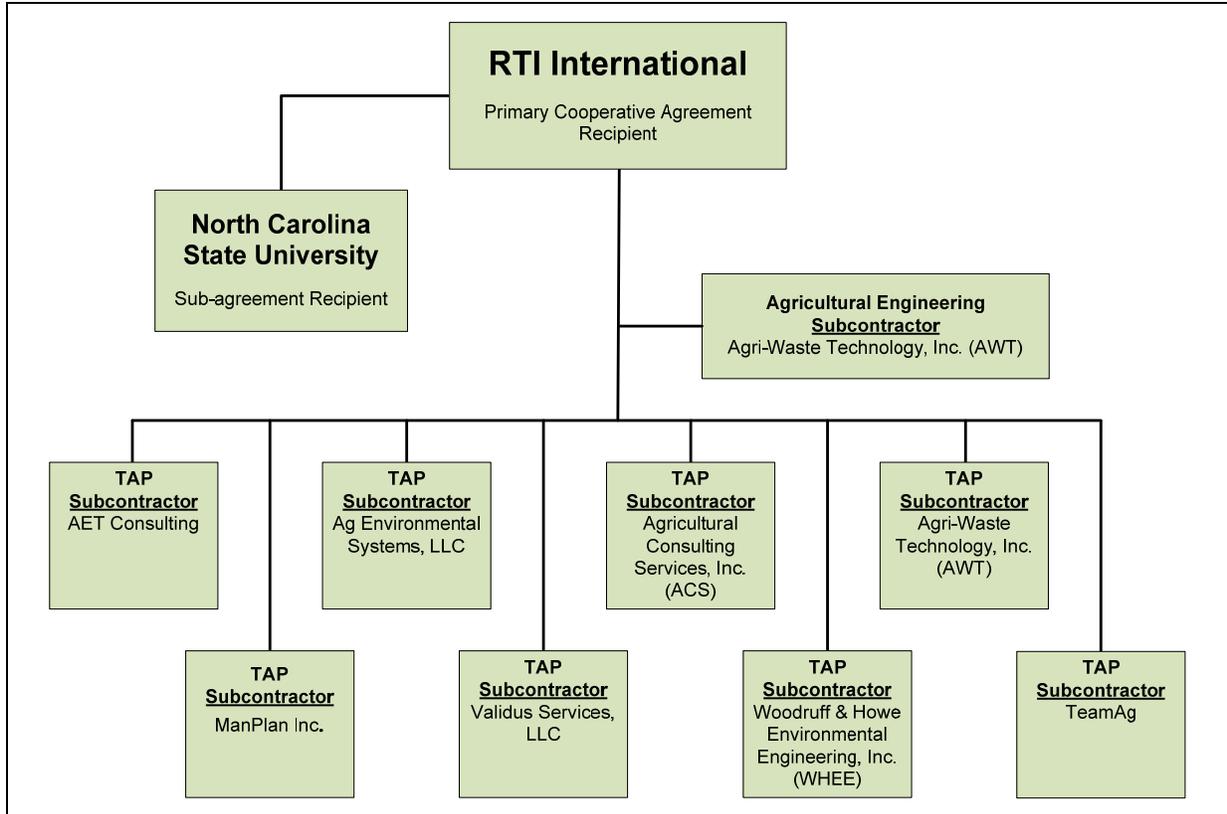
- **NMP Assistance.** The farm operator could request NMP assistance from the CLEAN<sub>EAST</sub> Project for one of several site-specific reasons. For farms with an existing NMP, the TAP reviewed the farm participant's existing NMP and then identified and prepared the necessary NMP documentation to update the plan for the current livestock or poultry operation, if needed. For farms with no NMP, the TAP collected information and performed the required analyses to prepare a new NMP for implementation at the farm participant's livestock or poultry operation.

A detailed discussion of the protocols used and the project-specific tools developed for providing EA and NMP assistance to farm operators is presented in **Section 3.3**.

## 2.4 Project Organization

### 2.4.1 Project Team Members

The CLEAN<sub>EAST</sub> Project was implemented and administered by RTI in a teaming collaboration with NCSU and eight subcontractors. The organization of the CLEAN<sub>EAST</sub> Project is shown in **Figure 2-1**. RTI was the primary cooperative agreement recipient, with NCSU serving as a sub-agreement recipient. To select the subcontractors, RTI conducted three competitive bid procurements, following award of the cooperative agreement. The first procurement was for an agricultural engineering subcontractor to assist RTI and NCSU with the development of the EA and NMP tools and protocols and project data analyses. RTI held two more regionally based procurements to select TAP subcontractors to provide the CLEAN<sub>EAST</sub> Project field services.



**Figure 2-1. CLEAN EAST Project team organization.**

The TAPs competition sought independent subcontractors to RTI with NRCS TSP registrations and farm animal operation expertise specific to the states in which they would be assigned to work for the CLEAN EAST Project. RTI held one competition for 13 states of the Northeast and mid-Atlantic regions and a second competition for the 14 states of the Midwest and Southeast regions. As a result, RTI assembled a team of TAPs from consulting firms with experienced TSPs on staff. The selection and management of the TAPs for the CLEAN EAST Project is discussed further in **Section 3.2**.

#### 2.4.2 Advisory Committee on Science and Strategy

To solicit stakeholder input for the CLEAN EAST Project development and implementation, RTI established an Advisory Committee on Science and Strategy (hereafter referred to as the Advisory Committee). Dr. Leonard Bull, Professor of Animal Science and Associate Director of the NCSU Animal and Poultry Waste Management Center (APWMC), served as Chairman of the committee. The committee members were selected to meet the overall objective of providing a forum that was representative of the key stakeholder groups and regions in the eastern United States that could request and would receive benefits from the types of technical assistance services to be offered by the CLEAN EAST Project. **Appendix A** presents a table that lists the names, affiliations, and stakeholder group representation of the members of the Advisory Committee.

An initial face-to-face meeting of the Advisory Committee was held at the RTI offices in North Carolina on January 28, 2008. Subsequent meetings of the committee were conducted as teleconferences

that were held at approximately 6-month intervals throughout the project performance period. Outcomes from the interaction of the Project Team and the Advisory Committee included the following:

- Significant input into the Outreach Strategy (**Appendix D**) for recruiting farm operators to participate in the project; formats used for the EA and NMP tools; and security procedures used to maintain the confidentiality of farm information.
- Recommendation for a pilot project in a manageable geographic area to allow evaluation of the Outreach Strategy and tools developed for the project in “real-world” conditions.
- Assistance in creating public awareness about the CLEAN<sub>EAST</sub> Project in the 27 states for which project assistance was available.

## 2.5 Project Data Management

To encourage farm operator participation in the CLEAN<sub>EAST</sub> Project, RTI maintained all individual farm-specific data and reports as confidential information that could only be accessed by authorized CLEAN<sub>EAST</sub> Project staff. Distribution of the final EA Report, NMP update, or new NMP prepared for an individual farm was at the sole discretion and approval of the farm participant receiving the report.

The confidentiality of non-publicly available information collected and findings for each farm was maintained by the assigned TAP and the CLEAN<sub>EAST</sub> Project staff. To ensure that confidentiality was maintained at all times, RTI developed a *CLEAN<sub>EAST</sub> Project Information Security Plan* that established facility and procedures for handling confidential data. All RTI, NCSU, AWT, and TAP project staff that potentially could handle individual farm data were required to complete training on the importance of maintaining confidentiality and using the procedures prescribed by the security plan before beginning work on any project activities.

Each individual farm operator applying for services was assigned a randomly generated identification number to avoid disclosing a farm’s identity. The farm operator’s information was entered into a Farm Applicant and TAP Tracking Database for the purpose of managing the logistics of services. In addition, a Farm Participant Database was created for managing information collected as part of the EA and NMP services. The primary use of the Farm Participant Database was to aggregate individual farm data into a non-confidential format for the purpose of identifying animal waste management baseline trends and ranking BMPs recommended by the TAPs for implementation at the farms. The database included information about animal numbers; manure collection and storage methods used by farm participants; animal housing and pasture systems; crop application methods used; mortality management; and animal contact with water. The results of the Farm Participant Database analyses are presented in **Section 4**.

Both databases designed by RTI are relational Microsoft Access databases. They exist only on a standalone computer that is neither connected to RTI’s internal server network nor accessible from the Internet. This Final Report and all other materials produced for the EPA or for public presentation only include non-confidential, multi-farm aggregated data collected by the CLEAN<sub>EAST</sub> Project. No specific farm locations are identified, and site-specific information is not presented in this report.

## 2.6 Project Implementation

The project's implementation can be divided into four phases: project initiation, pilot testing, TAP field services, and project completion. In **Section 2.7**, the specific individual activities performed in each of these phases are presented in a timeline by the three major tasks of the cooperative agreement and the five project years.

### 2.6.1 Project Initiation Phase

Initiation of the CLEAN<sub>EAST</sub> Project began by developing an Outreach Strategy to create public awareness of the project, promote buy-in from stakeholders in the agricultural community, and identify target farm operators to recruit to participate in the project. The outreach and communication activities began by performing two analyses to help identify the target subsets of farm operators in the 27 eligible states to participate in the project to recruit farm participants for the CLEAN<sub>EAST</sub> Project. RTI first conducted a qualitative analysis of the economic incentives that influence farm operator decisions regarding participation in voluntary environmental programs (referred to hereafter as the Economic Incentives Analysis). For a companion analysis, RTI used GIS and a variety of datasets to create a series of maps showing farm density, animal density, impaired waters, nitrogen deposition, and locations of current USDA NRCS registered TSPs in the states served by the CLEAN<sub>EAST</sub> Project. (This analysis is referred to hereafter as the GIS Analysis.) Using information from these two analyses, input from the Advisory Committee, and other information sources, RTI, in collaboration with NCSU, prepared the *Comprehensive Environmental Assessments and Nutrient Management Plans for Livestock and Poultry Operations: Outreach Plan 2007–2011* (henceforth referred to as the CLEAN<sub>EAST</sub> Outreach Plan) (**Appendix D**), which outlined the strategy to be used to promote the CLEAN<sub>EAST</sub> Project. Work also began on development of a project website and promotion materials identified in the Outreach Plan. **Section 3.1** presents additional information about the Economic Incentives Analysis, GIS Analysis, and other outreach and communication activities.

Concurrent with the outreach and communication activities, RTI began administering a series of competitive bid processes previously described. Also, in collaboration with NCSU and AWT (after AWT was awarded the engineering subcontract), RTI developed standardized procedures and tools to be used by the TAPs for providing EA and NMP technical assistance to individual farms participating in the CLEAN<sub>EAST</sub> Project. These procedures addressed the use of tools developed specifically for the CLEAN<sub>EAST</sub> Project; the security of individual farm information; the biosecurity procedures to be used on each farm; report formats; and report quality assurance. To ensure that all of the TAPs provided a consistent, high-quality level of technical assistance services to the farm participants, RTI developed and administered a TAP management system, a Farm Applicant and TAP Tracking Database to facilitate scheduling farm assignments, a CLEAN<sub>EAST</sub> Project Information Security Plan, and a quality assurance program (a copy of the *Quality Assurance Plan* for this project is provided in **Appendix Q**).

### 2.6.2 Pilot Project Phase

To test and refine the initial versions of the procedures and tools developed for implementing the CLEAN<sub>EAST</sub> Project, a pilot project was conducted prior to the project's full public roll-out. Two farms

located in the Northeast volunteered to participate in the pilot project and were visited by the assigned, subcontracted TAPs in the fall of 2008. The assigned TAPs completed both EAs and NMPs for the farms. For the pilot project, RTI evaluated the following:

- Procedures used for accepting farms, including contacting the farm operator and assigning TAPs to the farm;
- Interactions of the TAPs and farm operators to perform the requested technical assistance services;
- Standardized templates designed to be used by all TAPs for invitation letters, tool reports, and transmittal letters for draft and final work products;
- Draft work products prepared by the TAPs, and subsequent revision to develop the final products; and
- Farm operator completion of a Participant Evaluation Survey (see **Appendix M**).

In addition, input and comment on the project protocols and tools were provided by the participating TAPs based on their field testing of the tools at actual operating farms. Upon review and consideration of the feedback obtained from the pilot project, adjustments and refinements were incorporated into the procedures and tools to be used by all TAPs to perform the technical assistance services in the future.

### 2.6.3 Farm Participant Technical Service Assistance Phase

In January 2009, the CLEAN<sub>EAST</sub> Project began soliciting applications from farm operators for technical assistance services. This application period was open from January 2009 through July 2011. Farm operators applied to the CLEAN<sub>EAST</sub> Project by completing a Participation Form (see **Appendix E**) and returning the form to RTI. RTI reviewed each Participation Form received, using a set of standardized criteria. Once a farm operator was selected for the CLEAN<sub>EAST</sub> Project to receive on-site technical assistance service, RTI assigned the farm participant to an individual TAP from one of the RTI TAP subcontractors who was qualified to perform the requested services in the state where the farm was located. The general steps presented in **Figure 2-2** were completed to provide the farm participant with the requested EA or NMP assistance service.

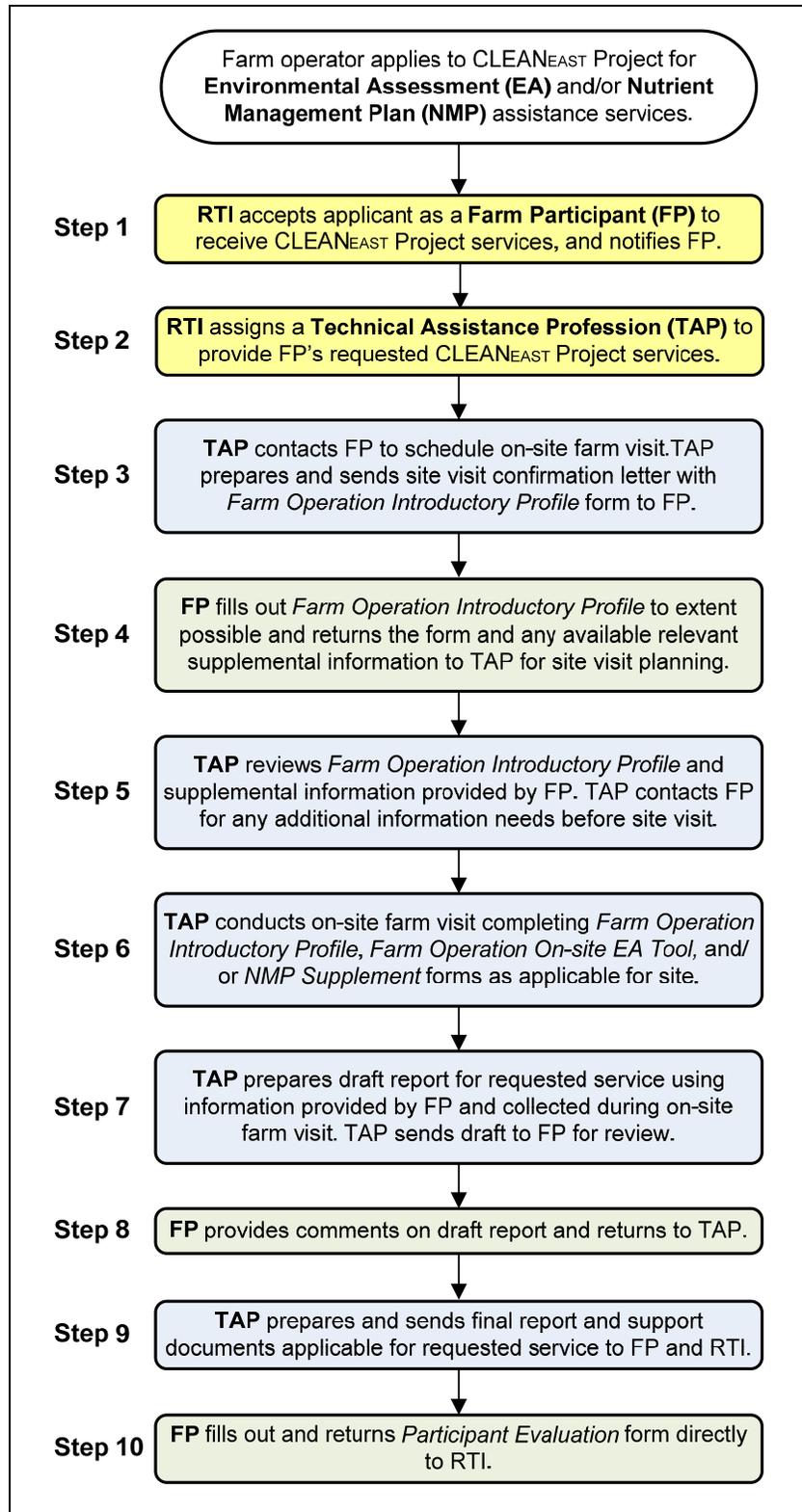


Figure 2-2. General CLEAN<sub>EAST</sub> Project implementation steps for farm participant selected to receive technical services.

A summary of the farm participation for the CLEAN<sub>EAST</sub> Project is presented in **Table 2-1**. For various reasons, not all farm operators who submitted a Participation Form to the CLEAN<sub>EAST</sub> Project ultimately were accepted to receive technical services. Additional discussion about the selection of the participating farms is presented in **Section 3.2.3**. A detailed characterization about the farms participating in the CLEAN<sub>EAST</sub> Project is presented in results **Section 4.1**.

**Table 2-1. Summary of CLEAN<sub>EAST</sub> Project Farm Participation**

Farm Participant Category	Total Number of Farms
Farm operators applying for technical assistance services	577
Farm operators selected as farm participants to receive technical services	429
Farm participants geographic distribution <sup>a</sup>	
▪ Farm participants located in mid-Atlantic states	169
▪ Farm participants located in midwestern states	133
▪ Farm participants located in northeastern states	38
▪ Farm participants located in southeastern states	89
Farm participants receiving EA assistance <sup>b</sup>	297
Farm participants receiving NMP assistance <sup>b</sup>	393

<sup>a</sup> See Table 4-5 for the total numbers of animals in each geographic area.

<sup>b</sup> Some farm participants requested both EA and NMP assistance. A discussion about reasons why some applicants were not accepted is provided in **Section 3.2.3**.

#### 2.6.4 Project Completion Phase

As the final set of TAP farm visits was being completed and the final EA Reports and NMPs were delivered to farm operators, RTI began work on a variety of project activities to measure the project performance, analyze the data collected for the project, and apply the project data for a case study. Telephone calls and a series of return site visits to a subset of the farms that had received CLEAN<sub>EAST</sub> services were made by RTI, with assistance from NCSU, AWT, and AET Consulting, Inc. staff, to determine if and how farm operators were implementing the recommendations made by the TAPs for their particular farm operations. Project activity concluded with preparation of this Final Report.

#### 2.7 Project Activity Summary by Project Year

A summary timeline of key project activities completed for the CLEAN<sub>EAST</sub> Project by the three major tasks areas (i.e., Outreach and Communication; TAP Management and Farm Visits; and Tool Development and Data Analysis) is presented in **Table 2-2**. The table does not present a comprehensive listing of all task activities completed. More detailed discussions of the procedures and tools used by the Project Team to perform the work required for each of the three tasks are presented in **Section 3**.

**Table 2-2. Summary of Key Activities Completed for CLEAN<sub>EAST</sub> Project**

Year	Task 1: Outreach and Communication	Task 2: TAP Management and Farm Visits	Task 3: Tool Development and Data Analysis
FY 2008	<ul style="list-style-type: none"> <li>▪ Advisory Committee assembled, and kickoff meeting held at RTI</li> <li>▪ Economic Incentives Study conducted</li> <li>▪ GIS Analysis conducted</li> <li>▪ Outreach Plan prepared</li> <li>▪ Project website launched</li> <li>▪ Participant recruitment brochure prepared</li> <li>▪ Conference and meeting attendance to introduce project to stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>▪ TAP subcontractor competitive bid procurement – Round 1</li> <li>▪ TAP subcontracts signed</li> <li>▪ First TAP training sessions conducted</li> <li>▪ Pilot project planning</li> </ul>	<ul style="list-style-type: none"> <li>▪ Agricultural engineering subcontractor competitive bid procurement</li> <li>▪ Farm Operations Introductory Profile developed and tested</li> <li>▪ On-Site Farm Operation Environmental Assessment Tool developed and tested</li> <li>▪ Standardized NMP preparation protocol developed for use by TAPs</li> </ul>
FY 2009	<ul style="list-style-type: none"> <li>▪ Advisory Committee teleconferences and e-mails</li> <li>▪ Farm participant recruitment begins</li> <li>▪ Conference technical paper presentations</li> <li>▪ Recruiting notices in trade journals</li> <li>▪ Contacts with state and local officials such as county agents</li> </ul>	<ul style="list-style-type: none"> <li>▪ TAP subcontractor competitive bid procurement – Round 2</li> <li>▪ TAP subcontracts signed</li> <li>▪ Pilot project farm visits conducted to test tools and protocols</li> <li>▪ Additional TAP training sessions held</li> <li>▪ Farm and TAP tracking database developed (applicants and participants)</li> <li>▪ TAP farm assignments begin</li> <li>▪ TAP farm visits begin</li> <li>▪ Individual farm EA Reports and NMPs delivered to farm participants</li> </ul>	<ul style="list-style-type: none"> <li>▪ Tools revised based on TAP recommendations</li> <li>▪ <i>Performance and Results Tracking Strategy Plan</i> prepared</li> <li>▪ Farm confidential database developed and implemented</li> </ul>
FY 2010	<ul style="list-style-type: none"> <li>▪ Advisory Committee teleconferences and e-mails</li> <li>▪ Farm participant recruitment continues</li> <li>▪ Conference technical paper presentations</li> <li>▪ Continued outreach to state and local officials such as county agents</li> </ul>	<ul style="list-style-type: none"> <li>▪ TAP farm assignments continue</li> <li>▪ TAP farm visits continue</li> <li>▪ Individual farm EA Reports and NMPs delivered to farm operators</li> </ul>	<ul style="list-style-type: none"> <li>▪ Nutrient Environmental Release Potential Indicator Tool (NERPI) developed</li> <li>▪ Ammonia Air Emissions Mitigation Indicator (AAEMI) Tool developed</li> <li>▪ Continued entry of data into farm confidential database</li> </ul>
FY 2011	<ul style="list-style-type: none"> <li>▪ Advisory Committee teleconferences and e-mails</li> <li>▪ Farm participant recruitment completed</li> <li>▪ Conference technical paper presentations</li> <li>▪ Continued outreach to state and local officials such as county agents</li> </ul>	<ul style="list-style-type: none"> <li>▪ TAP farm assignments</li> <li>▪ TAP farm visits continue</li> <li>▪ Individual farm EA Reports and NMPs delivered to farm operators</li> </ul>	<ul style="list-style-type: none"> <li>▪ Individual farm data entry and QA into confidential database</li> <li>▪ Preliminary data analyses begin</li> </ul>

(continued)

Table 2-2. Summary of Key Activities Completed for CLEAN<sub>EAST</sub> Project (continued)

Year	Task 1: Outreach and Communication	Task 2: TAP Management and Farm Visits	Task 3: Tool Development and Data Analysis
FY 2012	<ul style="list-style-type: none"> <li>▪ Advisory Committee teleconferences and emails</li> <li>▪ Project video produced and released</li> <li>▪ Conference technical paper presentations</li> <li>▪ <i>Final Report</i> preparation</li> </ul>	<ul style="list-style-type: none"> <li>▪ TAP farm visits completed</li> <li>▪ Individual farm EA Reports and NMPs delivered to farm operators</li> <li>▪ TAP subcontracts closed out</li> </ul>	<ul style="list-style-type: none"> <li>▪ Additional farm data entry and QA into confidential database</li> <li>▪ Follow-up visits to a subset of participating farms</li> <li>▪ Follow-up phone calls to a subset of participating farms</li> <li>▪ Farm data in confidential database aggregated into non-confidential formats for analysis, public presentations, and final report production</li> <li>▪ Performance measurement analysis</li> <li>▪ Case study conducted of participating farms located in Chesapeake Bay watershed</li> <li>▪ Draft final and final reports produced</li> </ul>
FY 2013	<ul style="list-style-type: none"> <li>▪ Two project results presentations at 2012 American Water Resources Assn. Annual Conference</li> </ul>	<ul style="list-style-type: none"> <li>▪ No farm visits in FY 2013</li> </ul>	<ul style="list-style-type: none"> <li>▪ Final reports produced and delivered to EPA</li> <li>▪ Final presentation to EPA produced</li> </ul>

## 2.8 Project Work Products and Deliverables

The major work products and deliverables prepared by the Project Team for the CLEAN<sub>EAST</sub> Project are listed in **Table 2-3**. Additional work products used for implementing the CLEAN<sub>EAST</sub> Project included a Participant Form for the farm operators to request technical service assistance; a Farm Operation On-Site Environmental Assessment Report template (henceforth referred to as the EA Report template); and TAP training PowerPoint presentations and handouts. Also, throughout the project performance period, RTI prepared and delivered to the EPA products required for administration of the cooperative agreement, including quarterly project progress reports and annual oral presentations of the past fiscal year project activity.

Table 2-3. CLEAN<sub>EAST</sub> Project Major Work Products and Deliverables

Work Product	Description	Completion Date
Economic Incentive Study Report	Analysis of the economic incentives that influence farm operator decisions regarding participation in voluntary environmental programs (see <b>Appendix B</b> ).	February 2008
CLEAN <sub>EAST</sub> Project Website	Internet website ( <a href="http://livestock.rti.org">http://livestock.rti.org</a> ) providing information about the project for the general public and project applicants, and links that allow the public to download specific tools developed for the project.	March 2008

(continued)

Table 2-3. CLEAN<sub>EAST</sub> Project Major Work Products and Deliverables (continued)

Work Product	Description	Completion Date
GIS Analysis Report	Analysis using GIS and a variety of datasets to identify livestock operation density, environmentally impacted areas, state policy status, and availability of USDA NRCS-registered TSPs in the eastern United States (see <b>Appendix C</b> ).	May 2008
Outreach Plan	Outreach Strategy developed for the CLEAN <sub>EAST</sub> Project to effectively promote the project to owners and operators of livestock and poultry feeding operations as a way to obtain technical assistance developing site-specific environmental assessments and developing or reviewing NMPs (see <b>Appendix D</b> ).	May 2008
CLEAN <sub>EAST</sub> Project Marketing Materials	Tri-fold brochure, press releases, advertisements used to recruit farm participants (see <b>Section 3.1.4</b> ).	May 2008
Farm Operation Introductory Profile	Standardized questionnaire used to collect the general information about a farm (see <b>Appendix F</b> ).	June 2008
On-Site Farm Operation Environmental Assessment Tool	Standardized questionnaire used to collect the information about a farm needed to prepare an EA (see <b>Appendix G</b> ).	June 2008
Farm Operation Profile Supplement (NMP Supplement)	Standardized questionnaire used to collect the supplemental information about the farm needed to prepare an NMP (see <b>Appendix I</b> ).	July 2008
CLEAN <sub>EAST</sub> Project Information Security Plan	Policies and procedures used for the CLEAN <sub>EAST</sub> Project to assure that the farm-specific data collected and analyzed is treated as confidential information.	January 2009
CLEAN <sub>EAST</sub> Project Nutrient Management Plan Assistance Protocol	Technical approach used by TAPs for preparing a new NMP and updating an existing NMP. The NMP Assistance Protocol makes use of existing NMP software packages or "tools" that are currently used to develop NMPs in each state served by the CLEAN <sub>EAST</sub> Project (see <b>Appendix J</b> ).	February 2009
Project Performance and Results Tracking Strategy Plan	Project tracking strategy used to measure CLEAN <sub>EAST</sub> Project outputs and outcomes to comply with GPRA EPA policy requirements, and tracking of additional performance measures specific to the implementation of CLEAN <sub>EAST</sub> Project needed during the cooperative agreement performance period to monitor the effectiveness and efficiency of outreach activities and TAP performance (see <b>Appendix K</b> ).	May 2009
Nutrient Environmental Release Potential Indicator Tool (NERPI)	Tool developed for CLEAN <sub>EAST</sub> Project to perform gross nutrient balance calculations for each participating farm using the NRCS Animal Waste Management (AWM) software (see <b>Section 3.3.4.1</b> ).	August 2010
Ammonia (NH <sub>3</sub> ) Air Emissions Mitigation Indicator Tool (AAEMI)	Tool using Excel spreadsheets developed for CLEAN <sub>EAST</sub> Project to perform a nitrogen mass balance to calculate NH <sub>3</sub> emissions separately from each of the three emission source components at a farm: animal confinement areas or housing, manure treatment/storage, and land application (see <b>Section 3.3.4.2</b> ).	November 2010
Individual farm EA Reports	297 EA Reports prepared by TAPs for individual farm locations.	2009 through 2012
Individual farm NMP new or updated plans	393 NMP reports prepared by TAPs for individual farm locations.	2009 through 2012
Video	10 minute CLEAN <sub>EAST</sub> Project video	June 2012
Final Report	Report documenting work performed for the cooperative agreement and the results of the project.	December 2012

## Section 3. Project Implementation Procedures and Tools

The procedures and tools developed and used to implement the CLEAN<sub>EAST</sub> Project activities were organized into three major tasks:

- Task 1: Outreach and Communication (**Section 3.1**)
- Task 2: TAP Management and Farm Visits (**Section 3.2**)
- Task 3: Tool Development and Data Analysis (**Section 3.3**).

Activities in these three tasks were performed concurrently throughout the 5-year cooperative agreement performance period. The type of activities performed for each of the tasks varied each year as the project progressed. This section presents descriptions of specific tools developed and procedures established to perform the CLEAN<sub>EAST</sub> Project activities.

### 3.1 Task 1—Outreach and Communication

An important initial activity for the CLEAN<sub>EAST</sub> Project was developing an effective Outreach Strategy that encouraged voluntary participation by individual farm operators. Because one of the project's objectives was to achieve representation across different farm sizes, animal categories, and watersheds to the extent possible, the outreach was designed and implemented to attract adequate participation, not only in terms of total number of farm participants but also from targeted subsets of farm operators. A representative distribution of farms would provide more information about the relative benefits of conducting these EA and NMP assistance services on different sizes and types of farms located in different watersheds.

The outreach and communication activities began by performing two analyses to help identify the target subsets of farm categories from which to recruit farm participants for the CLEAN<sub>EAST</sub> Project: a GIS Analysis, as discussed in **Section 3.1.1**, and an Economics Incentives Analysis, as discussed in **Section 3.1.2**. Using information from these two analyses, input from the CLEAN<sub>EAST</sub> Advisory Committee, and other information sources, RTI, in collaboration with NCSU, prepared an Outreach Plan (discussed in **Section 3.1.3**) that outlined the strategy to be used to promote the CLEAN<sub>EAST</sub> Project. The tools developed and activities conducted to implement the strategy are described in **Section 3.1.4**.

#### 3.1.1 GIS Analysis

RTI used GIS and a variety of datasets to identify livestock density, environmentally sensitive and/or impacted areas, state policy and regulatory status, and the availability of USDA NRCS registered TSPs in the eastern United States. This approach allowed RTI to collect and process relevant geographic-based information about farm locations to predict and prioritize strategic outreach that would produce the most benefit to water and air quality through assistance to the farm operators in preparing EAs and NMPs. The GIS Analysis approach involved several steps:

**Step 1 – Identify Eastern U.S. Farm Animal Density.** RTI used the USDA 2002 Census of Agriculture (USDA, 2002) to obtain county-level animal densities and counts for beef, dairy, swine and poultry.

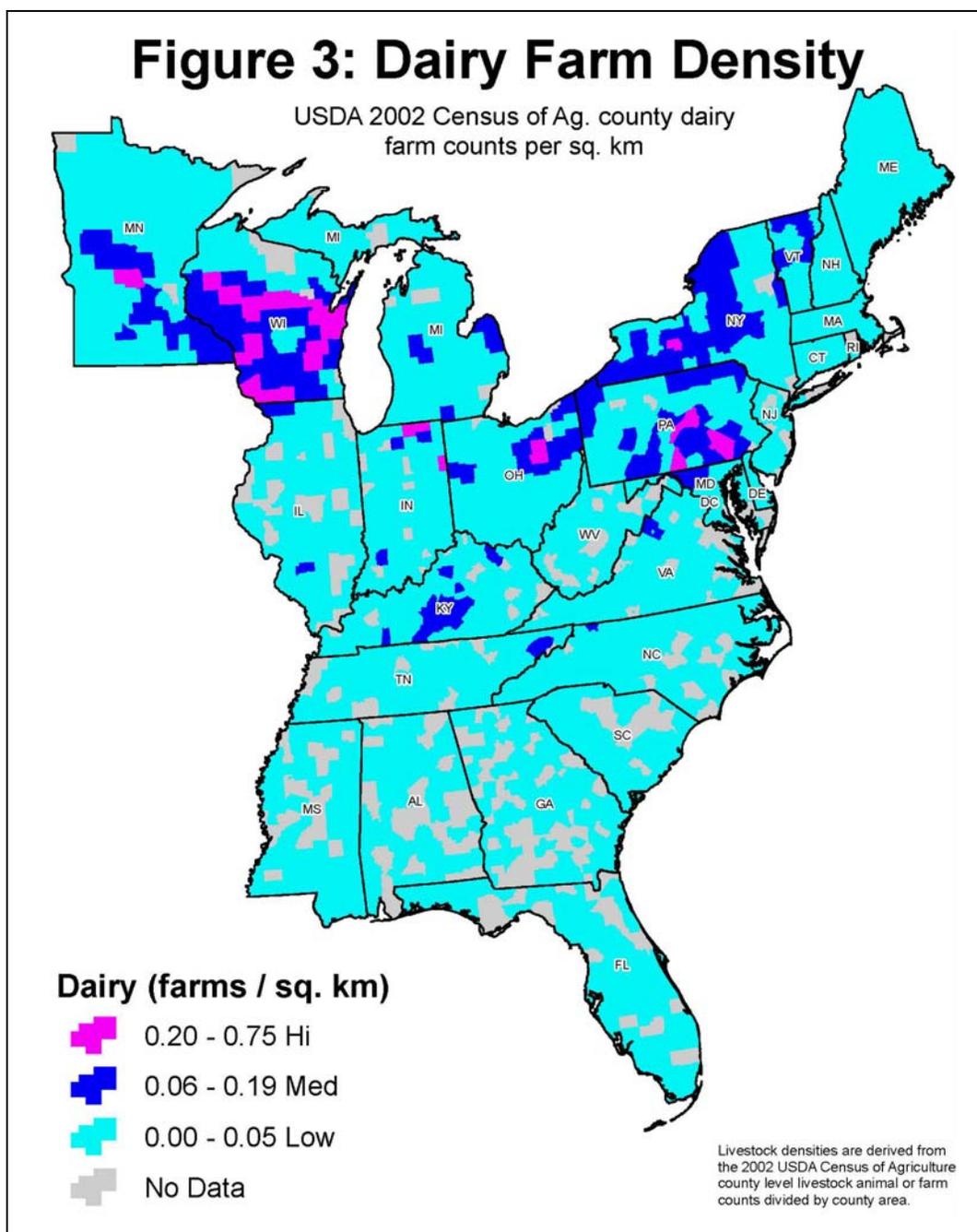
**Step 2 – Identify Environmentally Impacted Areas in the Eastern United States.** To determine areas potentially impacted by livestock operators, RTI used a combination of datasets that included a GIS layer of the 2002 EPA CWA Section 303(d) impaired waters; estimated nitrogen load exports by Hydrologic Cataloging Unit (HUC) (<http://nhd.usgs.gov>); nitrogen atmospheric deposition data; and U.S. Geological Survey (USGS) National Water Quality Assessment (NAWQA) Program study area boundaries.

**Step 3 – Identify State Policy Status.** RTI staff used the EPA’s NPDES web page ([http://cfpub.epa.gov/npdes/afo/afoinfo.cfm?view=category&link\\_cat=23](http://cfpub.epa.gov/npdes/afo/afoinfo.cfm?view=category&link_cat=23)) to identify state-level CAFO NMPs.

**Step 4 – Identify Availability of USDA NRCS registered Technical Service Providers.** The number of TSPs (i.e., number of entries) and number of CNMP-certified TSPs from USDA-NRCS’ online TechReg database (<http://techreg.usda.gov/index.aspx>) was summarized by state and mapped.

**Step 5 – Overlay Selected Mapping Layers Created in Steps 1 through 4.** RTI created a series of maps that addressed multiple criteria and characterized the geographic coverage for this project.

RTI created maps that presented information on farm density, animal density, impaired waters, atmospheric nitrogen deposition, and the availability of TSPs. Maps were prepared depicting animal and farm density for dairy cows, beef cows, and swine, as well as farm density for poultry. Additional maps showed areas in the eastern United States that have nutrient-related water quality impairments in relation to animal and farm density. **Figure 3-1** presents an example of one of the maps, which shows dairy cow density in the 27 states eligible for CLEAN<sub>EAST</sub> Project assistance. The complete series of maps is presented in the *GIS Analysis of Livestock and Environmental Data to Support Outreach Planning* report in **Appendix C**.



**Figure 3-1. Example map prepared for GIS analysis.**

### 3.1.2 Economic Incentives Analysis

RTI and NCSU performed a qualitative analysis of the economic incentives that could potentially influence farm operator decisions regarding participation in voluntary environmental programs. The Economic Incentives Analysis evaluated seven specific factors, as shown in the text box; each of these factors is discussed in the *Factors Influencing Livestock Producer Participation in Voluntary Environmental Programs* report (i.e., Economics Incentives report) provided in **Appendix B**. The Project Team also addressed the identification of potential barriers to participation in such programs, and the

potential outreach features of the CLEAN<sub>EAST</sub> Project that could help overcome some of those barriers. Because the CLEAN<sub>EAST</sub> Project was intended to achieve participation across major animal categories, different farm sizes, and diverse locations in impaired watersheds, consideration and articulation of project features likely to be important to certain subgroups of farm operators would help the outreach effort attract the desired distribution of participants. The Economic Incentives report also discussed implications for the Outreach Strategy and the types of marketing information to be used to promote the project.

**Analyzed Factors Potentially Impacting Farm Operator Decision-Making Regarding Participation in Voluntary Programs**

1. Awareness of environmental impacts
2. Awareness of government technical and financial assistance projects
3. Expected impacts on profitability
4. Credit constraints
5. Management intensity of environmentally beneficial practices
6. Liability and future regulations
7. Farm structure and ownership

Overall findings of the Economics Incentive Analysis included the discovery that while the major categories of benefits associated with a program (e.g., improved input management, better position to qualify for cost-share funds, improved position for compliance with or avoidance of future environmental regulations) are similar across farm operator subgroups, the importance of those benefits to individual farm operators varies greatly. Operators of large farms may have been more incentivized to participate in the CLEAN<sub>EAST</sub> Project because of the public relations benefit, whereas operators of smaller farms may have been influenced by the cost saving and impact on farm profitability. It was concluded that the variability of farm operators' motives for participation makes it critical to include local representation in the outreach efforts.

### 3.1.3 Outreach and Communication Strategy

A combination of outreach activities for the CLEAN<sub>EAST</sub> Project was developed and implemented to promote awareness about the project and to recruit farm participants. Based on the results of the Economic Incentives Analysis and GIS Analysis, as well as feedback from key stakeholders and the CLEAN<sub>EAST</sub> Advisory Committee, the CLEAN<sub>EAST</sub> Project Team selected and prioritized target audiences for promoting the project. The overall goal of this outreach effort was to increase farms' participation in the CLEAN<sub>EAST</sub> Project, especially those located in impaired watersheds. Specific objectives of the outreach and communication activities included the following:

- Create awareness of the CLEAN<sub>EAST</sub> Project, and promote buy-in from stakeholders in the agricultural community;
- Recruit farm participants to volunteer for technical services offered by the CLEAN<sub>EAST</sub> Project;
- Increase awareness of farm operators of the environmental issues associated with AFOs; and
- Identify sources of additional information available to assist farm operators in protecting their operation and the environment.

The Project Team prepared an Outreach Plan to coordinate and efficiently use resources for the outreach and communication activities. The complete Outreach Plan is presented in **Appendix D**.

### 3.1.4 Outreach Implementation Tools and Activities

Using the Outreach Plan as an initial guide, the CLEAN<sub>EAST</sub> Project Team prepared outreach tools and performed outreach activities. During the first years of the CLEAN<sub>EAST</sub> Project, the focus of the outreach tools and activities was to increase awareness about the project and to recruit farm participants by providing information to farm owners/operators about the technical services offered. In the latter years of the CLEAN<sub>EAST</sub> Project, as the application period came to an end and data started becoming available from project services, the focus of the outreach tools and activities transitioned to presentations on status and accomplishments, including selected interim results and the long-term utility of tools developed.

**Table 3-1** presents the outreach tools developed and the outreach activities performed by the CLEAN<sub>EAST</sub> Project Team during the 5-year project performance period. **Table 3-2** lists public presentations and conferences and meetings attended for CLEAN<sub>EAST</sub> Project outreach activities. Examples of several of the outreach materials created for the project are shown in **Figures 3-2 through 3-4**.

**Table 3-1. Outreach Tools Developed for the CLEAN<sub>EAST</sub> Project**

Outreach Tool	Description
Project Logo	Project staff designed a logo for the CLEAN <sub>EAST</sub> Project that was used on project outreach materials and products.
Project Website	Project staff designed, implemented, and administered a website on RTI's server for the CLEAN <sub>EAST</sub> Project at <a href="http://livestock.rti.org">http://livestock.rti.org</a> . A screen shot of the website home page is presented in Figure 3-2.
Toll-free Telephone Line	Project staff operated a toll-free line for the CLEAN <sub>EAST</sub> Project to allow interested farm operators to talk directly to project staff to ask questions about the project, and for farm participants to talk with RTI staff coordinating the TAP assigned to the participant's farm.
Press Releases	Project staff prepared and distributed press releases for publication in farm publications and newsletters.
Publication Advertisements	Project staff created advertisements and purchased ad space in farm trade publications to recruit farm participants. An advertisement created for the CLEAN <sub>EAST</sub> Project is shown in Figure 3-3.
Public Presentations and Attendance at Conferences and Meetings	Table 3-2 lists the conferences and meeting attended by project staff to promote the CLEAN <sub>EAST</sub> Project. Initially, conference selection was based on weighing the benefits of communicating at national conferences versus targeted local venues such as co-op meetings. For some conferences, a booth was rented, as was determined to be appropriate and cost-effective. As the number of farm participants and the requested services approached completion, emphasis shifted to presenting technical papers about the CLEAN <sub>EAST</sub> Project at national and regional conferences.
Project Brochure	Project staff prepared a tri-fold brochure for distribution at conferences and meeting booths rented by RTI to promote the project. RTI also coordinated with EPA to display brochures at EPA-sponsored conference booths, as appropriate (Figure 3-4).
Personal Contact by CLEAN <sub>EAST</sub> Project Staff	Project staff scheduled and conducted face-to-face meetings or telephoned county agriculture agents, farm operators, state nutrient management specialists, and cooperatives' representatives in the areas targeted for project implementation.
Project Video Posted for Online Internet Viewing	RTI produced a 10-minute video highlighting the project and its performance. The video included testimonials about the services provided by the CLEAN <sub>EAST</sub> Project by two farm participants at their farm locations. The online video link can be found on YouTube at <a href="http://youtu.be/tQyZFNhh_Gg">http://youtu.be/tQyZFNhh_Gg</a> . Notice of the video's release was via emails to the website listserv and through posting on RTI's website and RTI's YouTube address, among other methods.

**Table 3-2. Public Presentations, Conferences, and Meetings Attended  
for CLEAN<sub>EAST</sub> Project Outreach Activities**

<b>Conference/ Meeting</b>	<b>Location</b>	<b>Date</b>
National Extension Water Quality Conference	Reno, Nevada	February 2008
American Society of Agricultural and Biological Engineers (ASABE) Annual Meeting	Providence, Rhode Island	June 2008
American Dairy Science Association –American Society of Animal Science	Indianapolis, Indiana	July 2008
International Poultry Expo	Atlanta, Georgia	January 2009
USDA-National Institute of Food and Agriculture National Water Conference,	St. Louis, Missouri	February 2009
U.S. Poultry and Egg – Environmental Manager Workshop	Nashville, Tennessee	March 2009
EPA AgCenter – Conference call with EPA Regions	Raleigh, North Carolina	March 2009
Chesapeake Bay States Meeting, organized by EPA Region 3 and Chesapeake Bay Program Office	Baltimore, Maryland	April 2009
World Pork Expo	Des Moines, Iowa	June 2009
Cooperative State Research, Education, and Extension Service (CSREES) Small Farms Conference	Springfield, Illinois	September 2009
Midwest Pork Conference	Danville, Indiana	September 2009
World Dairy Expo	Madison, Wisconsin	September 2009
Minnesota Pork Congress	Minneapolis, Minnesota	January 2010
International Poultry Expo	Atlanta, Georgia	January 2010
North Carolina Association of Soil and Water Conservation Districts	Raleigh, North Carolina	January 2010
USDA-CSREES National Water Conference	Hilton Head, South Carolina	February, 2010
American Society of Civil Engineers Watershed Management Conference	Madison, Wisconsin	August 2010
Livestock and Poultry Agriculture Environmental Assessment Field Day	Dayton, Virginia	September 2010
2011 Annual International Meeting of the American Society of Agricultural and Biological Engineers	Louisville, Kentucky	August 2011
Southern Region Water Conference	Athens, Georgia	September 2011
2012 Air & Waste Management Association Conference & Exhibition	San Antonio, Texas	June 2012
2012 American Society of Agricultural and Biological Engineers Annual International Meeting	Dallas, Texas	July 2012



Figure 3-2. CLEAN<sup>EAST</sup> Project web site home page screen shot (<http://livestock.rti.org>).

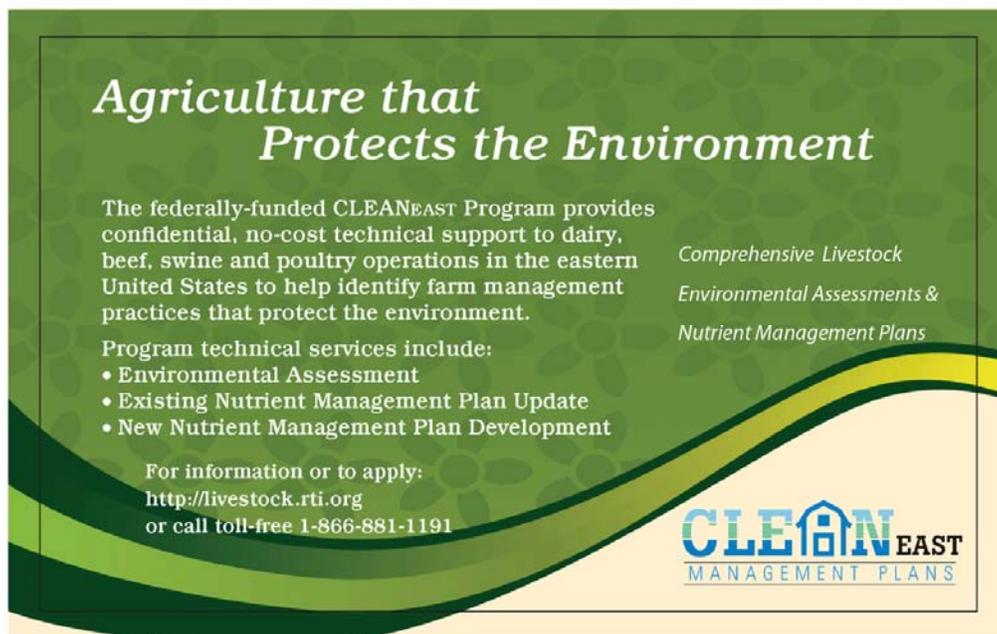


Figure 3-3. CLEAN<sup>EAST</sup> Project publication advertisement.

Comprehensive Livestock Environmental Assessment and Nutrient Management Plans
<http://livestock.rti.org>

The **CLEANeAST Program** provides confidential, no-cost technical support to owners and operators of beef, dairy, swine, and poultry operations located in the Eastern United States to help them identify and implement farm management practices that protect the environment. Owners/operators who apply and are selected by the program receive on-site support services from a qualified Technical Assistance Professional (TAP).

**Program Services**

The technical services offered by the **CLEANeAST Program** are:

- **Environmental Assessment (EA).** The TAP conducts a confidential on-site environmental review of the owner/operator's livestock or poultry operation and prepares recommendations that can be implemented to address any identified environmental issues.
- **Existing Nutrient Management Plan (NMP) Review and Update.** The TAP reviews the owner/operator's existing NMP, then identifies and prepares necessary NMP documentation to update the plan for the current livestock or poultry operation.
- **New NMP Development.** The TAP collects the needed information and performs the required analyses to prepare an NMP for implementation at the owner/operator's livestock or poultry operation.

**Program Administration**

The **CLEANeAST Program** is developed and administered jointly by **RTI International (RTI)** and **North Carolina State University (NCSU)**. Funding support for the program is provided under a cooperative agreement with the U.S. Environmental Protection Agency. TAPs are independent subcontractors to RTI with certifications and expertise specific to the states where they are assigned to work for the **CLEANeAST Program**.



**Benefits to Program Participants**

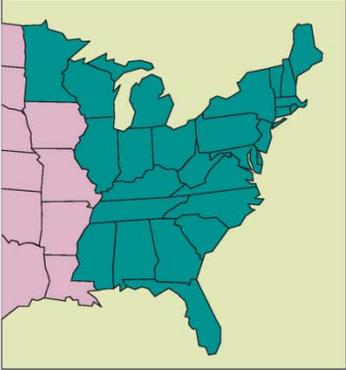
- Provide owner/operator with an objective, confidential review of site operations, identify any environmental issues and suggest potential remedies.
- Determine if a livestock or poultry operation is in an impaired watershed and whether manure management practices can be implemented to contribute to improving water quality.
- Help owner/operator formulate long-term nutrient management strategies.
- Improve manure management efficiency.

**Costs to Program Participants**

The services of the TAP are provided at no cost to the owner/operator. The owner/operator fills out an operation profile for the TAP and meets with the TAP at the owner/operator's site.

**Participant Eligibility**

Owners/operators of livestock and poultry operations located in any of the 27 eastern states shown in the map below are eligible to apply for technical services from the **CLEANeAST Program**.



**How the Program Works**

1. Owner/operator applies for program services and is selected.
2. Qualified TAP is assigned to complete requested service for livestock or poultry operation.
3. TAP contacts owner/operator and schedules date for on-site visit.
4. TAP conducts site visit to meet with owner/operator to collect information about the site, livestock, poultry and crop operations.
5. TAP uses collected information to perform site-specific calculations and prepare documentation for requested service.
6. Owner/operator receives final EA report, NMP amendment, or new NMP as appropriate for the requested service.

Figure 3-4. CLEANeAST Project brochure (excerpt).

## 3.2 Task 2—TAP Management and Farm Visits

Concurrent with the initiation of the outreach and communication activities discussed in **Section 3.1**, RTI began administering a series of competitive bid processes (see **Section 3.2.1**) to select an agricultural engineering subcontractor and TAP subcontractors. Each TAP providing technical assistance services for the CLEANeAST Project was required to attend one of the TAP training sessions (see **Section 3.2.2**) that RTI had developed for its subcontractors.

Farm operators interested in volunteering and receiving CLEANeAST services were required to complete and submit a standard CLEANeAST Participation Form. A copy of the Participation Form is provided in **Appendix E. Section 3.2.3** describes how (1) farm participants were selected from the applicant pool, and (2) TAPs were assigned to perform the technical services requested by the farm participant. Once the TAP was assigned, the TAP and the farm participant worked together over time to schedule a farm visit, share pre-visit information, perform the farm visit, collect additional information to complete the requested service, and prepare the report applicable to the requested service (i.e., EA Report, NMP update, new NMP). These activities are described in **Section 3.2.3.2**. Long-term tracking of a subset of farm participants is presented in **Section 3.2.4**.

### 3.2.1 Subcontractor Competitive Bid Procurement

To support the activities required to implement the CLEAN<sub>EAST</sub> Project, subcontractors to RTI were hired using a competitive bid procurement process after the cooperative agreement was awarded. A series of three procurements were conducted to secure the required subcontractor support. These subcontractors worked under the supervision of the RTI project manager according to the terms of contractual agreements between RTI and the subcontracted companies. **Table 3-3** lists key activity dates for the subcontractor bid process.

**Table 3-3. CLEAN<sub>EAST</sub> Project Subcontractor Competitive Bid Activity Dates**

Compleitive Bid Procurement Activity	Subcontractor Procurement		
	Agricultural Engineering Subcontractor	TAPs for Northeast and Mid-Atlantic States	TAPs for Southeast and Midwest States
Introductory letter to potential TAPs	Not applicable	May 1, 2008	September 30, 2008
Due date for reply forms	Not applicable	May 15, 2008	October 15, 2008
Release of RFP to potential list of bidders	December 3, 2007	June 27, 2008	October 28, 2008
Due date for proposals	December 18, 2007	July 21, 2008	December 4, 2008
Proposal review questions sent	Not applicable	August 12, 2008	December 29, 2008
Notification of award	January 2008	September 2008	January 2009

#### 3.2.1.1 Agricultural Engineering Subcontract Procurement

An initial procurement was conducted to hire an agricultural engineering subcontractor to support RTI's development of the CLEAN<sub>EAST</sub> Project Outreach Plan, certain field service tools, and TAP training. The scope of work for the agricultural engineering subcontractor also included a limited number of confidential follow-up visits to farms participating in the CLEAN<sub>EAST</sub> Project. These visits were intended for providing additional services (such as providing an engineering consultation that could include identifying treatment options and estimating costs, or conducting more detailed EA or NMP-related services, but excluding EA or NMP implementation).

To begin the agricultural engineering subcontractor procurement process, RTI searched the American Society of Agricultural and Biological Engineers' (ASABE's) *Guide to Consultants* and the USDA's NRCS TSP Registry (TechReg) database (<http://techreg.usda.gov/>) to identify prospective qualified engineers and engineering firms by. Firms were selected for the Request for Proposals (RFP) distribution list based on the capabilities listed in these publications and the firms' geographic service area. RTI issued an RFP to 10 agricultural engineering firms on December 3, 2007, and 2 of the firms submitted proposals to RTI in response to the RFP. The proposals were evaluated and scored by a panel of RTI staff based on a set of technical criteria and best overall value. The winning bidder with the best score and overall value rating for the agricultural engineering subcontract award was Agri-Waste Technology, Inc. (AWT), located in Raleigh, North Carolina. RTI issued an award letter in January 2008 and executed a subcontract with AWT.

### 3.2.1.2 Technical Assistance Professionals (TAP) Subcontract Procurements

RTI conducted two additional competitive bid procurements to hire the TAPs to provide the field services requested by the farm participants. Once the farm participants received their CLEAN<sub>EAST</sub> reports and recommendations for improvements, a select subset of farms could receive project performance visits to determine if and how the farm participants implemented the recommendations made by the TAPs in the EA Reports and NMPs prepared for the farms. To identify potentially qualified TAPs to provide the field service subcontractor support, RTI began by reviewing the USDA NRCS TSP TechReg database (<http://techreg.usda.gov/>). The NRCS TechReg database lists, by state, TSPs who have completed NRCS certification training and are eligible to conduct work for the NRCS. RTI created an initial list of prospective TAPs by state from relevant categories of certifications in the database, including *Nutrient Management – Organic and Inorganic – Total Plan*; *Manure and Wastewater Handling and Storage*; and *Nutrient Management – Organic and Inorganic*. In addition, a number of prospective TAPs contacted CLEAN<sub>EAST</sub> Project staff, and, if they requested, these individuals were added to the prospective bidders list. RTI also obtained a list of state Nutrient Management Specialists and requested that these individuals forward project information and opportunities to bid to certified nutrient management planners in their respective states.

RTI sent a letter by electronic mail to the initial list of prospective TAPs introducing the CLEAN<sub>EAST</sub> Project and providing the project scope and general criteria and conditions that bidders should be willing to meet. A reply form was included as part of the letter, and those prospective TAPs interested in the project who would consider bidding were asked to complete the form and return it to RTI. Based on a company’s or individual’s expression of interest in being a TAP subcontractor, RTI created a revised list of prospective TAPs to receive the RFP.

The 27 states served by the CLEAN<sub>EAST</sub> Project were divided into two groups for the purpose of awarding the TAP subcontracts: Group 1 consisted of the 13 northeastern (EPA Regions 1 and 2) and mid-Atlantic (EPA Region 3) states, and Group 2 consisted of the 14 southeastern (EPA Region 4) and midwestern (EPA Region 5) states. The states in each group and region of the country are shown in **Table 3-4**. The competitive bid process to select TAP subcontractors for the Group 1 states was held first to allow for the selection of TAPs to participate in the pilot project phase of the CLEAN<sub>EAST</sub> Project, which was planned for a region in the Northeast.

**Table 3-4. CLEAN<sub>EAST</sub> Project List of States by Region**

Group: Region	States
Group 1: Northeast	Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New York, New Jersey
Group 1: Mid-Atlantic	Pennsylvania, Maryland, Delaware, West Virginia, Virginia
Group 2: Midwest	Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio
Group 2: Southeast	Kentucky, Tennessee, Mississippi, Alabama, Georgia, Florida, South Carolina, and North Carolina

RTI issued the RFP to the list of prospective bidders by electronic mail for the Group 1 states on June 27, 2008. As part of the RFP, bidders were asked to provide cost estimates for various farm sizes,

animal categories, and the type of service and work product (i.e., to essentially create a fee schedule). In preparation for review of the cost proposals submitted by bidders, RTI reviewed the NRCS TSP TechReg website for typical payment rates for technical services by practice and geographic area to provide a general frame of reference for costs. A total of seven proposals were received for the Northeast and mid-Atlantic regions in response to the RFP. RTI evaluated the proposals based on technical criteria and best overall value and selected those bidders with the best scores and overall value. The winning bidders for the Group 1 states were notified in August 2008. The same process was repeated for the Group 2 states, beginning with the sending of the RFP to the applicable list of identified prospective bidders by electronic mail on October 28, 2008. A total of 18 proposals were received for the Southeast and Midwest regions. The winning bidders for the Group 2 states were notified in January 2009. **Table 3-5** lists the selected TAP subcontractors providing service for the CLEAN<sub>EAST</sub> Project; these subcontractors were identified on the CLEAN<sub>EAST</sub> website at the time of contract award.

**Table 3-5. CLEAN<sub>EAST</sub> Project Technical Assistance Professional Subcontract Awards (TAPs)**

Company	Contracted to Serve Northeast	Contracted to Serve Mid-Atlantic	Contracted to Serve Midwest	Contracted to Serve Southeast
AET Consulting	No	Yes	No	No
Ag Environmental Systems, LLC	No	No	Yes	No
Agricultural Consulting Services, Inc.	Yes	Yes	Yes	Yes
Agri-Waste Technology, Inc. <sup>a</sup>	No	No	Yes	Yes
ManPlan Inc.	No	No	Yes	Yes
TeamAg	No	Yes	No	No
Validus Services, LLC	No	No	Yes	Yes
Woodruff & Howe Environmental Engineering, Inc.	No	No	No	Yes

<sup>a</sup> Agri-Waste Technology was also awarded a subcontract for agricultural engineering consulting services (see **Section 3.2.1.1**).

### 3.2.2 TAP Training

To ensure technical consistency and quality across the CLEAN<sub>EAST</sub> Project, RTI developed a training program for the TAPs that reviewed the project’s tools and templates, emphasized customer service for the farm participants, and described the administrative procedures/steps to be used. Before assigning a farm, each individual TAP within a subcontracted firm was required to complete the training session (at the subcontractor’s own expense).

The TAP training included a module on each step for completing the EA and NMP services offered to farms, such as training on how to use the Farm Operation Introductory Profile; tools to be used on-site during the farm visit (On-Site Farm Operation Environmental Assessment Tool, Farm Operation Profile Supplement [NMP Supplement]); and an explanation of the project steps, from first contact with the farm applicant through preparation and delivery of draft and final work products for the farm participant. Biosecurity, confidentiality, and administrative procedures were also reviewed as part of the training. In addition, RTI developed a TAP training manual to cover all project aspects. **Appendix L**

presents the agenda developed for the TAP training session and a copy of the Table of Contents for the training manual.

Training sessions are shown in **Figure 3-5**. A total of six training sessions were conducted over the project period (see **Table 3-6**). All CLEAN<sub>EAST</sub><sup>™</sup> TAPs, a total of 57, completed the training to qualify for farm assignments. An initial training session was conducted in September 2008 before selecting TAPs for farms to be included in the pilot project phase of the CLEAN<sub>EAST</sub> Project. Following the pilot project phase, RTI revised the training program and the individual tools to address any issues that may have surfaced during field use. The training materials were updated, as appropriate, for the subsequent training sessions to address TAP experiences as they began to perform services at individual farms and to answer questions raised by TAPs during earlier sessions. TAPs previously trained were provided updated training materials as needed.

**Table 3-6. Training Project Sessions for the CLEAN<sub>EAST</sub> Project**

Session Date	Training Format	Location	TAP Attendance
September 2008	In-person presentations and farm visit	Albany, NY	7
February 2009	In-person presentations and farm visit	Raleigh, NC	22
February 2009	In-person presentations and farm visit	Indianapolis, IN	17
June 2009	Webinar conference call	Not applicable	6
April 2010	Webinar conference call	Not applicable	2
March 2011	Webinar conference call	Not applicable	2
<b>Total TAPs Trained</b>			<b>57</b>



**Figure 3-5. RTI, NCSU, and AWT conducted TAP training on farm visit procedures and the use of CLEAN<sub>EAST</sub> tools.**

In addition to the three face-to-face TAP training sessions conducted at the onset of subcontracts, additional training occurred if TAP subcontractors had staffing changes. To train those staff (typically 1 to 3 provisional TAPs) in a cost-effective manner, the training was administered via Webinar and conference call format with a homework assignment to review a virtual farm visit and develop an EA Report. The TAPs completing Webinar training were required to perform their first few site visits with an

experienced TAP at their firm who had attended previous CLEAN<sub>EAST</sub> Project training, and this project-experienced TAP provided oversight of the work products completed by the newly trained TAP.

### 3.2.3 Farm Participation

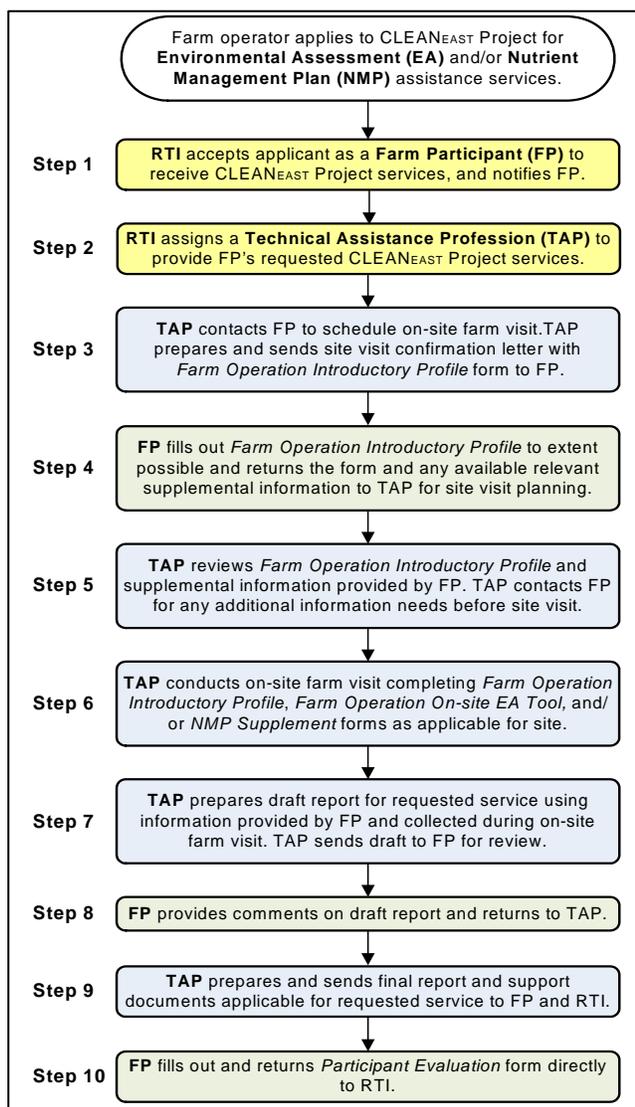
This section discusses the 10 steps of farm participation in the CLEAN<sub>EAST</sub> Project introduced in **Section 2**. The discussion moves from submittal of application through completion of services and highlights the procedures and tools used in those 10 steps.

#### 3.2.3.1 Farm Participant Selection and TAP Assignment

Farm operators interested in volunteering to receive CLEAN<sub>EAST</sub> services were required to apply by completing and submitting a standardized Participation Form to RTI. Once RTI received the Participation Form and confirmed it was complete and the operator was deemed qualified for receiving services, the following implementation Steps 1 and 2, as identified in Figure 2-2 (shown right), were conducted to select the farm applicant to receive CLEAN<sub>EAST</sub> services and to assign a TAP to perform the requested CLEAN<sub>EAST</sub> services.

**Step 1 – Acceptance of farm applicant to receive CLEAN<sub>EAST</sub> Project services.** Each farm operator applying to the CLEAN<sub>EAST</sub> Project was assigned a randomly generated identification number to protect the confidentiality of the farm. All farm operator applicants for the CLEAN<sub>EAST</sub> Project were added to the confidential Farm Applicant and TAP Tracking Database, where their applications were stored and managed as confidential farm information, as described in **Section 2.5**.

**Step 2 – Assignment of TAP to perform farm participant requested services.** Upon acceptance of a farm participant to receive CLEAN<sub>EAST</sub> services, the farm was assigned to a model operation category for the purpose of determining the TAP cost-rate schedule for performing technical services based on the farm’s livestock type, number of animals, and number of acres land-applied on the farm. During initial telephone discussions with a farm participant to review their information, the RTI TAP Coordinator discussed the



list of TAPs identified as qualified to perform the participant's requested services in the farm's state, and asked if the participant had any preference for a TAP. Where possible, in cases where the farm participant stated a preference for a particular TAP on the list of available TAPs, RTI attempted to honor preferences of the farm participants. The RTI TAP Coordinator assigned the farm to one of the TAP subcontractors, considering the TAP's previous experience with the animal category, the state or location of the farm, the service to be provided to the farm, and any preferences stated by the farm participant. If more than one TAP subcontractor met the criteria for a particular farm, then the RTI TAP Coordinator selected the TAP subcontractor with the best value to the project. Considering these assignment criteria, the RTI TAP Coordinator also attempted to provide equitable distribution of farms across TAP subcontractors.

The TAP assignment was finalized after confirming availability, drafting a Technical Directive to the TAP's subcontract administrator for the specific farm, and providing the farm's information (i.e., Participation Form) to the TAP. The TAP would accept the farm assignment by returning the signed Technical Directive to RTI. To protect the confidentiality of the farm, the specific farm information was transmitted to the selected TAP in accordance with the security procedures outlines in RTI's *CLEAN<sub>EA</sub>ST Project Information Security Plan* (see **Section 2.5**); farm-specific information was sent by registered U.S. mail using return receipt or by an overnight courier. Upon receipt of the signed Technical Directive from the TAP, RTI contacted the farm participant to convey the name of the TAP who would be working with the farm.

Once the farm participant was notified of the TAP assignment, the assigned TAP and the farm participant communicated directly on information collection and scheduling. The RTI TAP Coordinator monitored the progress of each TAP completing the services for the assigned farm by reviewing periodic TAP subcontractor status reports on each farm assigned to them, as well as conducting telephone calls with the TAP subcontractor administrator and, in certain circumstances, the TAP directly.

### *3.2.3.2 Farm Site Visits and Report Preparation*

As part of the TAP training, each of the registered TAPs was trained in the specific CLEAN<sub>EA</sub>ST Project procedures/steps for providing services to farms, so that all project services were provided uniformly. The assigned TAP and the farm participant worked together to set up the site visit, share pre-visit information, perform the site visit, collect additional data or information to complete the work, and draft and review the final work product (i.e., EA Report, updated NMP, or new NMP). The following bullets present the project Steps 3 through 10, as identified in Figure 2-2 (see **Section 2**). These steps were performed by the assigned TAP and farm participant to complete the requested CLEAN<sub>EA</sub>ST services.

**Step 3 – TAP contacts farm participant to schedule on-farm visit.** The assigned TAP contacted the farm participant and to discuss the next steps. The TAP and the farm participant agreed on a date for the on-farm visit. The TAP sent an RTI-standardized confirmation letter to the farm participant, welcoming them to the CLEAN<sub>EA</sub>ST Project. The confirmation letter referenced the agreed upon date for the on-farm visit and included a copy of the Farm Operation Introductory Profile form.

**Step 4 – Farm participant completes the Farm Operation Introductory Profile form.** The participant completed the form before the farm visit to the fullest extent possible and provided

additional information needed to complete the service (e.g., maps, manure sample results, soil sample results, copy of the most recent NMP [where applicable], biosecurity measures in place at the farm).

**Step 5 – TAP reviews information provided by farm participant.** The TAP reviewed the completed Farm Operation Introductory Profile form and supplemental information provided by the farm participant to become familiar with the farm operation and to identify the additional information needs required to complete the requested service.

**Step 6 – TAP conducts the on-farm visit.** The TAP conducted the on-farm visit on the agreed upon date, walking through the farm with the operator to discuss each component of the operation, and completing the On-Site Farm Operation Environmental Assessments Tool and Farm Operation Profile Supplement (NMP Supplement) on site, as needed. At the end of the on-farm visit, the TAP conducted an exit interview with the farmer to discuss the preliminary findings and initial observations during the site visit, to explain the next steps, and to answer any of the farm participant’s questions.

**Step 7 – TAP prepares draft report for requested service and delivers report to farm participant.** Following the on-farm visit, the TAP drafted the work products (e.g., EA Report or NMP and associated report) for the farm participant to review. As part of management oversight, RTI reviewed at least one EA and one NMP work product for each TAP subcontractor to ensure adherence to project policies and procedures, and returned comments to the TAP subcontractor, so that TAP staff could amend their procedures and report production methods appropriately per RTI’s comments. TAP subcontractor management was responsible for reviewing remaining reports for technical quality and adherence to project guidance and templates.

**Step 8 – Farm participant reviews draft report.** The farm participant reviewed the draft report and shared his or her comments with the TAP regarding any corrections to information presented that may need to be made.

**Step 9 – TAP prepares and delivers final report to farm participant.** The TAP revised the report as needed, addressing the farm participant comments, and sent the final report to the farm participant. A copy of the final report also was sent to RTI to document completion of the work by the TAP in accordance with the Technical Directive. When RTI received the final report, project staff entered selected farm information and data from the tools and respective reports into the confidential Farm Participant database (see **Section 2.5** for discussion of the database).

**Step 10 – Farm participant completes Participant Evaluation Survey.** The TAPs were trained to request each farm participant to complete and return a Participant Evaluation Survey directly to RTI after the final work products for their requested service were completed and delivered to them. The survey allowed each farm participant to provide feedback to RTI regarding the CLEAN<sub>EAST</sub> Project, their experiences working with the assigned TAP, and the level of satisfaction with the final work products received. Approximately 37% of farm participants completed and returned the Participant Evaluation Survey (see **Appendix M**) directly to RTI.

At the conclusion of each on-farm visit, the TAP discussed follow-up activities with the farm participant. The farm participants were informed that they could submit a request for an additional site visit for consulting services to be provided by the CLEAN<sub>EAST</sub> Project. These services offered (1) an

engineering consultation that could include identifying treatment options and estimating costs, or (2) more detailed EA or NMP-related services, but excluding EA or NMP implementation.

### 3.2.4 Long-Term Tracking of Farm Participants

RTI conducted long-term tracking of the farm participants to assess the degree to which TAP recommendations and BMPs were implemented. This tracking was conducted by using two methods: (1) project performance site visits (i.e., follow-up visits) to a selection of participating farms, and (2) telephone contacts with additional farm participants. In the Participant Evaluation Survey, farm participants were asked whether they were willing to participate in long-term tracking for the CLEAN<sub>EAST</sub> Project. TAPs were trained to share with the farm participant that the long-term tracking would be conducted after significant time had passed from the receipt of their final work products, typically 12 months. In Year 5 of the CLEAN<sub>EAST</sub> Project, these follow up contacts were made with a number of those farms that had previously agreed to tracking. The following subsections describe how the two tracking methods were performed. The results of the project performance site visits are discussed in **Section 4**.

#### 3.2.4.1 Follow-up Site Visits

The Project Team conducted project performance site visits for approximately 13% of the total farms served by the CLEAN<sub>EAST</sub> Project to determine if and how the farm participants implemented the recommendations made by the TAPs in their CLEAN<sub>EAST</sub> EA Reports and NMPs. A *Project Performance Site Visit Guide* was developed to provide guidance to the TAPs conducting those site visits (see **Appendix N**).

Beginning with the list of farm participants that agreed in their Participant Evaluation Survey responses to be contacted for future project tracking, the CLEAN<sub>EAST</sub> Project Team selected a diverse sample of candidate farms to be contacted, considering farm size, animal categories, and geographic location. An initial call was made to selected candidate farm participants to gauge their interest in having a project performance site visit. Each farm participant who agreed to have a project performance site visit was then contacted by the same TAP who provided the original CLEAN<sub>EAST</sub> Project services to schedule the follow-up visit. Before the follow-up site visit, the TAP used the *Project Performance Site Visit Guide* to gather necessary information on TAP recommendations made to the selected farm.

Upon completion of the project performance site visit, the TAP prepared a *Project Performance Site Visit Report*. The contents of the report included a brief summary of the farm operation and identified which of the TAP's recommendations were being implemented. If a recommendation was not implemented, the TAP noted the reasons why implementation was not occurring. The report also included additional information collected by the TAP regarding the farm participant's overall satisfaction with the CLEAN<sub>EAST</sub> Project. The results presented in the reports were entered in the confidential Farm Participant database for analysis.

#### 3.2.4.2 Project Follow-up Telephone Contacts

Based on the list of farm participants that agreed in their Participant Evaluation Survey response to be contacted for future project tracking and those farms that were not selected for project performance site visits, CLEAN<sub>EAST</sub> Project staff contacted an additional set of farms by telephone. The purpose of the telephone contact was to determine if and how the farm participants were implementing the recommendations made by the TAPs. A Project Performance Call Worksheet was developed to gather information from these telephone calls (**Appendix O**). The worksheet was auto-generated from the project database and contained a list of all TAP recommendations and several additional questions for farm participants. In an effort to be respectful of the farm participant's time, telephone calls were limited to 10 minutes when possible. The results from the project performance telephone calls were entered in the confidential Farm Participant Database for analysis.

### 3.3 Task 3—Tool Development and Data Analysis

A variety of specialized tools were developed by the CLEAN<sub>EAST</sub> Project Team for the purpose of performing the EA and NMP technical services. Applying these tools at 429 farm locations resulted in the collection of large amounts of farm-specific data for analysis. **Section 3.3.1** describes the tools developed for EA and NMP services and the data analysis procedures used for the TAPs to prepare EA Reports and NMPs for farm participants. Analysis procedures for the data collected by the project are described in **Section 3.3.2**. Procedures used by RTI to measure the project performance and assess environment benefits resulting from CLEAN<sub>EAST</sub> services are described in **Sections 3.3.3 and 3.3.4**, respectively.

#### 3.3.1 CLEAN<sub>EAST</sub> Project Farm Service Tools

To ensure that consistent protocols were used by all of the TAPs performing services for the CLEAN<sub>EAST</sub> Project, a set of tools was developed and distributed for the TAPs' use when conducting a EA or preparing an NMP for each CLEAN<sub>EAST</sub> Project farm participant. **Table 3-7** presents a summary of the tools developed by the CLEAN<sub>EAST</sub> Project, with complete copies of the tools available in the appendices to this report. All information collected using these tools for preparation of an individual EA Report or NMP was handled, transmitted, and stored by RTI and its subcontractors according to the security procedures described in **Section 2.5** to maintain the confidentiality of site-specific information provided by the farm participant. The application of the tools is summarized below.

**EA Assistance.** The EA assistance provided by the CLEAN<sub>EAST</sub> Project consisted of an on-site environmental review by the TAP of the farm participant's livestock or poultry operations and preparation of recommendations that could be implemented by the farm participant to address any identified environmental issues. The tools listed in Table 3-7 that were used to prepare an EA were (1) the Farm Operation Introductory Profile tool, completed by the farm participant (with support from the TAP if needed) to collect background information about the farm for the TAP before the scheduled visit; and (2) the On-Site Environmental Assessment tool, completed by the TAP during the on-farm visit to identify and evaluate any potential environmental issues observed by the TAP. In addition to these tools, a

standardized EA Report template was provided to all TAPs so that all EA Reports prepared for the CLEAN<sub>EAST</sub> Project and delivered to the farm participant used a consistent format.

**Table 3-7. Tools Developed for Performing CLEAN<sub>EAST</sub> Project Farm Services**

Tool	Description
Farm Operation Introductory Profile Tool	A questionnaire completed for all farm participants, regardless of the type of CLEAN <sub>EAST</sub> Project service requested, to provide background information about the farm, such as the number and categories of animals and the farm's land application practices. Farm participants were instructed to review the profile questions prior to the TAP's site visit to give them a better understanding of the type of information that would be needed by the TAP during the visit, and to answer as many of the question as possible and send it back to the TAP before the visit. During the site visit, the TAP checked the information provided by the farm participant and filled in any applicable missing information (see <b>Appendix F</b> ).
Farm Operation On-Site Environmental Assessment Tool	A series of worksheets designed for the TAP to use when conducting on-farm visits to collect information needed to evaluate any potential environmental issues. Separate worksheets address the following topics (see <b>Appendix G</b> ): <ul style="list-style-type: none"> <li>▪ General facility information</li> <li>▪ Overall farm appearance</li> <li>▪ Animal categories and numbers</li> <li>▪ Confinement buildings</li> <li>▪ Sheds, lots, and pastures</li> <li>▪ Manure storage and treatment methods</li> <li>▪ Conservation practices</li> <li>▪ Land management and tillage practices</li> <li>▪ Mortality management</li> <li>▪ Water quality and quantity management</li> <li>▪ Chemical storage and handling</li> <li>▪ Facility emergency management plans</li> <li>▪ Records and sampling.</li> </ul>
Farm Operation Profile Supplement (NMP Supplement) Tool	A supplemental questionnaire to the Farm Operation Introductory Profile used by TAPs for conducting on-site interviews with farm participants requesting NMP assistance. The tool was used to collect additional information about the farm to support preparation of an NMP or NMP update (see <b>Appendix I</b> ).
Nutrient Management Plan (NMP) Protocol For Technical Assistance Professionals	A guideline document describing the technical approach used by TAP for preparing a new NMP and updating an existing NMP. The NMP Protocol uses existing software tools supplemented with Farm Operation Introductory Profile tool and Farm Operation Profile Supplement (NMP Supplement). Three types of tools are used for preparing the NMP: (1) nutrient management planning software; (2) state-specific phosphorus index software; and (3) soil erosion estimation software. The same overall protocol described is used by all TAPs for NMPs. Appropriate adjustments to the NMP Protocol can be made on a site-specific basis based on the TAP's professional judgment as needed to meet the requirements of the type of NMP requested by the farm participant and to meet locality-specific conditions (see <b>Appendix J</b> ).

**NMP Assistance.** The NMP assistance provided by the CLEAN<sub>EAST</sub> Project consisted of providing the farm participant with a new NMP or a review and update to an existing NMP for managing

manure and organic by-products, in combination with conservation and facility management practices to protect and improve water and air quality. The tools listed in Table 3-7 used to prepare an NMP were: (1) the same Farm Operation Introductory Profile used for EAs, in combination with a second Farm Operation Profile Supplement (NMP Supplement) Tool to collect the information needed by the TAP to prepare a new or updated NMP for a given farm; and (2) the *Nutrient Management Plan (NMP) Protocol For Technical Assistance Professionals*, which describes the procedure that the TAP follows to prepare the NMP. In accordance with this protocol, the Manure Management Planner (MMP) software tool developed at Purdue University (Purdue University, 2010), in cooperation with USDA NRCS, was used unless other state-specific nutrient management planning software was required for the farm location, as identified in the protocol. Nutrient planning calculations were based on soil and manure analyses results provided by the farm participants. In accordance with the cooperative agreement scope of work, the TAP did not conduct any sampling and analyses required for preparation of the NMP. A standardized NMP report template was provided to all TAPs, which the TAP could modify, as appropriate, to meet any state-specific requirements for the farm location.

It is noteworthy that RTI posted the Farm Operation Introductory Profile, the Farm Operation On-Site Environmental Assessment Tool, and the Farm Operation Profile Supplement (NMP Supplement) on the CLEAN<sub>EAST</sub> Project website the first year the tools were put into use. Placing these tools in the public domain early in the project provided the option for farm operators and TSPs not participating in the CLEAN<sub>EAST</sub> Project to download and use the tools independently.

### 3.3.2 Farm Information Analysis Procedures

The Farm Operation Introductory Profile and Farm Operation On-Site Environmental Assessment tools prepared for individual farm locations served by the CLEAN<sub>EAST</sub> Project contain extensive data requests about the farm operations. On-farm data available from these tools included livestock and/or poultry population data, details regarding manure collection and storage methods used by farm participants, type(s) of animal housing and pasture systems, mortality management practices, and records of animal contact with surface water. **Section 2.5** contains the procedures used to aggregate the farm-specific data into a non-confidential format for the purpose of public presentation of data, such as general animal waste management baseline trends and ranking of TAP-recommended BMPs.

Answers to selected questions listed in each tool were input into the database maintained on an RTI-secured computer system by RTI project staff cleared for handling confidential project data. The farm participant confidentiality was maintained by aggregating farm location data into categories that are untraceable to individual farms. A series of queries was made to sort and extract data by specific categories of interest to prepare an overall profile of the farm participants that received CLEAN<sub>EAST</sub> Project services (e.g., geographic regions, animal categories, farm size). Additional queries were made to prepare compilations of the TAP recommendations by the different farm participant profile categories. The results of the farm data analysis are presented in **Section 4** and **Appendix T**.

### 3.3.3 Project Performance Tracking Measurements

The EPA is required by legislative directives of the Government Performance and Results Act (GPRA) to ensure that work the Agency funds through assistance agreements achieves environmental benefits for the U.S. taxpayer. To meet these directives, the EPA tracks the environmental results achieved by projects funded under assistance agreements, using a set of project-specific performance measures. The CLEAN<sub>EAST</sub> Project Team developed and implemented a written *Project Performance and Results Tracking Strategy* (see **Appendix K**) complying with GPRA regulatory and EPA policy requirements. Project tracking of additional performance measures specific to the implementation of CLEAN<sub>EAST</sub> Project also was used during the cooperative agreement performance period to monitor the effectiveness and efficiency of outreach activities and TAP performance. Therefore, the *Program Performance and Results Tracking Strategy* for the CLEAN<sub>EAST</sub> Project identified measurable performance parameters to address two tracking objectives:

- **Outputs and Outcomes Tracking.** Performance measures were established to monitor the project's planned outcomes and outputs. Without compromising the confidentiality of individual farm information, these performance measures work toward quantifying the environmental results from the CLEAN<sub>EAST</sub> Project and assessing how the project contributes to the EPA's environmental goals and strategic plans.
- **Project-Specific Activity Tracking.** Performance measures were established to monitor and evaluate the effectiveness of the ongoing activities conducted during the CLEAN<sub>EAST</sub> Project to create public awareness of the technical services offered, recruit farm participants, and meet participants' needs for the requested EA and NMP technical services.

Outputs and outcomes are distinctly different types of performance parameters, as defined by EPA Order 5700.7. For each of these specified outputs and outcomes, the tracking strategy identifies specific performance measure parameters to determine the level to which each output and outcome is achieved. A key consideration in the development of the outputs and outcomes tracking strategy for the CLEAN<sub>EAST</sub> Project was maintaining the confidentiality of the individual farm-specific information used to perform EAs and prepare NMPs. Confidentiality of non-public information and findings for individual farms is maintained by RTI, and these data cannot be reported nor directly used for project performance or results measurements. However, some of these data can be aggregated in such a manner to define meaningful performance and results measurements for the CLEAN<sub>EAST</sub> Project that neither identify nor trace to individual farm locations. **Tables 3-8 and 3-9** present the performance measures and measurement methods for each of the identified CLEAN<sub>EAST</sub> Project's desired outputs and outcomes, respectively.

The purpose of the project-specific activity tracking was to monitor outreach activities and TAP performance during the cooperative agreement performance period to allow for any activity adjustments needed to improve the success level of the project in achieving the desired project outputs and outcomes. To track the outreach activity's effectiveness and TAP performance for the CLEAN<sub>EAST</sub> Project, performance measures for specific activities were defined. The objectives of the project-specific activity tracking strategy are to measure the following

- Awareness of technical services offered by CLEAN<sub>EAST</sub> Project by potential farm participants.
- Timeliness to provide requested technical services to farm participants.
- Quality of EAs and NMPs prepared for participating farm operators.
- Evaluation of individual TAP performance in delivering CLEAN<sub>EAST</sub> Project technical services.
- Satisfaction of farm participants with technical services received from CLEAN<sub>EAST</sub> Project.

Project-specific activity performance measures have been defined for each of these objectives.

**Table 3-10** presents the performance measures and measurement methods for the project-specific activity performance tracking.

**Table 3-8. CLEAN<sub>EAST</sub> Project: EPA Outputs Tracking Performance Measures**

Desired Output	Performance Measure Parameter	Measurement Method
Recruit farm owners to voluntarily participate in the CLEAN <sub>EAST</sub> Project.	Inquiries about technical services offered by CLEAN <sub>EAST</sub> Project by potential farm participants (see Table 3-10).	Tabulation of inquiry records by method (see Table 3-10).
Recruit farm owners to voluntarily participate in the CLEAN <sub>EAST</sub> Project.	Farm participants receiving CLEAN <sub>EAST</sub> Project technical services.	Total number of farm participants accepted for CLEAN <sub>EAST</sub> Project technical and assigned TAP as of reporting date
Perform EAs and prepare new or update existing NMPs for livestock and poultry operations potentially impacting water bodies in states served by the CLEAN <sub>EAST</sub> Project.	EA tool for application to farms with livestock and poultry operations.	Delivery to EPA of final version of EA tool with availability of the EA tools on CLEAN <sub>EAST</sub> web site for public download.
Perform EAs and prepare new or update existing NMPs for livestock and poultry operations potentially impacting water bodies in states served by the CLEAN <sub>EAST</sub> Project.	NMP tools for application to farms with livestock and poultry operations.	Delivery to EPA of final version of NMP Protocol with availability of the NMP Protocol on CLEAN <sub>EAST</sub> web site for public download.
Perform EAs and prepare new or update existing NMPs for livestock and poultry operations potentially impacting water bodies in states served by the CLEAN <sub>EAST</sub> Project.	EAs performed for CLEAN <sub>EAST</sub> Project farm participants.	Total number of EAs performed for participating farms as of reporting date.
Perform EAs and prepare new or update existing NMPs for livestock and poultry operations potentially impacting water bodies in states served by the CLEAN <sub>EAST</sub> Project.	NMP updates prepared for CLEAN <sub>EAST</sub> Project farm participants.	Total number of NMP updates prepared for participating farms as of reporting date.

(continued)

**Table 3-8. CLEAN<sub>EAST</sub> Project: EPA Outputs Tracking Performance Measures (continued)**

Desired Output	Performance Measure Parameter	Measurement Method
Perform EAs and prepare new or update existing NMPs for livestock and poultry operations potentially impacting water bodies in states served by the CLEAN <sub>EAST</sub> Project.	New NMPs prepared for CLEAN <sub>EAST</sub> Project farm participants.	Total number of new NMPs prepared as of reporting date.
Perform EAs and prepare new or update existing NMPs for livestock and poultry operations potentially impacting water bodies in states served by the CLEAN <sub>EAST</sub> Project.	Geographic distribution of livestock and poultry operations receiving CLEAN <sub>EAST</sub> Project technical services.	Numbers of participating farms in each of the 27 states served by CLEAN <sub>EAST</sub> Project (and possibly by watershed provided that individual farm confidentiality is maintained) as of reporting date.
Compile a database of non-confidential information from farm visits for assessing extent of adverse impacts.	Database of aggregated, non-confidential information collected by CLEAN <sub>EAST</sub> Project related to sources and mitigation of nutrient runoff and NH <sub>3</sub> air emissions from farm participants.	Delivery to EPA of electronic data base file of non-confidential information aggregated from selected data in completed Farm Profiles, EA Reports, NMP Updates, and new NMPs prepared for farms participating in CLEAN <sub>EAST</sub> Project.
Expand availability of trained professionals capable of performing EAs and preparing NMPs for livestock and poultry operations potentially impacting water bodies.	CLEAN <sub>EAST</sub> Project TAP contractors.	Total number of companies and consultants with active RTI subcontracts to provide TAP services as of reporting date.
Expand availability of trained professionals capable of performing EAs and preparing NMPs for livestock and poultry operations potentially impacting water bodies.	CLEAN <sub>EAST</sub> Project training sessions.	Total number of TAP training sessions held by RTI to instruct individual TAPs on use of project-specific EA/NMP tools as of reporting date.
Expand availability of trained professionals capable of performing EAs and preparing NMPs for livestock and poultry operations potentially impacting water bodies.	CLEAN <sub>EAST</sub> Project TAPs trained to use EA and NMP tools.	Total number of individual TAPs attending and completing TAP training sessions.
Expand availability of trained professionals capable of performing EAs and preparing NMPs for livestock and poultry operations potentially impacting water bodies.	Geographic distribution of trained CLEAN <sub>EAST</sub> Project TAPs.	Total number of trained individual TAPs qualified to provide services in each of the 27 states served by CLEAN <sub>EAST</sub> Project as of reporting date.

**Table 3-9. CLEAN<sub>EAST</sub> Project: EPA Outcomes Tracking Performance Measures**

Desired Outcome	Performance Measure Parameter	Measurement Method
Increased number of partially or fully restored nutrient-impaired water bodies.	Watersheds with nutrient-impaired water bodies and farms participating in the CLEAN <sub>EAST</sub> Project.	Total number and listing of watersheds (provided that individual farm confidentiality is maintained) with nutrient-impaired water bodies having one or more farms participating in the CLEAN <sub>EAST</sub> Project as of reporting date.
Mitigation of adverse impacts from livestock and poultry operations on the environment as a result of implementing EAs and NMPs.	Nutrient Environmental Release Potential Indicator Tool (NERPI). A measure of the change in the amount of nitrogen and phosphorus nutrients potentially available for release into the environment following implementation of the BMPs included in the CLEAN <sub>EAST</sub> NMPs and EA Reports.	Gross nutrient balance calculated for each participating farm using NRCS's Animal Waste Management (AWM) software Project. Calculations made for baseline existing farm operations and farm operations, assuming all recommended BMPs are implemented by farm participants. Individual farm results aggregated on a watershed basis for reporting.
Mitigation of adverse impacts from livestock and poultry operations on the environment as a result of implementing EAs and NMPs.	Ammonia (NH <sub>3</sub> ) Air Emissions Mitigation Indicator Tool (AAEMI). A measure of the change in NH <sub>3</sub> air emissions following implementation of the BMPs included in the CLEAN <sub>EAST</sub> NMPs and EA Reports.	NH <sub>3</sub> air emissions calculated for each participating farm using applicable published NH <sub>3</sub> emission factors. Calculations made for baseline existing farm operations and farm operations, assuming all recommended BMPs are implemented by farm participants. Individual farm results aggregated on a watershed basis for reporting.
Mitigation of adverse impacts from livestock and poultry operations on the environment as a result of implementing EAs and NMPs.	Percent distribution of BMPs recommended by TAPs in EAs and NMPs prepared for farms participating in the CLEAN <sub>EAST</sub> Project that the farm participants are planning to or have implemented (as of project end date).	Project performance telephone contacts by RTI project staff to a limited number of farms participants in the CLEAN <sub>EAST</sub> Project.

(continued)

**Table 3-9. CLEAN<sub>EAST</sub> Project: EPA Outcomes Tracking Performance Measures (continued)**

Desired Outcome	Performance Measure Parameter	Measurement Method
Increased knowledge of environmental impacts and methods to mitigate adverse impacts from livestock and poultry operations.	<ul style="list-style-type: none"> <li>■ Percent distribution of farms participating in CLEAN<sub>EAST</sub> Project by animal type, farm size, and geographic location categories.</li> <li>■ Types and percent distribution of animal waste management practices identified at farms participating in the CLEAN<sub>EAST</sub> Project.</li> <li>■ Types and percent distribution of BMPs for livestock and poultry operations currently used at farms participating in the CLEAN<sub>EAST</sub> Project.</li> <li>■ Types and percent distribution of BMPs for livestock and poultry operations recommended for use at farms participating in the CLEAN<sub>EAST</sub> Project.</li> </ul>	Compilation of selected data gathered from completed Farm Profiles, EA Reports, and NMPs prepared for farms participating in CLEAN <sub>EAST</sub> Project in an appropriate format to report the data in aggregated, non-confidential form.

**Table 3-10. CLEAN<sub>EAST</sub> Project-Specific Activity Tracking Performance Measures**

Tracking Objective	Performance Measure Parameter	Measurement Method
Awareness of technical services offered by the CLEAN <sub>EAST</sub> Project by potential farm participants.	Inquires received about CLEAN <sub>EAST</sub> Project by method (e-mail, telephone, in-person conference contact, project brochure, publication ad, trade association, state/local farm agent, TAP).	Tabulation of number of inquiries using appropriate counter method (e.g., website hits, telephone calls received by CLEAN <sub>EAST</sub> Project hotline and directly by RTI/NCSU, e-mails received, requests to receive newsletter) as of reporting date.
Awareness of technical services offered by CLEAN <sub>EAST</sub> Project by potential farm participants.	Information sources by which farm operator applicants learned about CLEAN <sub>EAST</sub> Project by livestock type, farm size, and geographic location categories.	Tabulation of responses provided on farm operator participation forms submitted to RTI for “How did you find out about the Project?” as of reporting date.
Awareness of technical services offered by CLEAN <sub>EAST</sub> Project by potential farm participants.	Applications for CLEAN <sub>EAST</sub> Project technical services by livestock type, farm size, and geographic location categories.	Sum total number of farm operators applying for CLEAN <sub>EAST</sub> Project technical services by category as of reporting date.

(continued)

Table 3-10. CLEAN<sub>EAST</sub> Project-Specific Activity Tracking Performance Measures (continued)

Tracking Objective	Performance Measure Parameter	Measurement Method
Awareness of technical services offered by CLEAN <sub>EAST</sub> Project by potential farm participants.	Technical services requested by farm operator applicants by livestock type, farm size, and geographic location categories.	Sum total number of farm operator applicants requesting EA, NMP update, and new NMP assistance by category as of reporting date.
Timeliness of CLEAN <sub>EAST</sub> Project to provide requested technical services to farm participants.	Initial contact with farm participant response time.	Calculation of the average number of days between date when RTI assigns TAP and date TAP mails initial site visit confirmation letter for all assigned projects as of reporting date.
Timeliness of CLEAN <sub>EAST</sub> Project to provide requested technical services to farm participants.	Delivery time of final documents applicable to requested service to farm participant.	Calculation of the average number of days between date when RTI assigns TAP and date TAP sends final documents for all assigned projects by document type (EA, NMP update, new NMP) as of reporting date.
Quality of EAs and NMPs prepared for farm participants.	Completeness of EA and NMP documents, as applicable, prepared by TAP.	RTI/NCSU project staff comparison of EA and NMP documents with Project guidance and templates.
Quality of EAs and NMPs prepared for farm participants.	Qualitative assessment of practicality of TAP's EA/NMP impact mitigation recommendations for implementation at a given farm considering technical and financial feasibility.	RTI/NCSU project staff review of TAP recommendations.
Evaluation of individual TAP performance in delivering CLEAN <sub>EAST</sub> Project technical services.	Performance of individual TAP to provide requested technical services to farm participant in a timely manner and by providing high-quality deliverables.	Assessment performed by RTI project staff using criteria to be determined.
Satisfaction of farm participants with technical services received from CLEAN <sub>EAST</sub> Project.	Qualitative farm operator assessment of EA and NMP assistance services, as applicable, received from TAP.	Completed Participant Evaluation Survey forms returned to RTI by farm participants.

### 3.3.4 Environmental Performance Assessment Tools

RTI developed the environmental performance assessment tools for the CLEAN<sub>EAST</sub> Project by relying on adapting existing software and using published information to develop the tools. Two tools were developed specifically for the CLEAN<sub>EAST</sub> Project to assess potential water quality and air quality impacts at participating farms where the TAP recommendations were implemented. The first tool, the Nutrient Environmental Release Potential Indicator Tool (NERPI) measures the change in the amount of nitrogen (N) and phosphorus (P) potentially available for release into surface waters following

implementation of TAP recommendations in the farm’s NMP. The NERPI is an adaptation of the existing NRCS Animal Waste Management (AWM) software program. The second tool, the Ammonia Air Emissions Mitigation Indicator Tool, or AAEMI, performs a simplified nitrogen mass balance to calculate ammonia (NH<sub>3</sub>) emissions into the atmosphere separately from each of the three emission source components at a farm: animal confinement areas or housing, manure treatment/storage, and land application.

#### *3.3.4.1 Nutrient Environmental Release Potential Indicator Tool (NERPI)*

The NERPI is a gross measure of the change in N and P potentially available for release into the environment following implementation of the CLEAN<sub>EAST</sub> TAP-recommended BMPs. To determine the change in N and P amounts, a gross nutrient balance is calculated for each participating farm operation using the NRCS AWM software program. The AWM software selected uses procedures and calculations from the USDA-NRCS *Agricultural Waste Management Field Handbook* (Natural Resources Conservation Service [NRCS], 2009) to calculate a gross nutrient balance based on a farm’s animal categories and populations, animal waste management practices, and crops receiving land application of animal manure and wastewater. For each participating farm receiving an NMP, two runs of the AWM program were calculated: (1) baseline conditions (the existing practices at time of the TAP farm visit) and (2) full NMP conditions (i.e., farm operation fully implements CLEAN<sub>EAST</sub> NMP). The difference between the nutrient balance predictions for the two AWM runs represented the change in the amount of N and P potentially available for release into the environment:

$$\text{NERPI Reduction} = [\text{AWM Run}]_{\text{Baseline}} - [\text{AWM Run}]_{\text{NMP Full Implementation}}$$

Based on the NERPI results, a farm was assigned to one of four categories indicative of overall nutrient reductions, as described in **Table 3-11**.

Table 3-11. NERPI Results Categories

NERPI Category	Category Description
<b><i>Excess of Nutrients → Nutrient Deficit</i></b>	This category describes farms where nutrients were originally applied to land in excess prior to TAP recommendations. Implementing the TAP recommendations will use all nutrients available from manure application and allow for additional nutrient application as needed.
<b><i>Excess of Nutrients → Lowered Excess of Nutrients</i></b>	This category describes farms where the nutrients were originally applied to land in excess prior to TAP recommendations. AWM indicates that implementing the TAP recommendations will increase the utilization of nutrients applied, but may not entirely eliminate the potential release of excess nutrients.
<b><i>Deficit of Nutrients → Increased Nutrient Deficit</i></b>	This category describes farms where the nutrient was not applied in excess prior to TAP recommendations, i.e., the operation has the option of supplementing nutrients.
<b><i>Competing Nutrient Outcomes</i></b>	This category describes number of cases where the potential to release one nutrient was reduced while the potential to release the other nutrient was increased

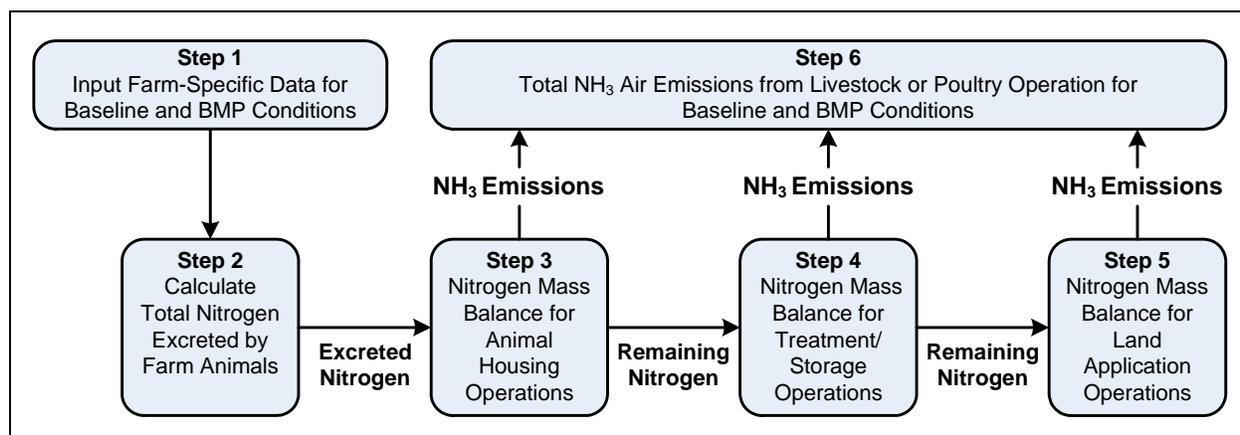
It is important to emphasize that AWM was adapted for use by the CLEAN<sub>EAST</sub> Project. This application of AWM is not its stated purpose; therefore, the results should be treated as general approximations, presuming each farm operation fully implements the TAP recommendations (i.e., the NMP). Further, AWM modeling may not show a nutrient benefit for certain operational circumstances, such as when the NMP recommends spreading to fewer acres; the NMP is written to respond to the farm operator's request for an increase in animal population; or the farm operator's current documented practices are identical to the NMP recommendations. Approximately 66% (259) of the 393 farm participants receiving NMPs experienced one of these three scenarios and, therefore, required qualitative reviews beyond the NERPI computed results. (For the qualitative analysis, EA Reports and NMP documents were reviewed to catalogue the TAP-recommended water quality related BMPs for each farm operation.)

### 3.3.4.2 Ammonia Air Emissions Mitigation Indicator Tool (AAEMI)

Ammonia air emissions from livestock and poultry operations are receiving increasing attention from the EPA and USDA because of the contribution of the potential impacts of these emissions to the environment, including deposition and the formation of PM<sub>2.5</sub>. The AAEMI is a custom Excel spreadsheet program that performs a nitrogen mass balance to calculate NH<sub>3</sub> emissions separately from each of the three emission source components at a farm: animal confinement areas or housing; manure treatment/storage; and land application. Separate worksheets were developed for the dairy, beef, swine, and poultry sectors to reflect the different species and types of farm operations used in the sectors. The NH<sub>3</sub> emissions from the three emission source components are totaled to obtain the total NH<sub>3</sub> emissions from the livestock or poultry operation. For a given farm, two complete sets of NH<sub>3</sub> emissions calculations are made by the tool: one set for the baseline conditions (i.e., existing practices at the farm at

the time of the TAP visit), and a second set for the operations assuming that all of the TAP-recommended BMPs are implemented. The difference between the two calculation sets' results represents the change in  $\text{NH}_3$  air emissions from the farm following implementation of the BMPs.

A simplified flow diagram of the emissions estimation method used for the AAEMI is presented in **Figure 3-6**. First, the tool user inputs farm-specific information about the animal population, animal housing type, manure treatment and storage practices used at the farm, and field crop acreage to which collected manure is applied (organized by application method). For certain nitrogen balance–required parameters (e.g., average animal weight, animal excretion rate, percentage of nitrogen in solids removed in a solids separator), the user can choose to use either default values provided in the tool or to input farm-specific values, if available.



**Figure 3-6. Flow diagram for AAEMI  $\text{NH}_3$  emissions estimation method.**

The second step is to calculate the amount of N excreted by the animals based on the animal population, animal weight, and a N excretion rate (lb N/1000 lb animal mass/day). Using the calculated amount of N excreted by the animals as the input value, the third step is to calculate the amounts of N in the liquid and solid wastes removed from the animal housing (as applicable to the type of housing used at the farm for the animals) and N emitted to the air as  $\text{NH}_3$ . Air emissions from the emission source component are calculated by applying the applicable emission factor selected from a standard set of emission factors in a look-up table included in the tool spreadsheet. The remaining N quantities in the collected liquid and solid wastes are used to calculate the N emitted to the air as  $\text{NH}_3$  during the applicable treatment and storage practices used at the farm. The residual N content of manure solids and liquids applied to land is used to calculate  $\text{NH}_3$  air emissions during land application based on the application method and the crop acreage of the parcel to which the manure is applied.

For the final step, the individually estimated  $\text{NH}_3$  emissions from animal housing, manure storage/treatment, and land application are totaled to obtain the total  $\text{NH}_3$  emissions from the livestock or poultry operations at the farm. The tool calculates two complete sets of  $\text{NH}_3$  emissions: one set for the user-defined baseline conditions, and a second set for the user-defined operations assuming implementation of BMPs. The tool then calculates the difference between the sets of emissions estimate to measure the incremental change in  $\text{NH}_3$  air emissions from the farm following implementation of the BMPs.

The primary published reference source for NH<sub>3</sub> emission factors used for the AAEMI was the EPA's National Emission Inventory of Ammonia Emissions from Animal Agricultural Operations (U.S. EPA, 2005b). This reference was selected because it is based on the EPA's collection and evaluation of data from a variety of data sources to develop emission factors for application to a mass balance NH<sub>3</sub> emissions approach. While the emission factors developed by the EPA are intended for use in preparing regional emission inventories, they are still useful for measuring the relative incremental changes in NH<sub>3</sub> emissions at an individual farm operation before and after implementation of recommended BMPs. Using information from other published references, some emission factors were adjusted to represent application of a specific BMP (e.g., application of an impermeable cover on a lagoon).

More up-to-date information may be available to derive emission factors in the future, such as data collected during the National Air Emissions Monitoring Study<sup>8</sup> (NAEMS). The tool is developed so that it can be updated to enter new emission factors and other input parameters. As site-specific information becomes available for an increasing number of AFOs, tools such as those developed for the CLEAN<sub>EAST</sub> Project, can be used to measure and compare the potential changes in NH<sub>3</sub> emissions from AFOs of alternative or site-specific control measures.

---

<sup>8</sup> The National Air Emissions Monitoring Study was established in 2006 by a voluntary Air Compliance Agreement between the EPA and the pork, dairy, egg and broiler industries to collect air emissions data at select AFO sites to: 1) accurately assess emissions from livestock operations and compile a database for estimation of emission rates, and 2) promote a national consensus for emissions-estimation methods/procedures from livestock operations. For more information see <https://engineering.purdue.edu/~odor/NAEMS/index.htm>.

## Section 4. Project Results

The CLEAN<sub>EAST</sub> Project provided EA and NMP technical services to 429 farms in the eastern United States. For each of these farms, site-specific information was collected and used by a TAP as needed for the assigned technical service. The TAP, in turn, produced an EA Report and/or an NMP for each farm participant. Select data from the project's information collection tools and TAP reports were entered into a relational database (the Farm Participant Database) designed by RTI specifically for the CLEAN<sub>EAST</sub> Project (see **Section 2.5**). This section presents the results from the compilation and analysis of that CLEAN<sub>EAST</sub> Project data. The results discussed in this section are presented as aggregated (multiple farm) data collected. In accordance with the CLEAN<sub>EAST</sub> Project's farm information confidentiality agreement with farm participants, no site-specific information identifiable at the individual farm level is presented in this section.

**Section 4.1** presents a discussion on the geographic distribution of CLEAN<sub>EAST</sub> Project farm participants, while **Section 4.2** presents a detailed profile of the collective farm participants. **Section 4.3** describes the baseline animal operations and manure management practices used by the farm participants before receiving the CLEAN<sub>EAST</sub> technical services. **Section 4.4** evaluates the BMPs recommended in the EA Reports and NMPs prepared by CLEAN<sub>EAST</sub> TAPs. **Section 4.5** presents the project results as applied to the project performance measure parameters identified to monitor the CLEAN<sub>EAST</sub> Project outcomes and outputs (see **Section 3.3.3**). Finally, **Section 4.6** presents the project results from the Participant Evaluation Surveys and follow-up contacts with farm participants.

### 4.1 Farm Participant Geographic Distribution

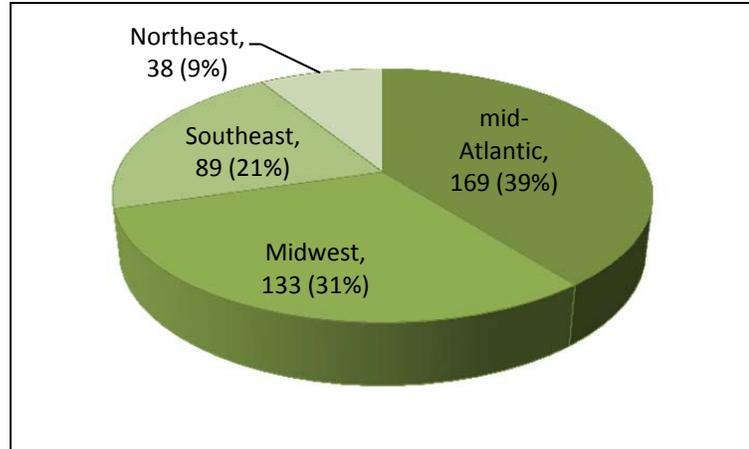
The CLEAN<sub>EAST</sub> Project provided technical services to farm participants located in 20 of the 27 states eligible to receive project services. **Table 4-1** and **Figure 4-1** present the distribution of the 429 farm participants by state and by the four CLEAN<sub>EAST</sub> Project regions (Northeast, mid-Atlantic, Southeast, and Midwest regions).

It is important for the reader to note that the total number of farms served by the CLEAN<sub>EAST</sub> Project equaled 429; however, RTI elected to record 419 of the 429 farm participants' records in the Farm Participant Database. (RTI chose not to receive the farm-specific information for 10 of the farm participants for site-specific reasons). Therefore, the results presented in **Section 4** reflect data regarding the EA Reports, NMPs, and associated project tools for 419 operations.

Table 4-1. CLEAN<sub>EAST</sub> Farm Participants by U.S. Region and State

U.S. Region	State	Number of Farm Participants
<b>Northeast</b>	Connecticut	1
	Maine	0
	Massachusetts	0
	New Hampshire	0
	New Jersey	1
	New York	20
	Rhode Island	0
	Vermont	16
	<b>Northeast Subtotal</b>	<b>38</b>
<b>Mid-Atlantic</b>	Delaware	0
	Maryland	19
	Pennsylvania	149
	Virginia	1
	West Virginia	0
	<b>Mid-Atlantic Subtotal</b>	<b>169</b>
<b>Southeast</b>	Alabama	4
	Florida	3
	Georgia	23
	Kentucky	7
	Mississippi	0
	North Carolina	12
	South Carolina	36
	Tennessee	4
	<b>Southeast Subtotal</b>	<b>89</b>
<b>Midwest</b>	Illinois	24
	Indiana	23
	Michigan	2
	Minnesota	2
	Ohio	67
	Wisconsin	15
	<b>Midwest Subtotal</b>	<b>133</b>
<b>TOTAL</b>		<b>429</b>

Nearly 40% (169) of the farm participants were located in the project's mid-Atlantic region, due to the large participation of Pennsylvania farms (149 farm participants), as discussed later in this section. The Midwest region had participants from each state in the region, with significant levels of participation in Ohio (67 farm participants), Illinois (24 farm participants), and Indiana (23 farm participants). Participation in the Southeast region (89 participants) represented 21% of CLEAN<sub>EAST</sub> farm participants. The smallest level of participation was in the Northeast region (38 farm participants).



**Figure 4-1. CLEAN<sub>EAST</sub> Project farm participant distribution by U.S. region.**

No farm operators located in seven of the CLEAN<sub>EAST</sub> Project states eligible to receive services chose to apply (i.e., Delaware, Maine, Massachusetts, Mississippi, New Hampshire, Rhode Island, and West Virginia). Possible reasons for farm operators located in these states not participating in the CLEAN<sub>EAST</sub> Project may have included the following:

- State officials may have deemed their technical assistance programs sufficient to provide services comparable to the CLEAN<sub>EAST</sub> Project;
- Contract AFOs may have received adequate services from their corporate integrators;
- States with low numbers of farms may not have found EAs as beneficial, or had other resources available for NMP preparation; and/or
- State regulatory programs may have already required and fulfilled the need for farm operations' NMPs.

The regional distribution of services requested by the farm participants is shown in **Figure 4-2**. These services were categorized as farm participants requesting only an NMP, only an EA, and both an EA and NMP. Because the EA was a new service concept specified in the EPA's cooperative agreement, many farm applicants were unfamiliar with its design and purpose. Therefore, if a farm applicant who requested an NMP was unfamiliar with the EA, CLEAN<sub>EAST</sub> Project staff also provided information to the applicant about the EA. As a result, a portion of the farm applicants who had not already requested EAs expressed interest in receiving an EA in addition to NMP assistance. In the mid-Atlantic states, 52% of the farm participants requesting NMPs also requested EAs; in the Midwest, 75%; in the Northeast, 68%; and in the Southeast, 53%.

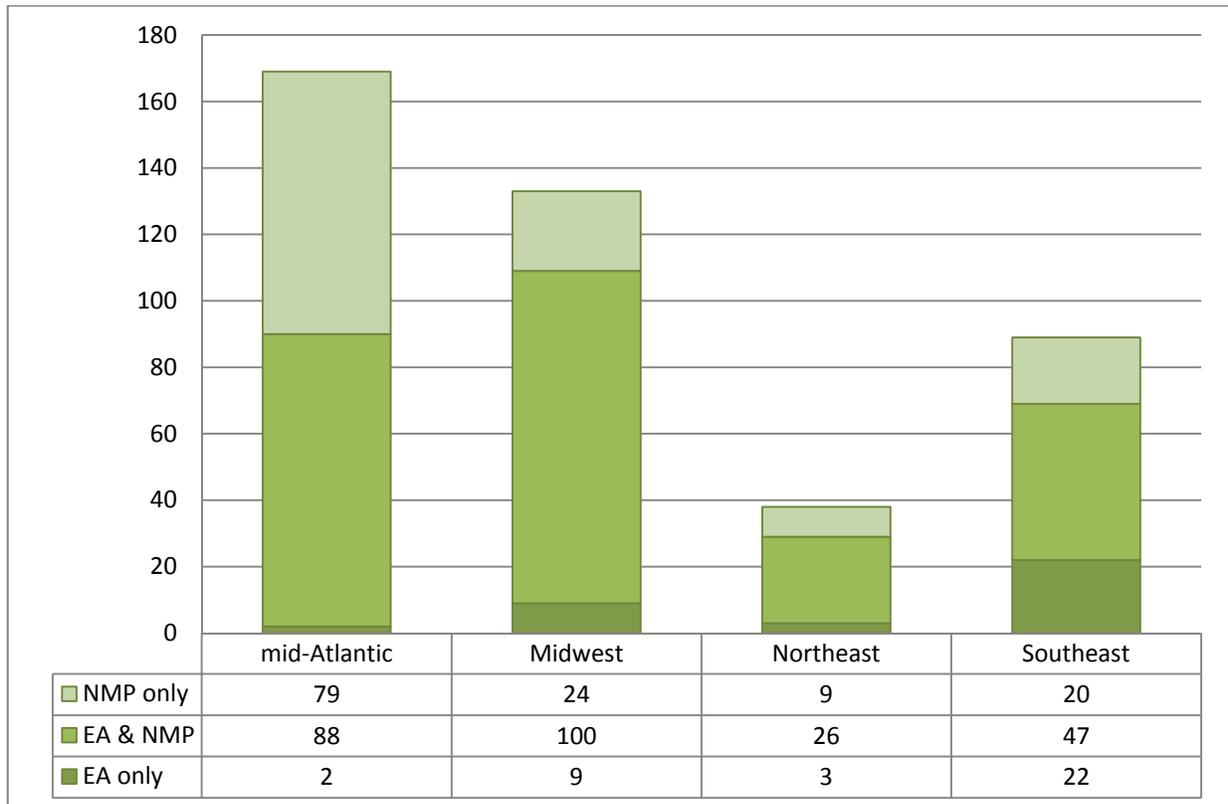
A portion of the requests for NMP technical services is attributed, in part, to the 2008 Final CAFO Rule (73 FR 225, p.70418, November 20, 2008). While the 2008 Final CAFO Rule did not expand the regulated community requiring NPDES permits, two regulatory amendments associated with the

NPDES permits appeared to result in more farm operators seeking NMPs through the CLEAN<sub>EAST</sub> Project, including

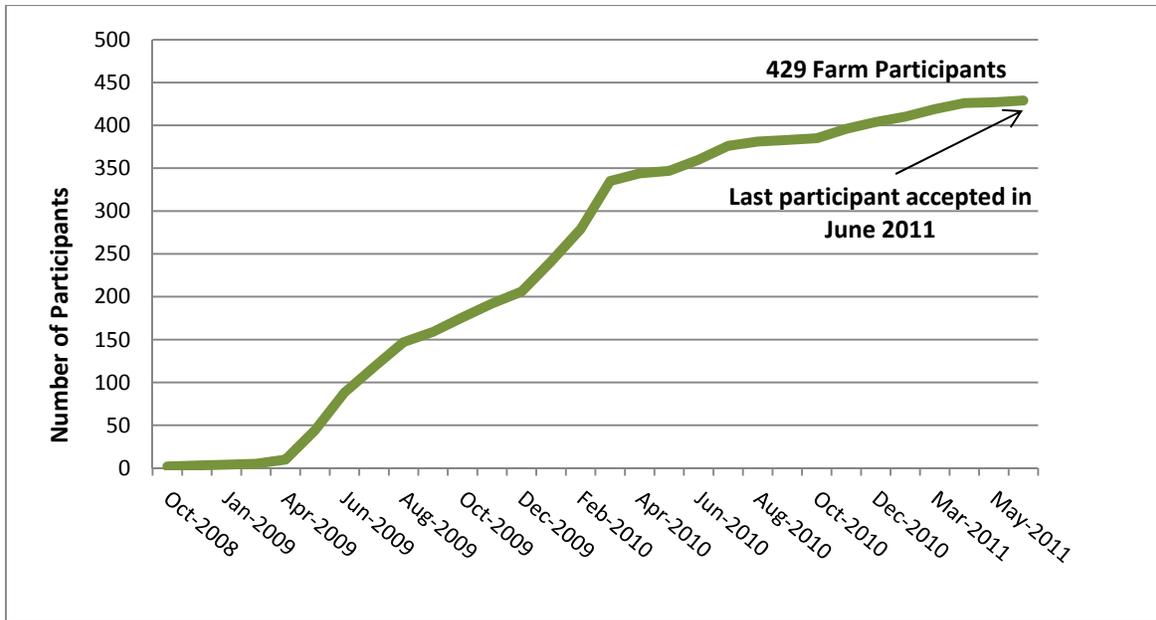
- Farm operators seeking an NPDES permit who were required to submit an NMP at the time of NPDES permit application submittal, and
- Farm operators opting out of an NPDES permit who exercised the voluntary “certification” option.

To obtain certification, farm operators were required to demonstrate (through objective evaluation) that their operation would not discharge to waters of the United States. This demonstration could be accomplished through the development and implementation of an NMP. The incentives for establishing certification were two-fold. The first incentive was that the certification provided the farm operator with a strategy for maintaining their status as a non-discharging operation (e.g., implementing an NMP). The second incentive was that, in the event of a discharge from an operation with a valid certification, the operator would only be subject to liability for the unpermitted discharge, and not for failure to seek permit coverage prior to the discharge.

The CLEAN<sub>EAST</sub> Project accepted applications (i.e., Participation Forms, see **Appendix E**) from farm operators from January 2009 through June 2011 (see **Figure 4-3**). In early 2009, a significant increase in the number of farms accepted into the project occurred due to a surge in applications as a result of Pennsylvania farm operator interest.



**Figure 4-2. Distribution of farm participant EA and NMP services requests by U.S. region.**



**Figure 4-3. Cumulative number of farm applicants accepted by the CLEAN EAST Project (October 2008 – June 2011).**

This surge from Pennsylvania for NMPs is also attributed to the state’s Nutrient Management Act. Pennsylvania amended its 1993 Nutrient Management Act, “Act 6,” with “Act 38” in October of 2006. Act 38 expanded the definition of CAFOs to include all livestock and required farm operators receiving financial assistance for nutrient management, such as those participating in the Chesapeake Bay Program, to have an up-to-date NMP (Pennsylvania State University, 2010). The Act also encouraged farm operations that were not subject to Act 38 requirements to voluntarily seek NMPs.

The surge of applications from farm operators located in Pennsylvania created the potential for committing a significant share of the project’s resources early in the cooperative agreement performance period. As a result, in 2009, RTI (with EPA’s approval) began prioritizing and, when appropriate, waitlisting subsequent Pennsylvania farm applicants to give farm operators from other eligible states the opportunity to apply for CLEAN EAST services. Those Pennsylvania farm operators given priority for receiving CLEAN EAST Project services (and not waitlisted) met all of the following criteria:

- The farm was located in the nutrient-impaired Chesapeake Bay watershed.
- The farm operator did not have an NMP.
- The farm’s AFO primarily produced swine, dairy, beef, or poultry.

In 2010, RTI also implemented a watershed-based priority policy (i.e., prioritizing operations located in nutrient-impaired watersheds) for farms in Illinois, Indiana, Vermont, Wisconsin, South Carolina, Ohio, and New York due to the higher rate of applications received from farm operators in those states compared to other states; however, the demand for services from those states was not as great as the demand from Pennsylvania.

It is important to note that all farm applicants who were initially waitlisted were contacted later in the project (in chronological order of application date) as resources allowed. If the farm operator remained interested in receiving project services, RTI strived to arrange assistance. During these contacts, it was determined that some of these farm operators no longer desired CLEAN<sub>EAST</sub> services for reasons that included either having already received services from another entity, or the operator—who was voluntarily seeking services and was not required to have either an EA or an NMP—chose not to receive services.

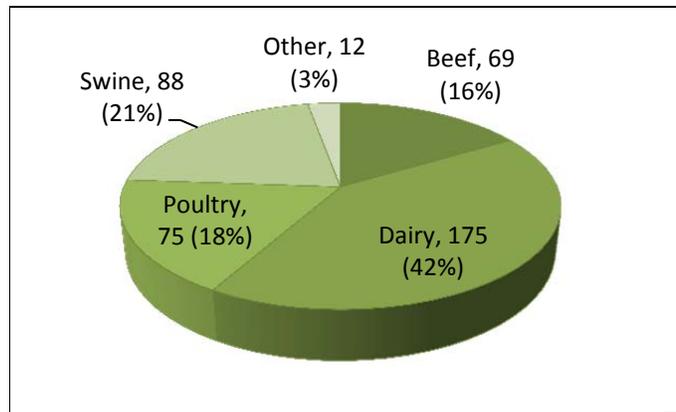
## 4.2 Farm Participant Profile

The farm participants in the CLEAN<sub>EAST</sub> Project represented a diverse group of farm operations located in the eastern United States based on geographic region, animal category, farm size, and location in relationship to impaired watersheds. This section presents the composite profile of the farm participants using the aggregated data in the Farm Participant Database (see **Section 2.5**).

### 4.2.1 Animal Category Distribution

The CLEAN<sub>EAST</sub> Project was intended to reach out to growers of all animal categories, with emphasis on recruiting dairy, beef, swine, and poultry operations because those are the most prevalent categories of feeding operations in the United States. However, operations with other animal categories (e.g., sheep and horses) expressed interest in the project and also received EA and NMP services.

The CLEAN<sub>EAST</sub> Project met EPA’s cooperative agreement condition that the AFOs that receive assistance include “facilities in all major animal sectors of the livestock industry (e.g., poultry, dairy, cattle, and swine)” (see **Section 1.1**). **Figure 4-4** shows the farm participant distribution by animal category based on the predominant animal category at the farm. Approximately 97% of the farm participants were in the dairy, swine, poultry, and beef animal categories. The largest animal category served by the CLEAN<sub>EAST</sub> Project was dairy, representing 42% (175 farms) of the farm participants, followed by swine at 21% (88 farms), poultry at 18% (75 farms), and beef at 16% (69 farms). The “Other” animal category included six horse farms, four sheep farms, and two operations importing manure from other operations exclusively (i.e., the operations did not have livestock or poultry onsite.) **Figure 4-5** and **Figure 4-6** show the CLEAN<sub>EAST</sub> animal category distribution by geographical regions.



**Figure 4-4. CLEAN<sub>EAST</sub> farm participant distribution by predominant animal category.**

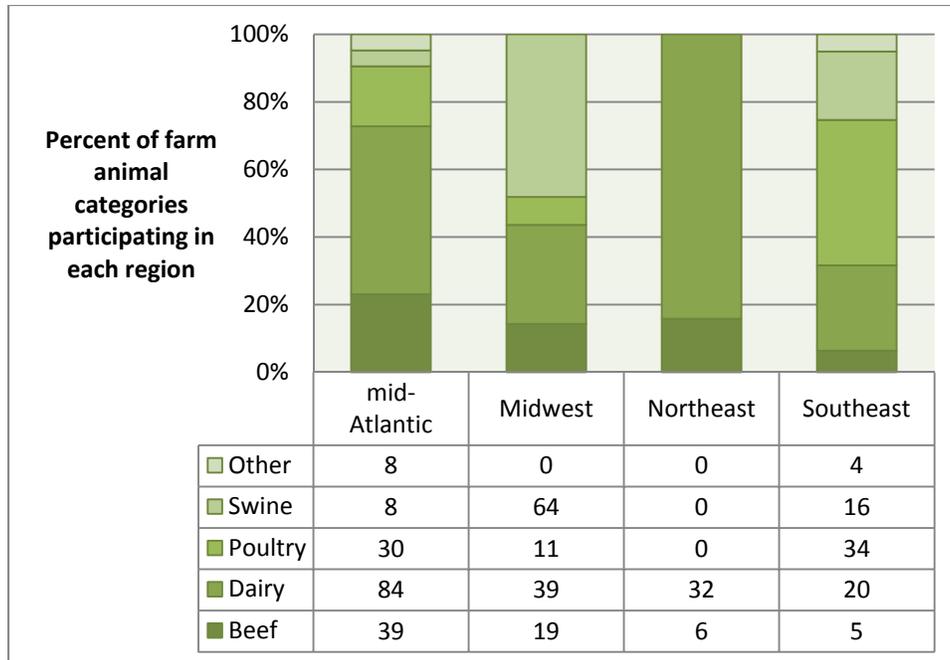


Figure 4-5. Predominant animal category distribution by U.S. region.

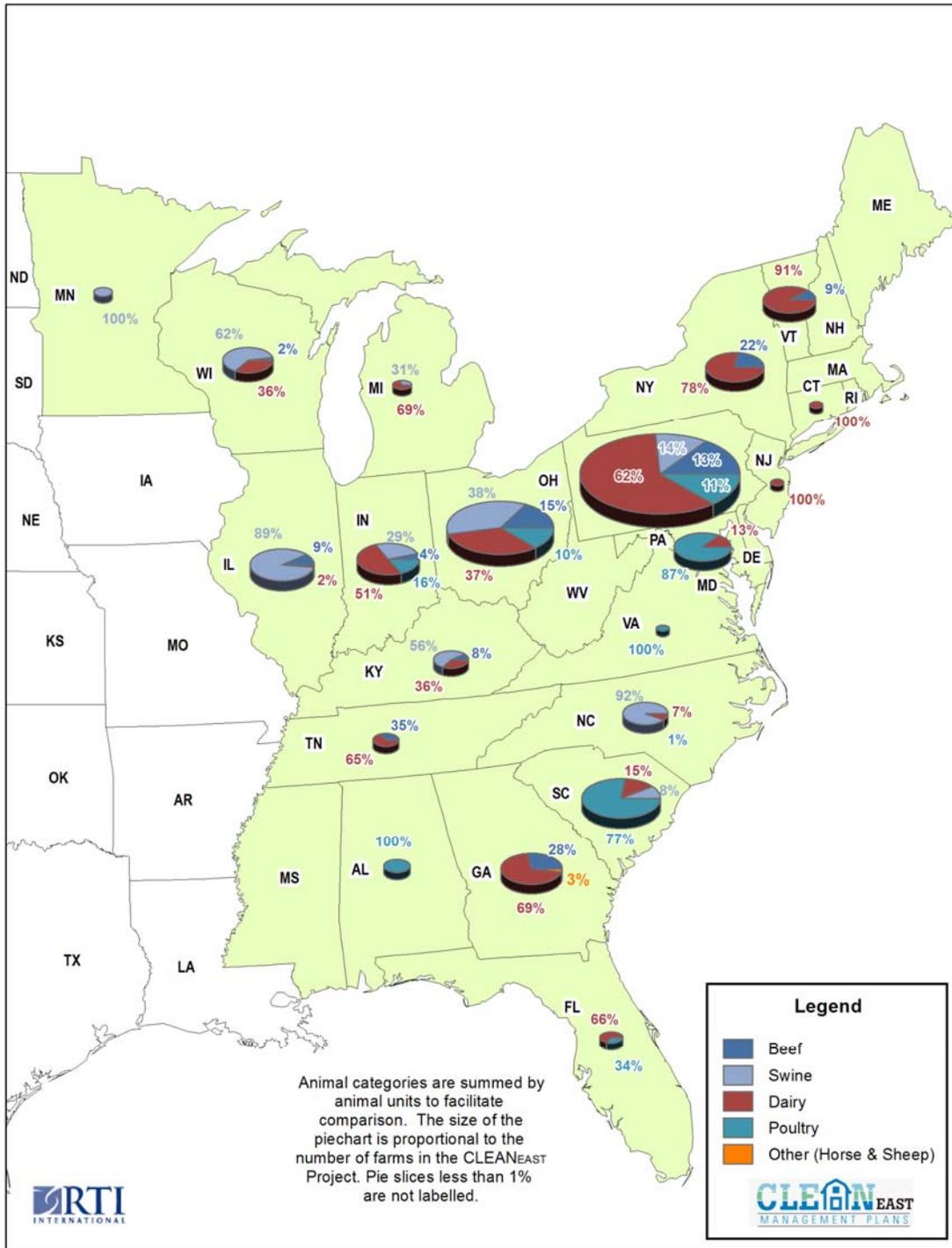


Figure 4-6. Predominant animal category distribution by state.

While we chose to classify participants by their predominant animal category, it should be noted that 22% (91) of the farm participants also had secondary animal categories in their operation (78%, or 328, of farm operations were single species only). There were 18 operations with a combination of beef and swine (i.e., 5 with beef as the predominant animal category and swine as the secondary; 13 with swine as the predominant category and beef as the secondary), 13 poultry/beef operations, and 12

beef/dairy operations. In addition, there were 10 dairy/poultry, 9 dairy/swine, and 6 dairy/horse operations (Table 4-2).

**Table 4-2. CLEAN<sub>EAST</sub> Project Farm Participant Distribution by Multiple-Animal Species Farms Animal Categories**

Predominant Animal Category	Number of Farm Participants						
	Predominant Animal Species Only at Farm Site	Multiple-Animal Species Farms with Other Species in Addition to Predominant Species at Farm Site					Total
		Beef	Dairy	Swine	Poultry	Other <sup>a</sup>	
Beef	53		6	5	0	5	<b>69</b>
Dairy	144	6		5	6	14	<b>175</b>
Swine	66	13	4		3	2	<b>88</b>
Poultry	53	13	4	2		3	<b>75</b>
Other	12	0	0	0	0		<b>12</b>
	328						<b>419</b>

<sup>a</sup> Other category includes horses and sheep.

The USDA's National Agricultural Statistics Service's (NASS) 2007 Ag Census provides state-level numbers of livestock and poultry. **Tables 4-3 to 4-6** compare the number of animals on farms served by the CLEAN<sub>EAST</sub> Project to the number of animals in each state. Although from a state-level herd- and flock-size perspective, the farms served by CLEAN<sub>EAST</sub> represent a low percentage, the trend in the number of animals served in each region closely follows the predominant animal categories reported in the mid-Atlantic and Southeast regions, both of which have a high poultry populations. CLEAN<sub>EAST</sub> participants from the Midwest region represented a significantly higher portion of swine. The CLEAN<sub>EAST</sub> Northeast participants had a significantly lower poultry population than the region actually reports. On the other hand, beef and dairy operations were served well in the Northeast region. **Tables 4-7 through 4-10** show the populations for the four regions.

Table 4-3. Comparison of CLEAN<sub>EAST</sub> Beef Cattle Population to 2007 Ag Census Data

Region	State	CLEAN <sub>EAST</sub> Project Animal Population	State Animal Population	Percent of State Population
<b>Midwest</b>	Illinois	1,587	429,111	0.4%
	Indiana	821	235,299	0.3%
	Michigan	0	109,500	0.0%
	Minnesota	2,210	399,768	0.6%
	Ohio	4,294	293,757	1.5%
	Wisconsin	414	269,820	0.2%
	<b>Midwest Subtotal</b>	<b>9,326</b>	<b>1,737,255</b>	<b>0.5%</b>
<b>Mid-Atlantic</b>	Maryland	91	44,015	0.2%
	Pennsylvania	6,441	158,430	4.1%
	Virginia	0	695,061	0.0%
	<b>Mid-Atlantic Subtotal</b>	<b>6,532</b>	<b>897,506</b>	<b>0.7%</b>
<b>Southeast</b>	Alabama	45	678,949	0.0%
	Florida	150	942,419	0.0%
	Georgia	2,506	554,099	0.5%
	Kentucky	450	1,166,385	0.0%
	North Carolina	291	373,024	0.1%
	South Carolina	186	230,419	0.1%
	Tennessee	480	1,179,102	0.0%
	<b>Southeast Subtotal</b>	<b>4,108</b>	<b>5,124,397</b>	<b>0.1%</b>
<b>Northeast</b>	Connecticut	0	5,982	0.0%
	New Jersey	0	9,298	0.0%
	New York	892	103,620	0.9%
	Vermont	1,808	10,002	18.1%
	<b>Northeast Subtotal</b>	<b>2,700</b>	<b>128,902</b>	<b>2.1%</b>
<b>TOTAL</b>		<b>22,666</b>	<b>7,888,060</b>	<b>0.3%</b>

Table 4-4. Comparison of CLEAN<sub>EAST</sub> Dairy Cow Population to 2007 Ag Census Data

Region	State	CLEAN <sub>EAST</sub> Project Animal Population	State Animal Population	Percent of State Population
Midwest	Illinois	396	1,330,782	0.0%
	Indiana	5,413	1,041,499	0.5%
	Michigan	690	1,392,439	0.0%
	Minnesota	0	2,854,969	0.0%
	Ohio	8,590	1,544,340	0.6%
	Wisconsin	2,596	4,623,232	0.1%
	<b>Midwest Subtotal</b>	<b>17,685</b>	<b>12,787,261</b>	<b>0.1%</b>
Mid-Atlantic	Maryland	1,993	247,676	0.8%
	Pennsylvania	22,417	2,162,468	1.0%
	Virginia	200	1,665,134	0.0%
	<b>Mid-Atlantic Subtotal</b>	<b>24,610</b>	<b>4,075,278</b>	<b>0.6%</b>
Southeast	Alabama	0	1,200,133	0.0%
	Florida	2,930	1,830,867	0.2%
	Georgia	4,382	1,194,280	0.4%
	Kentucky	2,968	2,485,917	0.1%
	North Carolina	880	867,771	0.1%
	South Carolina	3,749	418,826	0.9%
	Tennessee	2,090	2,183,149	0.1%
	<b>Southeast Subtotal</b>	<b>16,999</b>	<b>10,180,943</b>	<b>0.2%</b>
Northeast	Connecticut	85	70,898	0.1%
	New Jersey	213	47,988	0.4%
	New York	2,511	2,069,752	0.1%
	Vermont	12,854	404,542	3.2%
	<b>Northeast Subtotal</b>	<b>15,663</b>	<b>2,593,180</b>	<b>0.6%</b>
<b>TOTAL</b>	<b>74,957</b>	<b>29,636,662</b>	<b>0.3%</b>	

Table 4-5. Comparison of CLEAN<sub>EAST</sub> Swine Population to 2007 Ag Census Data

Region	State	Number of Animals in CLEAN <sub>EAST</sub> Project	Number of Animals in State	Percent of Animals Participating vs. in State Population
Midwest	Illinois	194,094	4,298,716	4.5%
	Indiana	28,788	3,669,057	0.8%
	Michigan	712	1,032,054	0.1%
	Minnesota	9,655	7,652,284	0.1%
	Ohio	47,005	1,831,084	2.6%
	Wisconsin	39,149	436,814	9.0%
	<b>Midwest Subtotal</b>	<b>319,403</b>	<b>18,920,009</b>	<b>1.7%</b>
Mid-Atlantic	Maryland	0	n/a <sup>a</sup>	—
	Pennsylvania	30,898	1,167,449	2.6%
	Virginia	0	371,176	0.0%
	<b>Mid-Atlantic Subtotal</b>	<b>30,898</b>	<b>1,538,625</b>	<b>2.0%</b>
Southeast	Alabama	0	178,275	0.0%
	Florida	0	19,937	0.0%
	Georgia	665	263,471	0.3%
	Kentucky	30,246	348,023	8.7%
	North Carolina	81,603	10,134,004	0.8%
	South Carolina	22,950	293,793	7.8%
	Tennessee	—	138,207	0.0%
	<b>Southeast Subtotal</b>	<b>135,464</b>	<b>11,375,710</b>	<b>1.2%</b>
Northeast	Connecticut	0	3,645	0.0%
	New Jersey	61	8,551	0.7%
	New York	12	85,741	0.0%
	Vermont	1	2,701	0.0%
	<b>Northeast Subtotal</b>	<b>74</b>	<b>100,638</b>	<b>0.1%</b>
	<b>TOTAL</b>	<b>485,839</b>	<b>31,934,982</b>	<b>1.5%</b>

<sup>a</sup> n/a- USDA Agricultural Census withheld to avoid disclosing data for individual farms.

Table 4-6. Comparison of CLEAN<sub>EAST</sub> Poultry Population to 2007 U.S. Ag Census Data

Region	State	Number of Animals in CLEAN <sub>EAST</sub> Project	Number of Animals in State	Percent of Animals Participating vs. in State Population
Midwest	Illinois	0	5,610,619	0.0%
	Indiana	247,000	61,310,622	0.4%
	Michigan	0	13,076,237	0.0%
	Minnesota	0	58,544,956	0.0%
	Ohio	449,716	76,726,183	0.6%
	Wisconsin	35	51,677,927	0.0%
	<b>Midwest Subtotal</b>	<b>696,751</b>	<b>266,946,544</b>	<b>0.3%</b>
Mid-Atlantic	Maryland	1,787,931	299,035,836	0.6%
	Pennsylvania	1,351,687	172,085,090	0.8%
	Virginia	100,000	252,393,279	0.0%
	<b>Mid-Atlantic Subtotal</b>	<b>3,239,618</b>	<b>723,514,205</b>	<b>0.4%</b>
Southeast	Alabama	406,200	1,025,854,879	0.0%
	Florida	340,000	85,141,109	0.4%
	Georgia	7,100	1,418,185,212	0.0%
	Kentucky	0	314,353,798	0.0%
	North Carolina	105,000	794,165,171	0.0%
	South Carolina	1,980,400	240,923,921	0.8%
	Tennessee	0	207,846,072	0.0%
	<b>Southeast Subtotal</b>	<b>2,838,700</b>	<b>4,086,470,162</b>	<b>0.1%</b>
Northeast	Connecticut	0	420,789	0.0%
	New Jersey	100	1,679,352	0.0%
	New York	240	5,732,708	0.0%
	Vermont	0	223,605	0.0%
	<b>Northeast Subtotal</b>	<b>340</b>	<b>8,056,454</b>	<b>0.0%</b>
<b>TOTAL</b>		<b>6,775,409</b>	<b>5,084,987,365</b>	<b>0.1%</b>

**Table 4-7. Percent of Animals Populating mid-Atlantic Region**

Animal Sector	Ag Census Pop'n.	CLEANEAST Participants
Beef	0%	0%
Dairy	1%	1%
Poultry	99%	98%
Swine	0%	1%

**Table 4-8. Percent of Animals Populating Southeast Region**

Animal Sector	Ag Census Pop'n.	CLEANEAST Participants
Beef	0%	0%
Dairy	0%	1%
Poultry	99%	95%
Swine	0%	5%

**Table 4-9. Percent of Animals Populating Midwest Region**

Animal Sector	Ag Census Pop'n.	CLEANEAST Participants
Beef	1%	1%
Dairy	4%	2%
Poultry	89%	67%
Swine	6%	31%

**Table 4-10. Percent of Animals Populating Northeast Region**

Animal Sector	Ag Census Pop'n.	CLEANEAST Participants
Beef	1%	14%
Dairy	24%	83%
Poultry	74%	2%
Swine	1%	0%

For the farm participants' animal population by region, the highest portion of animal populations served were (1) beef in the Northeast region (2.1%), (2) swine in the mid-Atlantic region (2.0%), and (3) swine in the Midwest region (1.7%). The percentage of each animal type served by the CLEAN EAST Project (e.g., number of CLEAN EAST animals in region/number of animals in region based on Ag Census data) is summarized in **Table 4-11**.

**Table 4-11. Percentage of Animal Population Served by Region**

Animal Sector	Mid-Atlantic	Midwest	Southeast	Northeast
Beef	0.7%	0.5%	0.1%	2.1%
Dairy	0.6%	0.1%	0.2%	0.6%
Poultry	0.4%	0.3%	0.1%	0.0%
Swine	2.0%	1.7%	1.2%	0.1%

## 4.2.2 Farm Size Distribution

Two approaches were used to categorize the CLEAN<sub>EAST</sub> Project farm participants by farm size. The first approach was to define farm size in terms of animal units (AU) based on live weight. The second approach was to define farm size based on the number of animals by using animal categories defined by the EPA for CAFOs regulated as part of the NPDES permit program. For the additional reporting on the project’s results, data are typically presented in terms of AU to convey information in the units of measure most commonly used in the livestock and poultry sectors.

### 4.2.2.1 Farm Size Categories by Animal Units

Each farm participant specified the number of animals or birds on their CLEAN<sub>EAST</sub> Participant Form and again on the Farm Information Profile questionnaire. The questionnaire requested the count and weight of each animal category by specific growth stages. Live weight has historically been standardized as AUs, where an AU is equivalent to 1,000 pounds of live animal weight (Kellogg, 2002). AUs were calculated by multiplying the number of animals by the average weight of each animal for an animal category and, in some cases, a growth stage within the animal category. This product of number of animals and average weight per animal was then divided by 1000 pounds:

$$AU = \sum_1^n \frac{A \times W}{1000}$$

Where,

- $n$  = the number of animal categories/growth stages present at the farm operation
- $A$  = the number of animals for a single category/growth stage,  $n$
- $W$  = the average weight of the animals for a single category/growth stage,  $n$ .

Once livestock and poultry counts were converted to AUs, RTI chose to use the EPA’s “cattle or cow/calf pairs” category in **Table 4-12** to derive AU-based (weight-based) farm size categories. One cattle or cow/calf pair “head” is equal to one AU. The cattle or cow/calf pair category was chosen, consistent with the project’s 2008 Economic Incentives report, *Factors Influencing Livestock Producer Participation in Voluntary Environmental Programs*, (**Appendix B**), which cites Poe et al. (2001). Poe et al. surveyed New York dairy farms to document manure management practices and to investigate farmers’ willingness to participate in voluntary environmental programs. The paper focused on farms with less than 1,000 AUs because those farms are not automatically considered CAFO point sources of pollution. Poe et al.’s survey respondents were then categorized into one of three groups based on current and proposed water quality regulations. The categories were described as “medium” farms (301–1,000 AU), “small” farms (101–300 AU), and “smallest” farms (<100 AU). For the purpose of this CLEAN<sub>EAST</sub> analysis, RTI chose to create one small category, combining Poe et al.’s “small” farms (101–300 AU) and “smallest” farms (<100 AU) to be consistent with the EPA’s three size category approach and its small category for “cattle-cow/calf pairs” category (<300 cattle-cow/calf pairs) in Table 4-12.

Table 4-12. Summary of CAFO Size Thresholds for All Sectors

Animal Sector	Large	Medium <sup>a</sup>	Small <sup>b</sup>
Cattle or cow/calf pairs	1,000 or more	300–999	Less than 300
Mature dairy cattle	700 or more	200–699	Less than 200
Veal calves	1,000 or more	300–999	Less than 300
Swine (weighing over 55 pounds)	2,500 or more	750–2,499	Less than 750
Swine (weighing less than 55 pounds)	10,000 or more	3,000–9,999.	Less than 3,000
Horses	500 or more	150–499	Less than 150
Sheep or lambs	10,000 or more	3,000–9,999	Less than 3,000
Turkeys	55,000 or more	16,500–54,999	Less than 16,500
Laying hens or broilers (liquid manure handling system)	30,000 or more	9,000–29,999	Less than 9,000
Chickens other than laying hens (other than a liquid manure handling system)	125,000 or more	37,500–124,999	Less than 37,500
Laying hens (other than a liquid manure handling system)	82,000 or more	25,000–81,999	Less than 25,000
Ducks (other than a liquid manure handling system)	30,000 or more	10,000–29,999	Less than 10,000
Ducks (liquid manure handling system)	5,000 or more	1,500–4,999	Less than 1,500

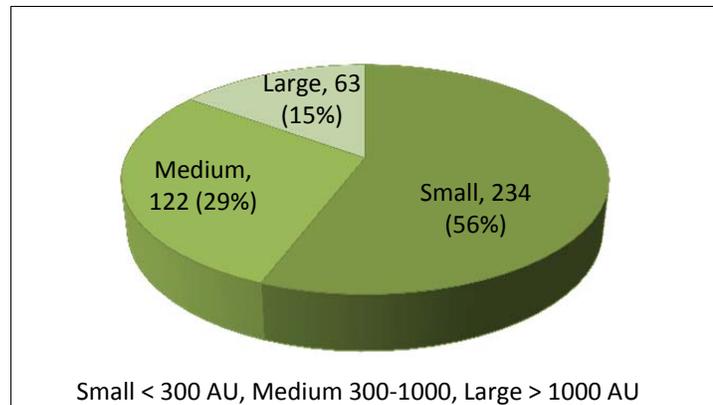
<sup>a</sup> May be designated or must meet one of the following two criteria to be defined as a medium CAFO: (A) discharges pollutants through a man-made device; or (B) directly discharges pollutants into waters of the United States that pass over, across, or through the facility or otherwise come into direct contact with the confined animals. 40 CFR 122.23(b)(6).

<sup>b</sup> Not a CAFO by regulatory definition, but may be designated as a CAFO on a case-by-case basis. 40 CFR 122.23(b)(9).

To gauge the size of each farm participant's operation before issuing a technical directive to a CLEAN<sub>EAST</sub> TAP, the AUs across all livestock and poultry types at the farms were summed to determine a total AU value for the farm operation. The size categories were as follows:

- Large: greater than 1,000 AU,
- Medium: 300–1000 AU, and
- Small: less than 300 AU, respectively.

**Figure 4-7** shows that 15% (63) of the CLEAN<sub>EAST</sub> farm operations were categorized as large, with greater than 1000 AU per operation; 29% (122) were medium, with 300 to 1,000 AUs per operation; and 56% (234) of farm participants had less than 300 AUs per operation. This distribution of 85% of farms being either small or medium infers that the participants seeking services were less likely to be large CAFOs that require CNMPs for NPDES permitting purposes. Rather, it is possible that these smaller operations were either responding to state-level NMP requirements and guidance, or were seeking the



**Figure 4-7. Farm participants by farm size.**

opportunity for first-time NMPs or EAs at no cost. Serving farms of all sizes was one of the objectives of the CLEAN<sub>EAST</sub> Project. The distribution of operations by size can be further observed by region (Figure 4-8) and by animal category (Figure 4-9).

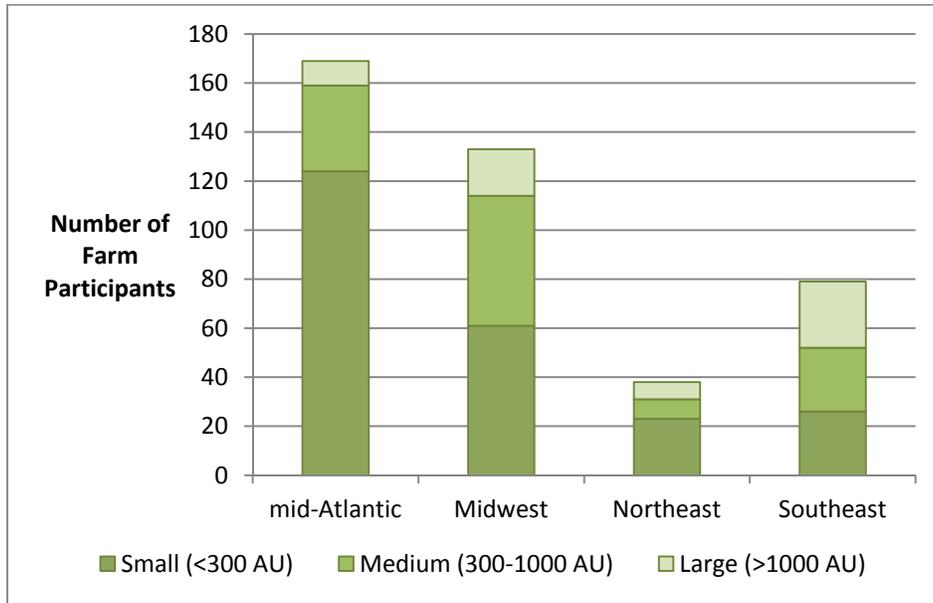


Figure 4-8. CLEAN<sub>EAST</sub> farm size distribution by U.S. region.

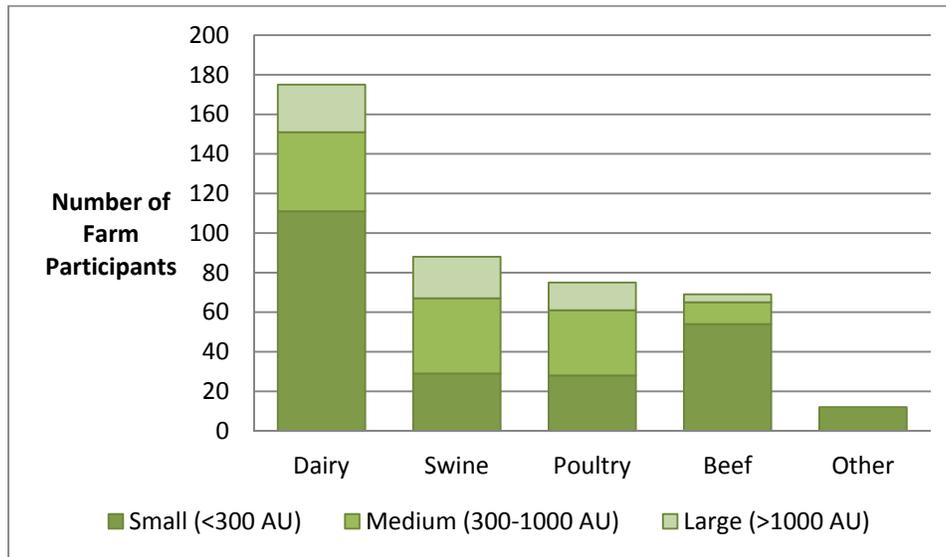


Figure 4-9. CLEAN<sub>EAST</sub> farm size distribution by predominant animal category.

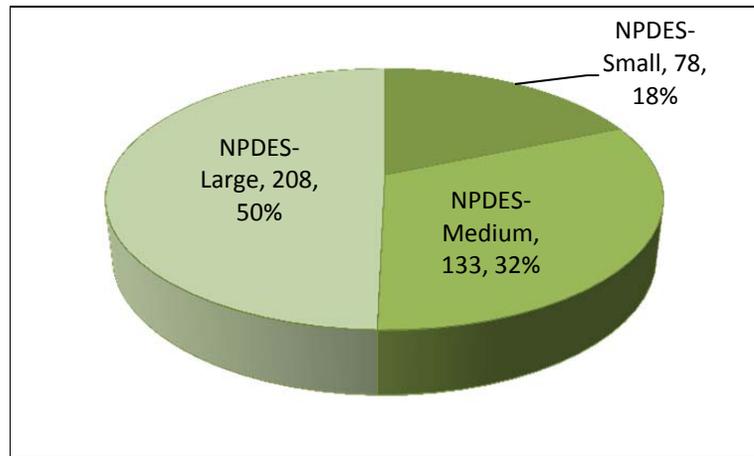
The portion of small and medium operations was similar to the overall project trend (85%) in the Midwest and Northeast regions, representing 86% and 82% of the total participant population in each region, respectively. Small plus medium operations represented 67% of all participants from the Southeast region and 94% of participants in the mid-Atlantic region.

A look at the participant distribution by farm size and animal category shows that 86% of dairy and 81% of poultry participants were small plus medium operations. Also, small plus medium operations represented 76% of all swine operations and 94% of beef operations.

#### 4.2.2.2 Farm Size Categories by Number of Animals

The EPA currently uses the size thresholds (number of animals) presented in Table 4-12 for large, medium, and small farm operations in each animal sector. These categories support the definition of CAFOs regulated as part of the NPDES permit program.

Using the NPDES size thresholds from Table 4-12, CLEAN<sub>EAST</sub> farm participants were sorted in NPDES [regulated] small, medium, and large categories. The overall NPDES size distribution for the farm participants indicates that 50% were NPDES large operations and 50% were NPDES small and medium operations (**Figure 4-10**).



**Figure 4-10. CLEAN<sub>EAST</sub> farm participants' distribution based on NPDES size categories.**

For the purposes of displaying farm participants by NPDES size categories, it should be noted that if more than one animal sector (e.g., dairy, other cattle, swine, poultry) was present at the operation, each sector was counted separately (**Figure 4-11**). That is, farm operations were assigned to the largest of the three NPDES size categories triggered by any one animal sector on the farm (**Table 4-13**, Figure 4-11). For example, if an operation managed 800 beef cattle, 10,000 sows, and 50,000 broilers with a dry litter manure handling system, only the sows exceed the NPDES “large” farm size category's threshold. In this case, the operation would be categorized as a large swine (>55lbs) operation.

**Table 4-13. Farm Operation NPDES Size Categories by Animal Sector**

Animal Sector	NPDES-Small	NPDES-Medium	NPDES-Large
Mature Dairy Cattle	84	34	17
Other Cattle (cattle of cow/calf pairs, veal calves)	70	14	4
Swine >55 pounds	14	30	32
Swine <55 pounds	5	12	3
Horse	6	0	0
Sheep	6	0	0
Laying Hens or Broilers (includes all other chicken types not listed elsewhere)-Liquid	1	0	0

(continued)

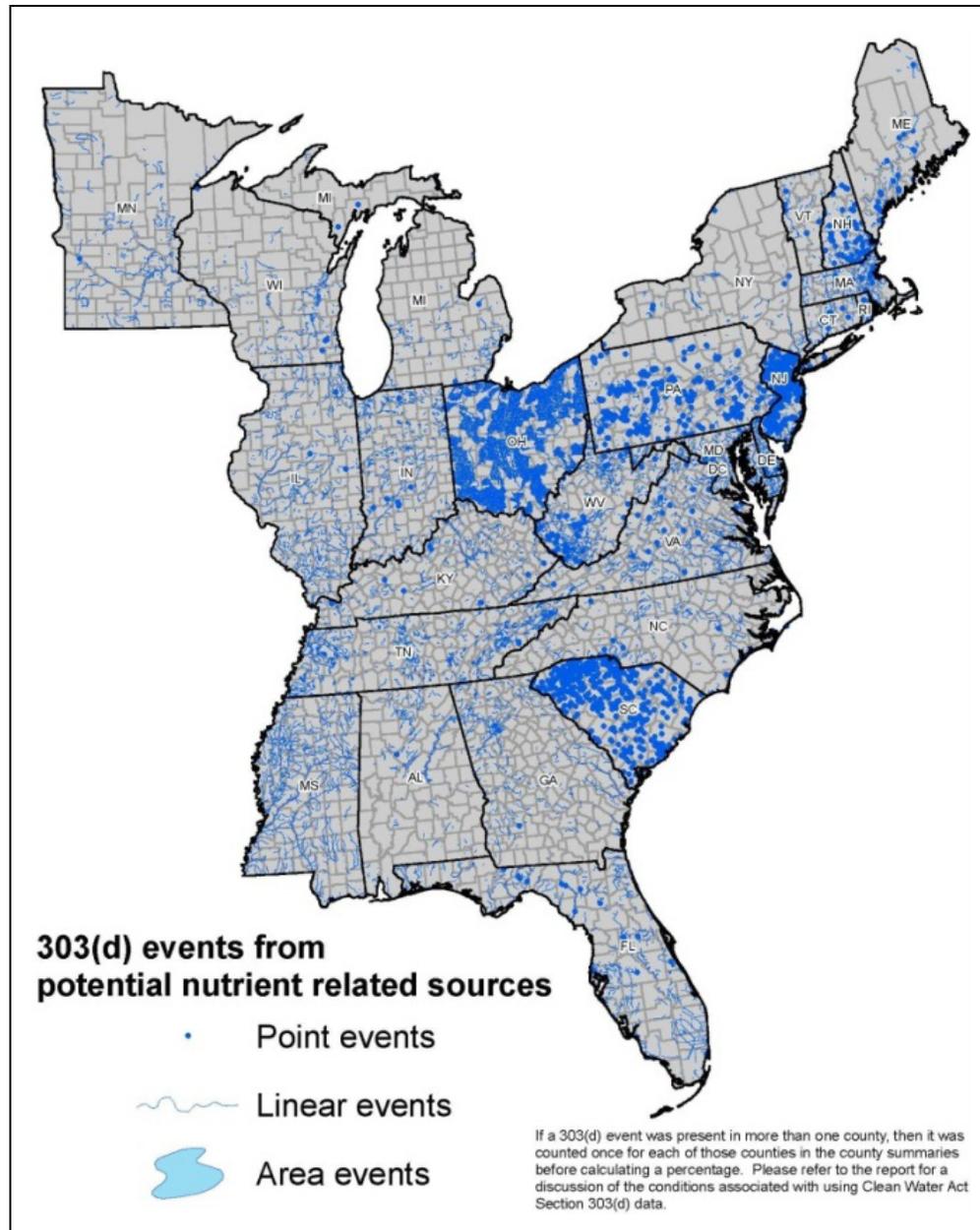
Table 4-13. Farm Operation NPDES Size Categories by Animal Sector (continued)

Animal Sector	NPDES-Small	NPDES-Medium	NPDES-Large
Turkeys	1	7	4
Other Chickens- Not liquid	10	33	14
Laying Hens- Not liquid	9	2	2
Ducks-Not liquid	0	1	0
Ducks-Liquid	0	0	2
None	2	0	0
<b>TOTAL</b>	<b>208</b>	<b>133</b>	<b>78</b>

#### 4.2.3 Farm Distribution by Impaired Watershed

Section 303(d) of the CWA requires states to develop a list of impaired waters biennially. Water bodies are placed on the 303(d) list if those waters are unable to attain or maintain applicable water quality standards. States are required to establish a schedule for development of total maximum daily loads (TMDLs) for waters on the 303(d) list. A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards, and an allocation of the load reduction needed from various sources of the pollutant.

RTI compiled a listing of CWA Section 303(d)-listed nutrient impaired waters. RTI compared those waters where impairments could potentially be attributable to livestock and poultry operations (Figure 4-11) to farm participants' locations to analyze the potential benefits of CLEAN<sub>EA</sub> and NMP services. As part of this effort, RTI used the 2002 Impaired Waters Baseline National Geospatial Dataset ([http://www.epa.gov/waters/data/downloads.html#303\(d\) Listed Impaired Waters](http://www.epa.gov/waters/data/downloads.html#303(d) Listed Impaired Waters)) to develop a TMDL rating scale. This RTI-developed rating scale was used to distinguish between counties with low, medium, or high levels of impairments. While the EPA provides more recent data on impaired waters, the 2002 reporting year was selected by RTI (with EPA's consent) to use as a baseline due to improved reporting by states and improved accuracy/availability of state-submitted geospatial data ([http://www.epa.gov/waters/doc/factsheets/impaired\\_baseline\\_gis.pdf](http://www.epa.gov/waters/doc/factsheets/impaired_baseline_gis.pdf)). This geospatial dataset contains all state-reported impaired waters from the 2002 reporting year available in the EPA's Reach Address Database (RAD) and represents 39,978 impaired water bodies classified into EPA's recommended Integrated Report Categories.



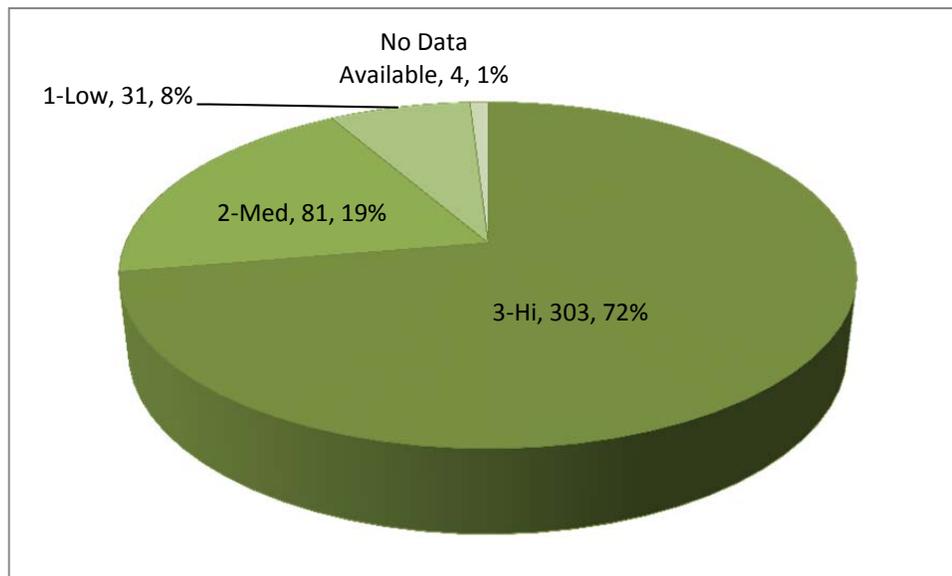
**Figure 4-11. EPA Baseline 303(d) impaired water events from potential nutrient-related sources.**

Section 303(d) impaired waters for the project area were defined at the county level, given that NRCS-registered TSPs and other outreach audiences are most commonly referenced by county. If an impaired water segment occurred in more than one county, then the impairment was counted once for each of those counties in the county summaries before calculating a percentage of impaired waters per county. (Note: “Impaired waters” do not capture all impaired streams.) Nutrient-related impaired waters are scattered throughout the 27-state CLEAN<sub>EAST</sub> Project area. One factor confounding possible linkages of nutrient-impaired waters to livestock manure management issues is that nutrients originate from human sources in more urban areas.

Using GIS, the percentage of 303(d)-listed waters impaired by a potential livestock and poultry nutrient-related source was calculated for counties in the project study area. The percent of potential nutrient-related 303(d) listed waters is the number of 2002 EPA baseline 303(d) impaired waters that had at least one nutrient-related source vs. all 2002 impaired waters that fell within each county. RTI sorted counties by the calculated percentages to create the following ratings:

- Low-priority: 0–35.3%,
- Medium-priority: 35.4 –77.3% and
- High-priority: 77.4–100%.

Applying these three priority ratings, it was determined that a total of 303 (72%) farms (**Figure 4-12**) served by the CLEAN<sub>EAST</sub> Project in the eastern United States were located in watersheds with “high-priority” levels of CWA Section 303(d) events that were potentially nutrient-related. This high percentage (72%) of farm participants is attributed to the project Outreach Strategy to achieve water quality improvements by serving farm operations in the most nutrient-impaired and/or nutrient sensitive watersheds. At the onset of the application period, to build interest and momentum, farms from all watersheds were considered equal candidates for project services. As CLEAN<sub>EAST</sub> Project resources became more committed, emphasis shifted to serving more farms in nutrient-impaired watersheds for those states having higher participation rates. It is important to emphasize that data were insufficient to confirm that counties’ nutrient-impaired designations were attributed primarily to livestock and poultry operations; however, RTI chose to make this assumption for outreach purposes. **Figure 4-13** is an example of dairy cow density mapped by the high, medium, and low nutrient-impairment categories for outreach planning. Comparable figures are available for beef, swine, and dairy in both **Appendices B and T**. **Appendix T** also maps farms served relative to counties ranked as high priority.



**Figure 4-12. CLEAN<sub>EAST</sub> farm participants’ priority distribution by RTI Rating of Clean Water Act Section 303(d) impaired waters: low-priority (0–35.3%), medium-priority (35.4–77.3%), and high-priority (77.4–100%).**

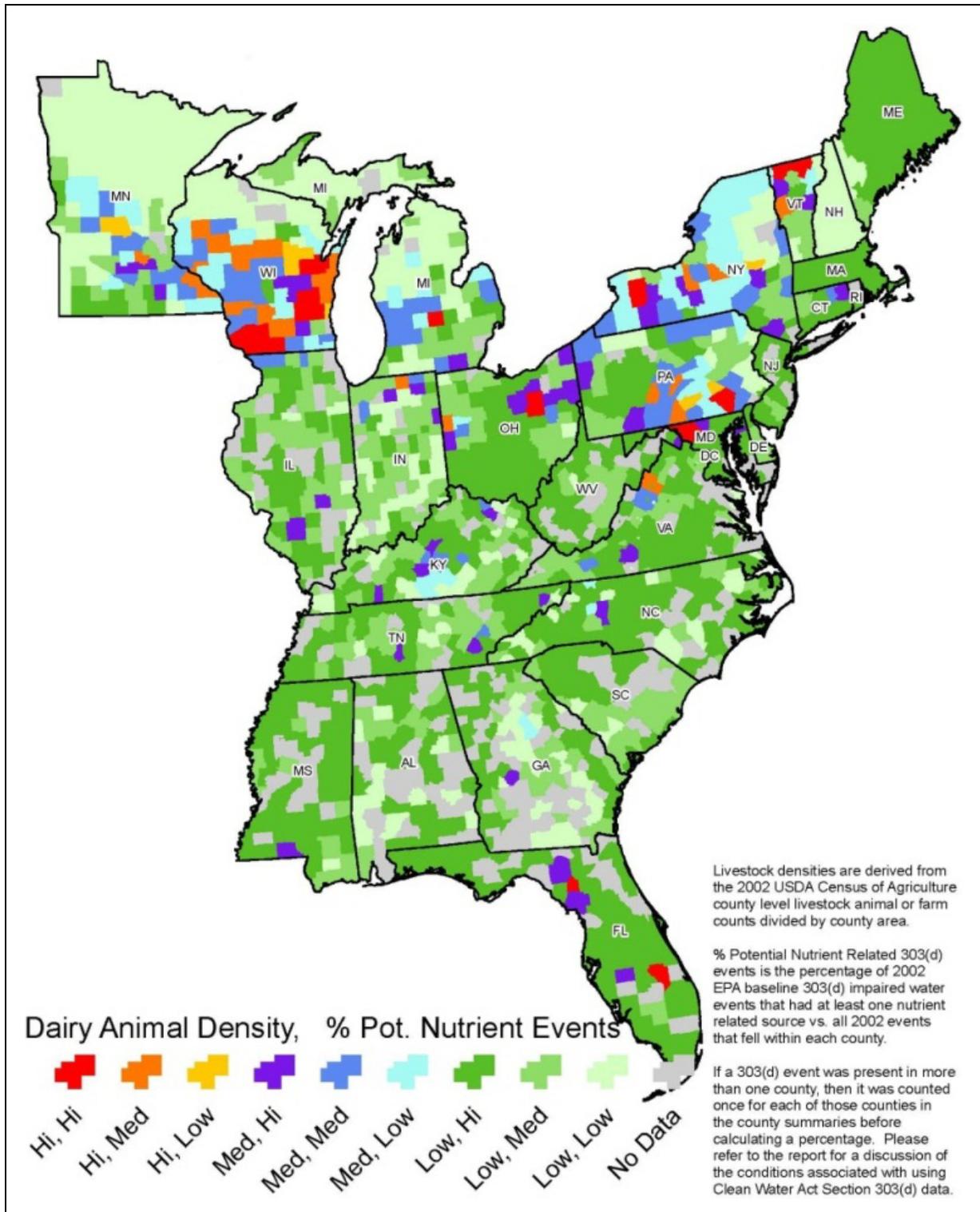


Figure 4-13. Dairy animal density and percent of potential nutrient-related 303(d) events.

Refer to **Appendices B and T** for additional maps.

### 4.3 Farm Participant Baseline Animal Operations and Manure Management Practices

Data collected in the Farm Operation Introductory Profile and Farm Operation Onsite Environmental Assessment Tool describe the farm operation conditions and manure management practices prior to services provided by the CLEAN<sub>EAST</sub> Project. Information collected about these practices includes the types of housing; manure handling and storage, treatment, and utilization systems; streams accessed by animals; mortality management methods; and water resources–related practices. It is important to note that data collected from the Farm Operation Introductory Profile and Farm Operation Onsite Environmental Assessment Tool have been summarized to convey the technologies and practices of the project’s farm participants and do not represent the general population of all livestock and poultry operations in the project’s study area. However, practices observed among the farm participants may provide insight into trends in practices and technologies in use across the livestock and poultry sectors in the eastern United States.

#### 4.3.1 Housing

Animals are raised in confinement (barns, lots) or are unconfined (pastures). The majority of participants (324; 76%) house the animals in holding areas/lots, and approximately 204 of these participants had uncovered holding areas. Eighty-eight (43%) of farms with covered holding areas collect the runoff from the holding areas/lots. Thirty-one (10%) of the 324 farms with holding areas allowed animals to have direct access to surface waters. It is important to note that surface waters may or may not include waters of the state. For example, surface waters may include isolated ponds that do not connect to streams.

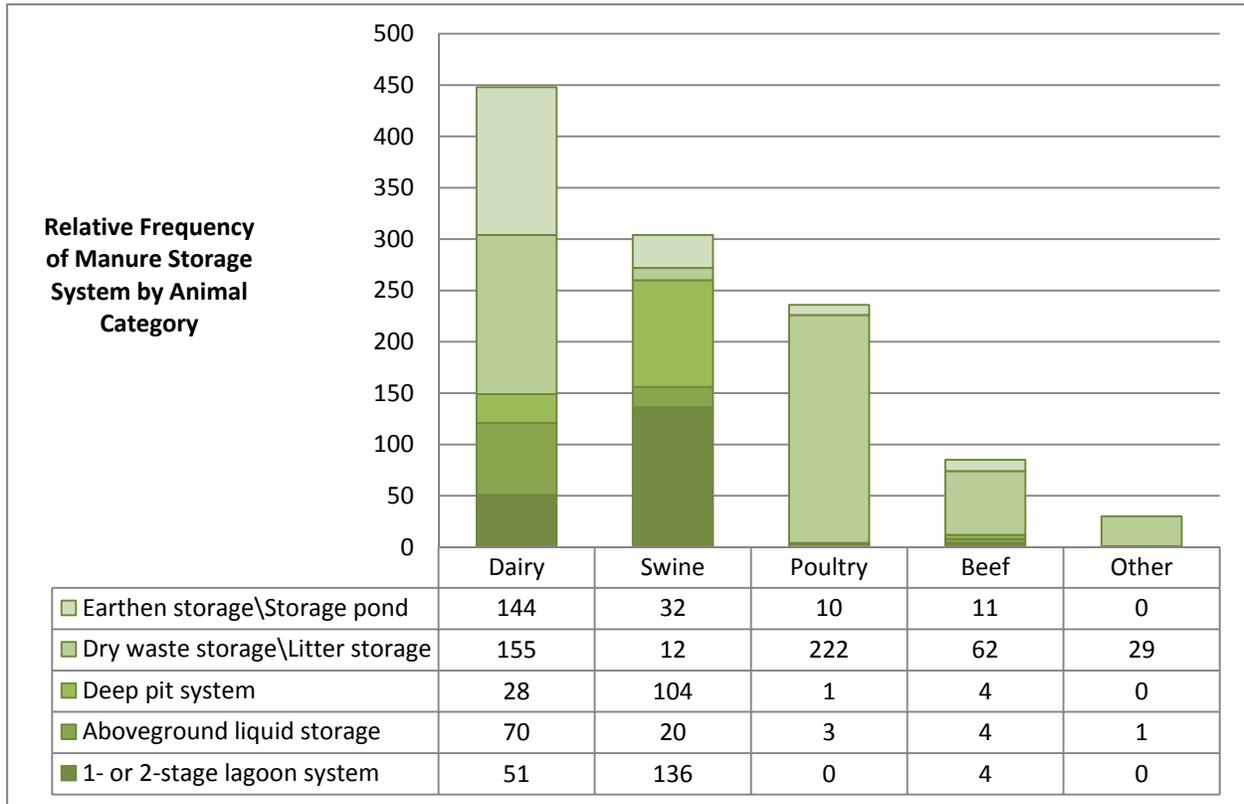
An ancillary component of animal housing is feed storage, in units such as silos. Feed storage units have been known to produce nutrient-rich leachate from silage. TAPs typically watch for silage-leachate issues and recommend remedies to mitigate nutrient runoff from those sources to surface waters. Less than 5% of the 175 dairies participating in the project were found to need guidance on silage leachate remedies.

#### 4.3.2 Manure Storage Practices

**Figure 4-14** presents baseline manure storage practices by primary animal category for CLEAN<sub>EAST</sub> farm participants. It is important to note that a single farm often has more than one storage practice. Therefore, the number of practices in Figure 4-14 is greater than the number of farm participants. Multiple manure storage practices exist on individual operations to accommodate the range of animal categories and growth stages present. Manure storage systems observed at participating farm operations include dry waste storage/litter storage, earthen storage/storage pond, aboveground liquid storage, deep pit systems, 1-stage lagoons, and 2-stage lagoons.

The major manure storage systems used by CLEAN<sub>EAST</sub> dairy operations include dry waste storage, earthen storage/storage pond, and aboveground liquid storage. For CLEAN<sub>EAST</sub> swine operations, the major manure storage systems were deep pit systems, and 1- or 2-stage lagoons. The

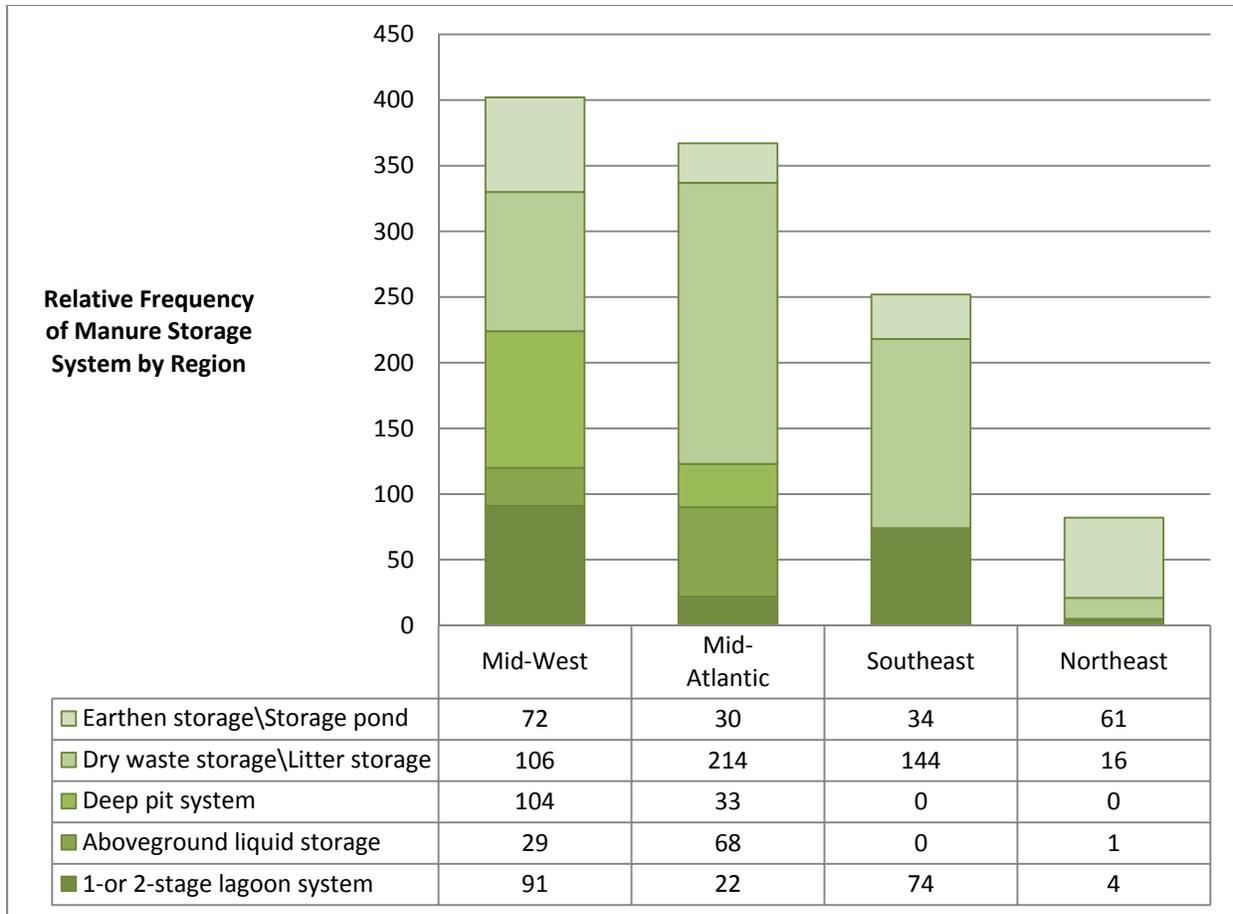
dominant manure storage system for CLEAN<sub>EAST</sub> poultry, beef, horse, and sheep operations is the dry waste storage/litter storage system.



<sup>a</sup> Each farm operation may have more than one manure storage system.

**Figure 4-14. Manure storage system<sup>a</sup> by primary animal category.**

**Figure 4-15** shows the regional distribution of the storage systems reported at farms served by the CLEAN<sub>EAST</sub> Project. In the Midwest and mid-Atlantic, all methods of storage were observed. However, in the Southeast, ponds and lagoon systems dominated, as well as litter storage for poultry. The predominance of ponds and lagoon systems reflects that the majority of participants, other than poultry operations, tend to use earthen, wet storage in warmer climates.

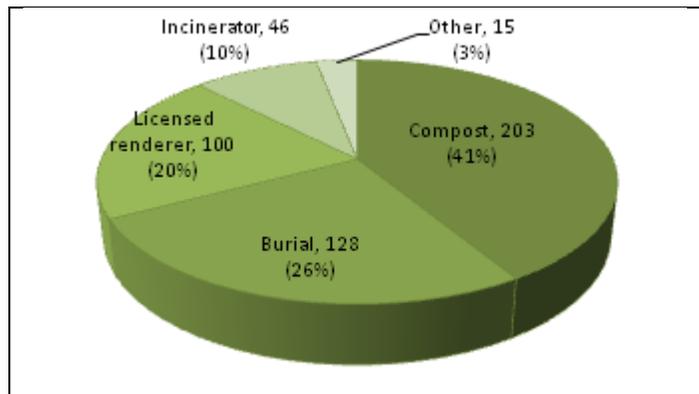


<sup>a</sup> Each farm operation may have more than one manure storage system.

**Figure 4-15. Manure storage system<sup>a</sup> by U.S. region.**

### 4.3.3 Mortality Management Methods

Mortality management methods varied among CLEAN<sub>EAST</sub> participants. Across animal categories, the common mortality management methods used by farm participants included composting (41%), burial (26%), and shipment to a licensed renderer (20%). Incineration (10%) and the use of other mortality management methods (3%) were less common. (Figure 4-16) Some farm operations were reported as using more than one mortality management method.



**Figure 4-16. Mortality management methods.**

Additional analysis of mortality management methods by animal category (Figure 4-17) found that composting is the most common mortality management method used by CLEAN<sub>EAST</sub> farm

participants for dairy (39%), swine (48%), poultry (43%), and beef (38%). Licensed rendering was also frequently identified for dairy (29%), swine (20%), and beef (18%), but it was identified for only 5 poultry operations. The distribution of farm participants who indicated they managed mortality by burial was 39% beef, 28% dairy, and 14% swine. Incineration as a mortality management method was practiced at 23% of the poultry operations participating and 16% of the swine operations participating. A total of 128 farm participants (31%) had catastrophic mortality management plans prior to participating in the project.

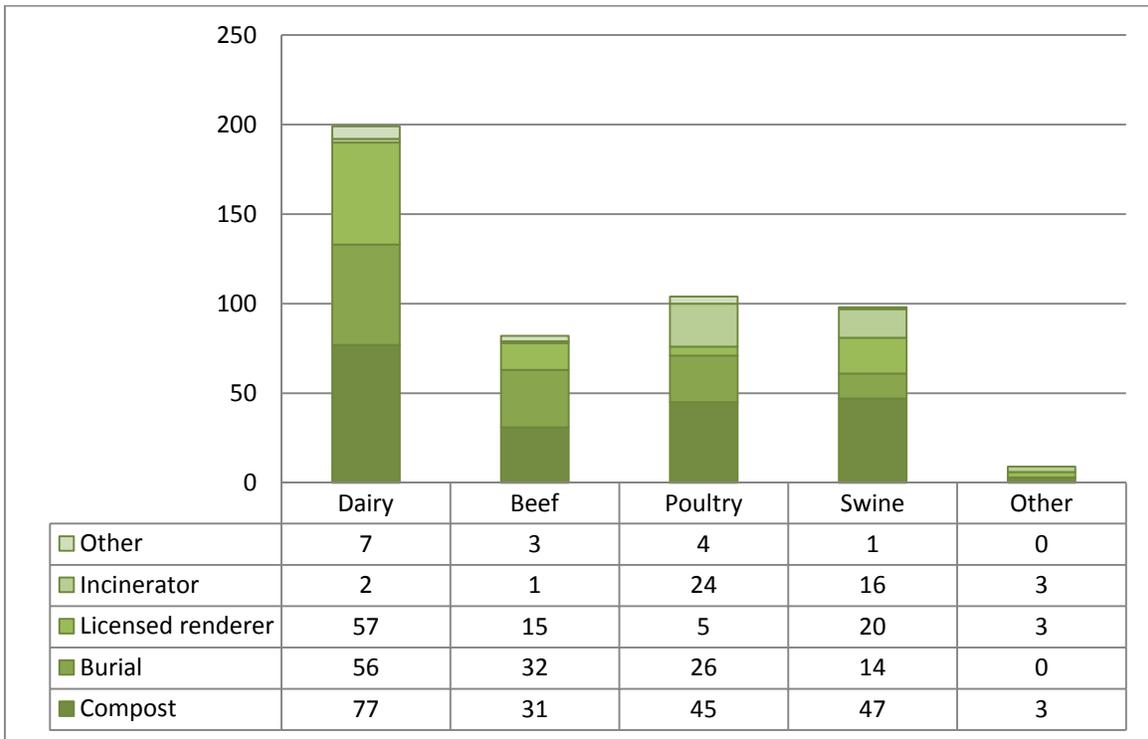
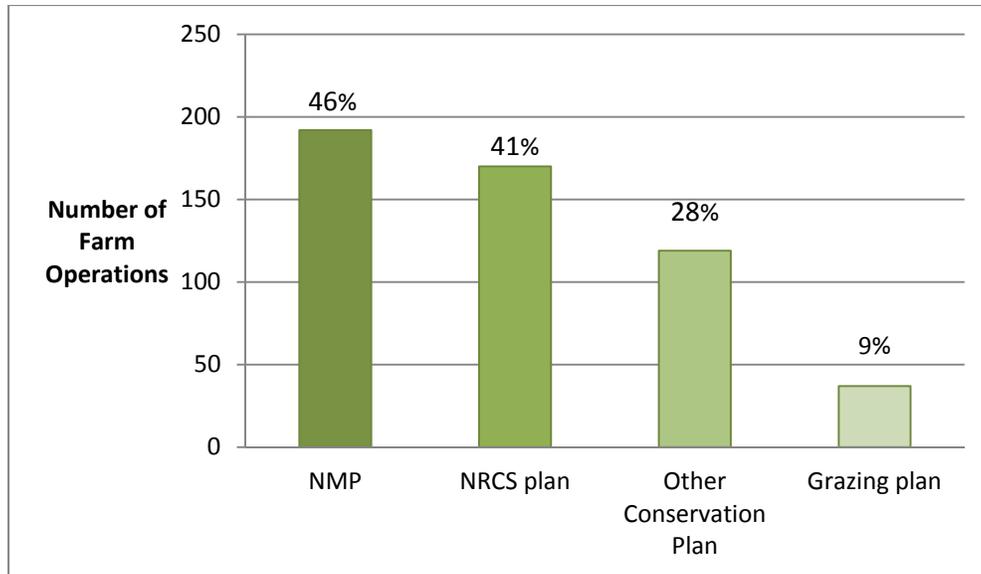


Figure 4-17. Mortality management methods by animal category.

#### 4.3.4 Nutrient Management Plans, Conservation Plans, and Grazing Plans

Livestock and poultry operations often use a variety of plans related to environmental practices. CLEAN<sub>EAST</sub> Project TAPs reported that the following plans were on file at the beginning of project services: 192 NMPs (46%); 170 NRCS Conservation Plans (41%); 119 (28%) Other Conservation Plans; and 37 Grazing Plans (9%) (Figure 4-18). It is important to note that a farm operator may have had more than one of these plans on file at the beginning of project services. Also, while farms indicated they had NMPs, farms often needed the NMPs updated due to the age of the NMP on file or changes in the farm operation. Of the 178 participants without an NMP prior to the project, 158 were provided new NMPs for their operation.



**Figure 4-18. Frequency of nutrient management, NRCS conservation, and grazing plans among CLEAN<sub>EAST</sub> participants when entering the project.**

(Note: A farm may have more than one of these plans on-file.)

#### 4.3.5 Onsite Manure Utilization and Land Application Equipment Calibration

Approximately 367 (88%) of the farm participants utilize manure and wastewater onsite, while 124 (30%) operations export manure and/or wastewater for use offsite. (Farms were also reported as both using manure onsite and also exporting residual manure.)

For those farm participants who land apply manure onsite, during on-farm visits, TAPs collected information on whether the farm operator calibrates the manure land application equipment. Results showed that of those responding, 46% of farm operators were calibrating their manure application equipment, while the remaining 54% were not. (Note: The 54% may contract custom applicators.) Evidence of equipment calibration may be a positive indicator that the farm operator is aware of the importance of calibration from an environmental protection perspective; however, the project was unable to ascertain and confirm that each farm operator consistently and accurately calibrates equipment to land apply manure at agronomic rates.

#### 4.3.6 Water Resources-related Practices

Responses to questions in the *Farm Operation Introductory Profile* (Farm Profile) and the EA Tool that are related to water use/management practices were used to provide a baseline evaluation on the drought management practices of the participating farms. Questions were reviewed in the Profile and from the Environmental Assessment Tool that related to one of two broad categories that correlate to drought management practices: 1) infrastructure related to supply and/or access to water resources and 2) infrastructure related to stormwater management. For this assessment, questions that had a “yes” or “no” response were pulled from the participant response database. In reporting the results and to ensure that the

same populations were compared for each question, a conservative approach was used to estimate the existence of a specific infrastructure of the data; for example, in reporting the number of farms that have a backup water source, only the number of farms that responded with “yes” were included, those that didn’t provide any answer were assumed to not have a backup water source. It is important to note the very preliminary nature of this analysis and not overstate the conclusions drawn. A more in-depth study on farm drought management practices that entails a detailed review of their water supplies, sources, and usage rates would be needed to draw firmer conclusions and is beyond the scope of this analysis. However, the data gathered do provide valuable insight into the current resources of the farm cohort.

The two major questions in the Farm Operation Introductory Profile that were analyzed both provide information on the farms’ access to water resources. The questions reviewed were:

- Are there wells (drinking water or other) onsite?
- Does the farm have a backup water source?

Out of the 414 respondents for the farm profile, 373 (90%) reported that they have either a drinking water or other type of water well onsite. Since water from wells is generally less sensitive to the effects of drought than surface water, this suggests that a majority of farms have water resources that would provide some resistance to a drought. Conversely, only 128 respondents (31%) indicated that they have a backup water source for their farms, which suggests a majority of the farms (69%) would be vulnerable to an extended drought that taxed their sole water source.

The EA Tool included questions on stormwater management, water conservation, and irrigation. Questions relating to stormwater management were reviewed since farms with the infrastructure to divert and collect stormwater have the potential to utilize this resource, even if they are not actively doing so. Questions analyzed from this dataset include:

- Related to animal housing buildings and stormwater management:
  - Is storm water runoff diverted away from building?
  - Do buildings have roof gutters and downspouts?
- Related to management practices associated with holding areas, lots, and pastures:
  - Is runoff from holding area/lot collected?
  - Is building /other runoff diverted away?
  - Is there a perimeter berm to hold runoff?
- Related to conservation management practices:
  - Is there a water facility onsite?
  - Does the farm practice irrigation?

Of the 283 respondents to the EA Tool, 217 (77%) indicated that they divert runoff from their buildings, while only 97 (35%) have roof gutters and downspouts installed. Sixty (21%) respondents indicated that they collect runoff from holding areas, lots, and pastures. There are fewer that utilize

stormwater management practices away from buildings, as only 101 (36%) respondents indicated that they divert stormwater away from holding areas, lots, and pastures, and 60 (21%) reported that they utilize a perimeter berm to hold runoff. Under the conservation management practices category, 75 (26%) of the 283 respondents reported that they utilize a watering facility, while only 6 (2%) indicated that they had an irrigation management plan or kept irrigation records. This suggests that implementing irrigation is the largest opportunity for farms to improve water use efficiency and improve their resistance to the effects of drought.

#### 4.4 CLEAN<sub>EAST</sub> Project Technical Services

##### 4.4.1 EA and NMP Technical Services Provided

Farm participants had the option of requesting an EA, an NMP, or both an EA and an NMP. In the EPA’s 2007 solicitation, the Agency appeared to place equal emphasis on providing EAs and NMPs with no stated preference in numeric goals. In response, RTI’s 2007 proposal established the goal of performing 500 EAs and developing 320 NMPs. Upon completion of the project’s farm services, the CLEAN<sub>EAST</sub> Project team had performed 297 EAs and 393 NMPs. As described in **Section 4.1**, this difference in demand versus proposed goals was attributed, in part, to the 2008 Final CAFO Rule. The CLEAN<sub>EAST</sub> Project delivered 285 new NMPs and 108 NMP updates. EA Reports were provided to 297 participants.

##### 4.4.2 Recommended Best Management Practices (BMP) Distributions Farm Participants

As part of the *Project Performance and Results Tracking Strategy* (**Appendix K**), RTI developed a frequency count of EA and NMP recommendations made by TAPs across farm participants. TAP recommendations were categorized based on BMP NRCS codes (<http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/technical/alphabeticall/ncps/?&cid=nrcs143026849>) or by general practices if an NRCS code could not be applied. A total of 1,637 recommendations were made to 419 farm operations in the project. The 15 most frequently cited categories of recommendations are presented in **Table 4-14**. (A complete list of recommendations and frequencies is provided in **Appendix T**.)

**Table 4-14. Accounting of Top 15 EA and NMP Categories of Recommendations<sup>a</sup>**

NRCS BMP Code <sup>b</sup>	Recommendation Category	Frequency of TAP Recommendation to Farm Participant
313	Waste Storage Facility	289
	▪ Waste Storage Facility (Increase Capacity Or Add New Facility)	136
	▪ Waste Storage Facility (O&M)	123
	▪ Waste Storage Facility (Install Permanent Marker)	20
	▪ Milk Parlor Wastewater Treatment	9
	▪ Waste Storage Facility (Liner)	1

(continued)

Table 4-14. Accounting of Top 15 EA and NMP Categories of Recommendations<sup>a</sup> (continued)

NRCS BMP Code <sup>b</sup>	Recommendation Category	Frequency of TAP Recommendation to Farm Participant
590	Nutrient Management Modifications <ul style="list-style-type: none"> <li>▪ Nutrient Management (Combination of Applying Setbacks, Method, Rates, Timing, Sampling And Setbacks)</li> <li>▪ Nutrient Management (Sampling)</li> <li>▪ Nutrient Management (Application Timing)</li> <li>▪ Nutrient Management (Application Rates)</li> <li>▪ Nutrient Management (Application Method)</li> </ul>	225 95 85 30 10 5
748	Recordkeeping	128
558	Roof Runoff Structure	115
561	Heavy Use Area Protection	83
472	Access Control/ Livestock Exclusion Area	60
316	Animal Mortality Facility	59
317	Composting Facility	59
N/A	Calibrate Application Equipment	57
359	Waste Treatment Lagoon	48
635	Vegetative Treatment Area	47
528	Prescribed Grazing	31
710	Secondary Containment (Fuel)	31
312	Improve Leachate Collection	30
412	Grassed Waterway	26

<sup>a</sup> More than one practice may be recommended at a single operation.

<sup>b</sup> NRCS BMP Code that most closely matches the TAP recommendation.

Farm participants often received multiple recommendations within one BMP category, in which case, each individual recommendation was included in the final tabulation. Recommendations were grouped into categories that could cover a number of distinct subcategories. For example, subcategories for recommendations assigned to NRCS BMP Code 313 are associated with the waste storage facility and were used to distinguish between recommendations to increase manure storage capacity versus improving an existing manure storage facility (**Table 4-15**). A complete list of subcategories by NRCS BMP Code is presented in **Appendix T**.

Table 4-15. Example of Subcategory Recommendations for NRCS Code 313

Subcategory for NRCS BMP Code 313	Example of recommendation as cited in EA or NMP
Waste Storage Facility	Increase manure storage capacity
Waste Storage Facility (Install Permanent Marker)	Install level gauges on manure storage ponds
Waste Storage Facility (O&M)	Remove excessive vegetation from manure storage pond banks

Trends in TAP recommendations were observed by the farm participants' predominant animal category (**Table 4-16**). Recommendations for waste storage facilities, nutrient management modifications, recordkeeping, and animal mortality facilities occurred frequently across all four major animal categories. Recommendations for adding or improving heavy-use area protection, addressing animal access control, making improvements to vegetated treatment areas, improving leachate collection systems, and implementing prescribed grazing occurred frequently for cattle (beef and dairy) operations (66, 47, 43, 28, and 24 occasions, respectively) and were less common for poultry and swine operations (recommended only 14, 13, 3, 2, and 7 occasions, respectively). Swine operations often received TAP recommendations pertaining to waste treatment lagoons and composting facilities, (36 and 25 respectively). Dairy operations also had a significant number of recommendations for composting facilities (23).

Recommendations also were sorted by farm size, as presented in **Table 4-17**. Waste storage facilities were recommended most frequently for small (161), medium (105), and large operations (23). Additional frequent recommendations were nutrient management modifications for medium operations (94), small operations (92), and large operations (39); roof runoff structures for small (75), medium (3), and large (10) operations; and recordkeeping (69, 46, and 13) for small, medium, and large operations, respectively.

**Table 4-16. Top 15 EA and NMP Recommendations by Animal Category<sup>a</sup>**

NRCS BMP Code <sup>b</sup>	Recommendation Category	Beef	Dairy	Poultry	Swine	Other	Total
313	Waste Storage Facility	51	131	48	59	0	289
590	Nutrient Management Modifications	25	63	69	67	1	225
748	Recordkeeping	23	40	29	35	1	128
558	Roof Runoff Structure	25	66	4	18	2	115
561	Heavy Use Area Protection	23	43	11	3	3	83
472	Access Control/ Livestock Exclusion Area	17	30	7	6	0	60
316	Animal Mortality Facility	8	16	20	15	0	59
317	Composting Facility	6	23	3	25	2	59
N/A	Calibrate Application Equipment	9	18	11	19	0	57
359	Waste Treatment Lagoon	4	5	3	36	0	48
635	Vegetative Treatment Area	15	28	3	0	1	47
528	Prescribed Grazing	6	18	5	2	0	31
710	Secondary Containment (Fuel)	8	13	1	9	0	31
312	Improve Leachate Collection	3 <sup>c</sup>	25	1 <sup>c</sup>	1 <sup>c</sup>	0	30
412	Grassed Waterway	6	9	3	8	0	26

<sup>a</sup> More than one practice may be recommended at a single operation.

<sup>b</sup> NRCS Practice code that most closely matches the TAP recommendation.

<sup>c</sup> Leachate is only found at operations with dairy cattle, the operation(s) has dairy cattle in addition to the primary animal category.

N/A means that the TAP recommendation did not apply to a specific NRCS Practice Code.

Table 4-17. Top 15 EA and NMP Recommendations by Farm Size<sup>a</sup>

NRCS BMP Code <sup>b</sup>	Recommendation Category	Large	Medium	Small	Total
313	Waste Storage Facility	23	105	161	289
590	Nutrient Management Modifications	39	94	92	225
748	Recordkeeping	13	46	69	128
558	Roof Runoff Structure	10	30	75	115
561	Heavy Use Area Protection	5	16	62	83
472	Access Control/Livestock Exclusion Area	6	19	35	60
316	Animal Mortality Facility	4	28	27	59
317	Composting Facility	5	25	29	59
N/A	Calibrate Application Equipment	7	22	28	57
359	Waste Treatment Lagoon	12	20	16	48
635	Vegetative Treatment Area	5	8	34	47
528	Prescribed Grazing	3	5	23	31
710	Secondary Containment (Fuel)	3	12	16	31
312	Improve Leachate Collection	6	10	14	30
412	Grassed Waterway	2	8	16	26

<sup>a</sup> More than one practice may be recommended at a single operation. Note that small and medium farm sizes made up the majority of farm operations for the project.

<sup>b</sup> NRCS Practice code that most closely matches the TAP recommendation.

N/A means that the TAP recommendation did not apply to a specific NRCS Practice Code.

A complete list of recommendations by animal category and by farm size categories is presented in **Appendix T**.

#### 4.4.3 BMP Environmental Benefits Results

##### 4.4.3.1 Nutrient Environmental Release Potential Indicator Tool (NERPI)

The NERPI is a gross measure of the change in the amount of nitrogen (N) and phosphorus (P) potentially available for release into the environment following implementation of the CLEAN<sub>EAST</sub> TAP-recommended BMPs. The potential release values are derived from the NMPs prepared for the CLEAN<sub>EAST</sub> Project farm participants. To determine the change in N and P amounts, a gross nutrient balance is calculated for each participating farm operation using the NRCS AWM software program (NRCS, 2010). The AWM software uses procedures and calculations from the USDA-NRCS *Agricultural Waste Management Field Handbook* (NRCS, 2009) to calculate the gross nutrient balance based on a farm's animal categories and populations, animal waste management practices, and crops receiving land application of animal manure and wastewater. For each participating farm receiving a CLEAN<sub>EAST</sub> NMP, two runs of the AWM program were performed: (1) baseline conditions (i.e., the existing practices at time of the TAP's farm visit), and (2) TAP-recommended BMP conditions (i.e., it is assumed the farm operation fully implements all CLEAN<sub>EAST</sub> TAP recommendations). The difference between the nutrient

balance predictions for the two runs represents the change in the amount of N and P potentially available for release into the environment:

$$\text{NERPI Reduction} = [\text{AWM Run}]_{\text{Baseline}} - [\text{AWM Run}]_{\text{NMP Full Implementation}}$$

The NERPI results place farm participants in one of three categories indicative of potential nutrient reductions:

Before CLEAN <sub>EAST</sub> TAP recommendations	Post- CLEAN <sub>EAST</sub> TAP recommendations (assuming 100% implementation)
Category 1: The number of farms where nutrients were originally applied to land in excess prior to CLEAN <sub>EAST</sub> TAP recommendations. Implementing the TAP recommendations will use all nutrients available from manure application <i>and</i> allow for additional nutrient application as needed.	
<i>Excess of Nutrients</i>	 <i>Nutrient Deficit</i>
Category 2: The number of farms where the nutrients were originally applied to land in excess prior to TAP recommendations. AWM indicates that implementing the CLEAN <sub>EAST</sub> TAP recommendations will increase the utilization of nutrients applied but may not entirely eliminate the potential runoff of excess nutrients.	
<i>Excess of Nutrients</i>	 <i>Lowered Excess of Nutrients</i>
Category 3: The number of farms where the nutrient was not applied in excess prior to CLEAN <sub>EAST</sub> <sup>TM</sup> TAP recommendations, i.e., the operation has the option of supplementing nutrients.	
<i>Deficit of Nutrients</i>	 <i>Increased Nutrient Deficit</i>

It is important to emphasize that the AWM software was adapted for use by the CLEAN<sub>EAST</sub> Project. This application of the AWM software is not its stated purpose; therefore, the results should be treated as general approximations, presuming each farm operation fully implements the CLEAN<sub>EAST</sub> TAP NMP recommendations. Further, AWM modeling may not show a nutrient benefit for certain operational circumstances, such as when the CLEAN<sub>EAST</sub> NMP recommends spreading to fewer acres; the NMP is written to respond to the farm operator’s request for an increase in animal population; or the farm operator’s current documented practices are identical to the CLEAN<sub>EAST</sub> NMP recommendations. Approximately 66% (259) of the 393 farm participants receiving CLEAN<sub>EAST</sub> NMPs experienced one of these three scenarios and, therefore, required qualitative reviews beyond the NERPI computed results. (For the qualitative analysis, EA Reports and NMP documents were reviewed to catalogue the TAP-recommended water quality–related BMPs for each farm operation.)

**Table 4-18** shows results for the 133 (34%) farm participants to which the NERPI could be applied quantitatively. The NERPI results showed that “*Excess of N → N Deficit*” situations occurred at 4 farms (less than 4% of 113 farm participants) and that “*Excess of N → Lowered Excess N*” situations occurred at 8 farms (less than 7% of 113 farm participants). Another 101 farms (89% of the 113 farm

participants) were found to begin with a N deficit and, after implementing the CLEAN<sub>EAST</sub> NMP, reduced their deficit even further (*Deficit of N → Increased N Deficit*). For P reductions, 20 of 113 farms processed in the NERPI showed improvements from *Excess of P → P Deficit*, 66 of 113 farms showed *Excess of P → Lowered Excess of P*, and 27 of 100 farms showed *Deficit of P → Increased P Deficit*. Overall, the project does demonstrate that a significant number (85%) of the 133 NERPI-analyzed farms could achieve reductions in N and/or P if CLEAN<sub>EAST</sub> NMPs are fully implemented. It is important to note that implementing an NMP may decrease the potential for N release to the environment (e.g., leaching) while it has no impact on the potential for P release. The inverse impact may also be true; therefore, a farm may show a decrease in N available for environmental release but not show a decrease in P available for release. This impact is shown in the ‘Competing Nutrient outcomes’ category in Table 4-18, and a total of 20 farms fit in this category. (Another 43 farms had no change in practices and, therefore, no change in nutrient releases.)

Appendix R provides additional information about the NERPI.

**Table 4-18. CLEAN<sub>EAST</sub> Nutrient Environmental Release Potential Indicator Tool (NERPI)**

Nutrient	Excess of Nutrients--> Nutrient Deficit <sup>a</sup>	Excess of Nutrients --> Lowered Excess <sup>b</sup>	Deficit of Nutrients --> Increased Deficit <sup>c</sup>	Total Number of Farms with N and P Benefit	Competing Nutrient Outcomes <sup>d</sup>	Total Number of Farms Processed Using NERPI	Farms with No Change in Practices
Nitrogen (N)	4	8	101	113	20	133	43
Phosphorous (P)	20	66	27	113	20	133	43

- <sup>a</sup> **Excess of Nutrients → Nutrient Deficit:** The number of farms where nutrients were originally applied to land in excess prior to TAP recommendations. Implementing the CLEAN<sub>EAST</sub> TAP recommendations will use all nutrients available from manure application *and* allow for additional nutrient application as needed.
- <sup>b</sup> **Excess of Nutrients → Lowered Excess of Nutrients:** The number of farms where the nutrients were originally applied to land in excess prior to TAP recommendations. AWM indicates that implementing the CLEAN<sub>EAST</sub> TAP recommendations will increase the utilization of nutrients applied but may not entirely eliminate the potential runoff of excess nutrients.
- <sup>c</sup> **Deficit of Nutrients → Increased Nutrient Deficit:** The number of farms where the nutrient was not applied in excess prior to CLEAN<sub>EAST</sub> TAP recommendations, i.e., the operation has the option of supplementing nutrients.
- <sup>d</sup> **Competing Nutrient Outcomes:** The number of cases where the potential to release one nutrient was reduced while the potential to release the other nutrient was increased.

#### 4.4.3.2 Ammonia Air Emissions Mitigation Indicator Tool (AAEMI) Results

The AAEMI was used to assess the change in ammonia (NH<sub>3</sub>) emissions from implementation of recommended BMPs at CLEAN<sub>EAST</sub> Project farms for which a final EA Report or NMP was completed. Farm-specific information extracted from the farm’s Farm Operation Introductory Profile and a completed EA Report or NMP was used to fill in values for the required tool user input parameters, as applicable to the farm’s livestock or poultry operations. While the AAEMI’s default value was always selected for the nitrogen balance, the tool also contains other related parameters that the user can choose to either use the tool default values or input farm-specific values (e.g., average animal weight, animal excretion rate, percentage of nitrogen in solids removed in a solids separator).

RTI's application of the AAEMI to CLEAN<sub>EAST</sub> Project farms showed that the tool is simple to use and the required information from the farm documents can be entered readily into the tool. However, very few of the farms showed any change in NH<sub>3</sub> emissions between the current livestock or poultry practices reported for the farm and the operations, assuming that all of the CLEAN<sub>EAST</sub> Project's recommended BMPs were implemented. One possible partial explanation for these results is the AAEMI tool's capability to measure a limited number of the **NH<sub>3</sub> emission-specific BMPs**. Follow-up examination of the individual BMPs recommended in the farm's EA Report or NMP showed that, in general, the reports did not include recommended BMPs for directly addressing NH<sub>3</sub> air emissions that are measurable by the AAEMI.

To investigate further the reasons why TAPs working with the CLEAN<sub>EAST</sub> Project farm participants did not recommend BMPs that decreased NH<sub>3</sub> emissions, RTI prepared and distributed a questionnaire to the TAPs. The questionnaire consisted of questions regarding specific BMPs that the TAPs would likely recommend for controlling/decreasing NH<sub>3</sub> air emissions from livestock and poultry operations. Responses were received from 13 of the TAPs who completed farm-related visits for the CLEAN<sub>EAST</sub> Project. While this questionnaire did not represent a statistically significant sampling of all NRCS-registered TSPs that prepare NMPs for livestock and poultry operations, the questionnaire results do provide insight into possible reasons why the AAEMI did not measure change in NH<sub>3</sub> emissions between the current livestock or poultry practices reported for the farm and the recommended BMPs assumed to be implemented.

The results indicate that only about one-half of the TAPs had received training specifically on the use of BMPs for decreasing NH<sub>3</sub> emissions from livestock and poultry operations. Regardless of training, all of the TAPs could identify individual BMPs that they would likely recommend to meet a farm-specific need to decrease NH<sub>3</sub> emissions from animal housing, manure storage/treatment, and land application activities. Among the potential reasons indicated by the TAPs for why more NH<sub>3</sub> emission-decreasing BMPs are not recommended as part of an EA or NMP were the following:

- No existing regulations require use of BMPs to decrease NH<sub>3</sub> air emissions. However, an NRCS BMP for air quality does exist.
- Guidance to NRCS-registered TSPs and funding support to farm operators from government agencies appear to be focused primarily on implementing BMPs for water quality protection.
- Certain BMPs to decrease NH<sub>3</sub> emissions can conflict with BMPs to protect water quality.
- Many of the surveyed TAPs were reluctant to recommend BMPs that decrease NH<sub>3</sub> air emissions because substantial financial investment would be required to implement the BMPs (e.g., converting from spray irrigation to soil injection, installation of filters on housing ventilation systems, installing covers on manure treatment/storage units).

For the surveyed TAPs who had not received training specifically on the use of BMPs for decreasing NH<sub>3</sub> emissions, additional training would be helpful.

In conclusion, the findings from application of this tool to farms participating in the CLEAN<sub>EAST</sub> Project are as follows:

- **Air Quality Issues Were Not Routinely Addressed by TAPs.** The results show that few changes in NH<sub>3</sub> air emissions were predicted to occur if CLEAN<sub>NEAST</sub>-recommended NMPs and EAs were implemented. Further review of the EA Reports and NMPs indicates that the reports routinely did not include BMPs specific to decreasing NH<sub>3</sub> emissions. A survey of a subset of CLEAN<sub>NEAST</sub> TAPs indicates a number of reasons, including lack of regulations, current guidance focusing on water quality–related BMPs, limited training, and cost of NH<sub>3</sub> emissions control-related BMPs.
- **Need Exists for a Tool to Measure the Benefits of BMPs to Air Quality.** Application of the CLEAN<sub>NEAST</sub> AAEMI shows that it is a readily useable indicator for measuring benefits of BMPs to air quality. Further development of the AAEMI is needed to expand its capability to measure the benefits of the full array of BMPs available for controlling NH<sub>3</sub> emissions. RTI plans to continue its efforts to refine the AAEMI for use as an air emissions assessment tool.
- **Need Exists for Expanded Guidance and Training for NRCS-registered TSPs on the Use of BMPs to Improve Air Quality.** The experience of the CLEAN<sub>NEAST</sub> Project suggests that the current focus of guidance and training for TSPs is on the use of BMPs that address water quality issues, not air quality issues. The outcomes from the air quality studies conducted as part of the 2006 National Air Emissions Monitoring Study (NAEMS) are expected to provide increased awareness and understanding of the environmental impacts of NH<sub>3</sub> air emissions from livestock and poultry operations and the development of improved guidance for implementing the BMPs that are most effective and appropriate for controlling these NH<sub>3</sub> emissions. Implementing the outcomes of the NAEMS study through expanded training and guidance to TSPs should lead to the inclusion of more BMP recommendations by TSPs that will benefit air quality and, in turn, water quality and human health.

**Appendix S** provides additional information about the AAEMI.

#### 4.4.4 BMP Recommendations and Implementation

RTI has implemented several follow-up activities to measure project performance and analyze the data collected for the project. Performance measures are used to quantify the potential environmental benefits resulting from the CLEAN<sub>NEAST</sub> Project. Since the CLEAN<sub>NEAST</sub> Project reports were delivered to farm operators through Year 4 of the 5-year project, all TAP-recommended BMPs were not expected to be fully implemented by the project's closure. The time required for farms to implement recommendations may, in some instances, be attributed to the participant's ability to secure cost share for BMP implementation, delivery time for new equipment, and making changes to the farm's crop rotation cycle, among others. Therefore, potential outcomes for the CLEAN<sub>NEAST</sub> Project are based on assuming the participant implements 100% of the TAP recommendations, but not necessarily within the timeframe of the project. See **Section 4.4.2** for further discussion on BMP implementation.

#### 4.5 CLEAN<sub>NEAST</sub> Project Performance Measurements Results

**Section 3.3.3** describes that legislative directives of the GPRA require that the EPA ensure that work funded through EPA assistance agreements achieves environmental benefits for the U.S. taxpayer.

To meet these directives, the EPA tracks the environmental results achieved by projects funded under assistance agreements using a set of project-specific performance measures. The CLEAN<sub>EAST</sub> Project provided measurable performance parameters for tracking in its May 2009 *Program Performance and Results Tracking Strategy* (see **Appendix K**). **Tables 4-19 through 4-21** present the performance measures in terms of outputs, outcomes, and project-specific activities tabulated in the May 2009 strategy and in **Section 3.3.3** of this report.

**Table 4-19. CLEAN<sub>EAST</sub> Project: EPA Outputs Tracking Performance Measures**

Desired Output	Performance Measure Parameter	Project Output
Recruit farm owners to voluntarily participate in the CLEAN <sub>EAST</sub> Project.	Potential farm participants' Inquiries about technical services offered by CLEAN <sub>EAST</sub> Project.	EAs requested by applicants: 352 NMPs requested by applicants: 544.
	Farm operators receiving CLEAN <sub>EAST</sub> Project technical services.	429 farm operations received CLEAN <sub>EAST</sub> services.
Perform EAs and prepare new or update existing NMPs for livestock and poultry operations potentially impacting water bodies in states served by the CLEAN <sub>EAST</sub> Project.	EA tools for application to farms with livestock and poultry operations.	Tool developed (see <b>Appendix G</b> ). Tool is available on CLEAN <sub>EAST</sub> website for public use.
	NMP tools for application to farms with livestock and poultry operations.	Protocol developed (see <b>Appendix J</b> ). Protocol is available on CLEAN <sub>EAST</sub> website for public use.
	EAs performed for CLEAN <sub>EAST</sub> Project farm participants.	297 EAs performed and reports delivered to farm participants.
	NMP updates prepared for CLEAN <sub>EAST</sub> Project farm participants.	108 NMP updates performed and reports delivered to farm participants.
	New NMPs prepared for CLEAN <sub>EAST</sub> Project farm participants.	285 new NMPs written and delivered to farm participants.
	Geographic distribution of livestock and poultry operations receiving CLEAN <sub>EAST</sub> Project technical services.	Services provided in 20 of 27 states. Services were not requested in 7 states ( <b>Section 4.1</b> ).
Compile a database of non-confidential information (Farm Participant Database) from farm visits for assessing extent of adverse impacts before and after CLEAN <sub>EAST</sub> services.	Aggregated, non-confidential information collected by CLEAN <sub>EAST</sub> Project related to sources and mitigation of nutrient runoff and NH <sub>3</sub> air emissions from farm participants.	Database increased the understanding of farm participants overall but did not statistically represent the general AFO population.
Expand availability of trained professionals capable of performing EAs and preparing NMPs for livestock and poultry operations potentially impacting water bodies.	CLEAN <sub>EAST</sub> Project TAP subcontractors.	Eight TAP consulting companies.
	CLEAN <sub>EAST</sub> Project training sessions.	Six training sessions.
	CLEAN <sub>EAST</sub> Project TAPs trained to use EA and NMP tools.	RTI trained all 57 CLEAN <sub>EAST</sub> TAPs to perform EAs and prepare NMPs consistent with the CLEAN <sub>EAST</sub> Project.
	Geographic distribution of trained CLEAN <sub>EAST</sub> Project TAPs.	TAPs were NRCS-registered TSPs and were CLEAN <sub>EAST</sub> trained and available to serve in 20 of the 27 states served by the Project. (TAPs were NRCS-registered for portion of the remaining 7 states as well.)

**Table 4-20. CLEAN<sub>EAST</sub> Project: EPA Outcomes Tracking Performance Measures**

Desired Outcome	Performance Measure Parameter	Project Outcome
Increased number of partially or fully restored nutrient-impaired water bodies.	Watersheds with nutrient-impaired water bodies and farms participating in the CLEAN <sub>EAST</sub> Project.	72% of participants were in counties designated with a Hi-TMDL rating.  Based on the Chesapeake Bay case study in <b>Section 5</b> , if these Bay-area farm participants are assumed to be representative of the total livestock and poultry farm population (55,600) in the Bay watershed, and it is assumed each non-participating farm achieved the level of nitrogen and phosphorus reductions estimated for the farm participants, then those reductions would achieve 78% of the nitrogen-reduction goal and 39% of the phosphorus-reduction goal for the entire watershed’s agricultural sector (comprised of 83,775 farms).
Mitigation of adverse impacts from livestock and poultry operations on the environment as a result of implementing EAs and NMPs	Nutrient Environmental Release Potential Indicator Tool (NERPI). A measure of the change in the amount of nitrogen and phosphorus nutrients potentially available for release into environment following implementation of the BMPs included in the CLEAN <sub>EAST</sub> NMPs and EA Reports.	The NERPI tool could be applied to 133 of 393 farm participants. 85% of the 133 farms were predicted to have decreases in nitrogen and/or phosphorus after full implementation of CLEAN <sub>EAST</sub> NMPs (see <b>Section 4.4.3.1</b> ).
	Ammonia Air Emissions Mitigation Indicator Tool (AAEMI). A measure of the change in NH <sub>3</sub> air emissions following implementation of the BMPs included in the CLEAN <sub>EAST</sub> NMPs and EA Reports.	EA Reports and NMPs did not include NH <sub>3</sub> air emissions BMPs. A survey of TAPs revealed (1) no existing regulations require use of NH <sub>3</sub> reducing BMPs, (2) guidance to TSPs and funding support to farm operators appears to be focused on water quality-related BMPs, (3) certain NH <sub>3</sub> reducing BMPs can conflict with water quality BMPs, 4) TAPs were reluctant to recommend NH <sub>3</sub> -reducing BMPs because of cost, 5) a portion of the TAPs had not received training on NH <sub>3</sub> issues (see <b>Section 4.4.3.2</b> ).
	Percent distribution of BMPs recommended by TAPs in EAs and NMPs prepared for farms participating in the CLEAN <sub>EAST</sub> Project that the farm participants are planning to or have implemented (as of project end date).	Based on the analysis of discussions with 56 farm participants in the follow-up site visits, approximately 44% of the TAP EA recommendations have been implemented.  Based on the analysis of discussions with farm participants in the follow-up site visits, approximately 70% of the TAP NMP recommendations have been implemented.

(continued)

Table 4-20. CLEAN<sub>EAST</sub> Project: EPA Outcomes Tracking Performance Measures (continued)

Desired Outcome	Performance Measure Parameter	Project Outcome
Increased knowledge of environmental impacts and methods to mitigate adverse impacts from livestock and poultry operations.	Percent distribution of farms participating in CLEAN <sub>EAST</sub> Project by animal type, farm size, and geographic location categories.	Dairy 42% Swine 21% Poultry 18% Beef 16% Other 3% (See <b>Section 4.2</b> for additional details.)
	Types and percent distribution of animal waste management practices identified at farms participating in the CLEAN <sub>EAST</sub> Project.	76% of farm participants keep animals in holding areas or lots. Dry manure or litter storage systems were the most frequent storage methods reported. Composting was the most common mortality management method (47% of participants). (See <b>Section 4.3</b> for additional details.)
	Types and percent distribution of BMPs for livestock and poultry operations currently used at farms participating in the CLEAN <sub>EAST</sub> Project.	BMPs in use were captured by responses in the Farm Operation Introductory Profile and Farm Operation Onsite EA Tools. The data summary is in <b>Appendix T</b> .
	Types and percent distribution of BMPs for livestock and poultry operations recommended for use at farms participating in the CLEAN <sub>EAST</sub> Project.	The most common TAP recommendation overall fell under the Waste Storage Facility BMP Code 313 (See <b>Section 4.4</b> for additional details.)

Table 4-21. CLEAN<sub>EAST</sub> Project-Specific Activity Tracking Performance Measures

Tracking Objective	Performance Measure Parameter	Project Result
Awareness of technical services offered by CLEAN <sub>EAST</sub> Project by potential farm participants.	Inquires received about CLEAN <sub>EAST</sub> Project by method (e-mail, telephone, in-person conference contact, project brochure, publication ad, trade association, state/local farm agent, TAP).	Over 20,000 hits on the project website Homepage 135 Phone calls via the toll free number 40 emails via the dedicated email address
	Information sources by which farm operator applicants learned about CLEAN <sub>EAST</sub> Project by livestock type, farm size, and geographic location categories.	How participants find out about CLEAN <sub>EAST</sub> : TAPs: 242 Local extension agent: 129 Local conservation district: 37 NRCS office: 11
	Applications for CLEAN <sub>EAST</sub> Project technical services by livestock type, farm size, and geographic location categories.	577 applicants. Distribution by region and primary animal category is available in <b>Section 4.1</b> .
	Technical services requested by farm operator applicants by livestock type, farm size, and geographic location categories.	297 EAs; 393 NMPs (285 new NMPs plus 108 NMP updates).

(continued)

Table 4-21. CLEAN<sub>EAST</sub> Project-Specific Activity Tracking Performance Measures (continued)

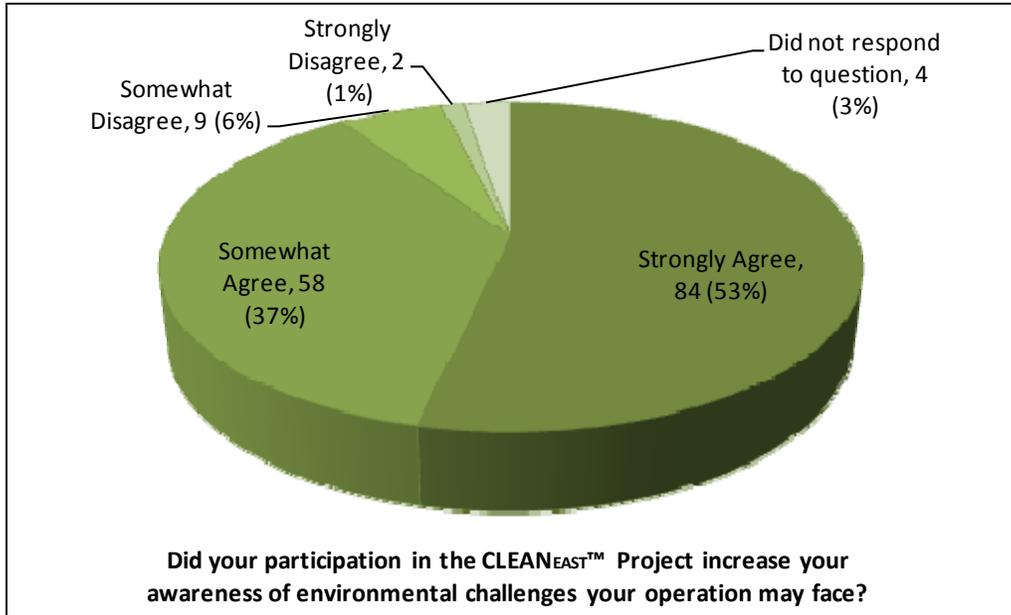
Tracking Objective	Performance Measure Parameter	Project Result
Timeliness of CLEAN <sub>EAST</sub> Project to provide requested technical services to farm participants.	Initial contact with farm participant: response time.	For farm applicants not waitlisted, RTI's goal was to respond within 7 business days of receiving application.
	Delivery time of final documents applicable to requested service to farm operator.	Average number of days between assigning TAP to farm participant and delivery of Final Report: <ul style="list-style-type: none"> <li>▪ EA: 173 days</li> <li>▪ NMP: 216 days</li> </ul> Time span includes farm participant's response time to provide soil and manure analyses, as well as time to formally approve draft report(s).
Quality of EAs and NMPs prepared for farm participants	Completeness of EA and NMP documents, as applicable, prepared by TAP.	RTI/NCSU reviewed the first 2 to 3 NMPs and EA Reports drafted by each TAP subcontractor. Subcontractor management was responsible for reviewing remaining reports for technical quality and adherence to project guidance and templates.
	Qualitative assessment of practicality of TAP's EA/NMP impact mitigation recommendations for implementation at a given farm considering technical and financial feasibility.	RTI/NCSU's evaluation of TAP recommendations was not feasible since RTI/NCSU staff were not on-farm.
Evaluation of individual TAP performance in delivering CLEAN <sub>EAST</sub> Project technical services.	Performance of individual TAP to provide requested technical services to farm participant in a timely manner and by providing high-quality deliverables.	Feedback from Participant's survey regarding satisfaction with TAP's timeliness and quality of reports delivered.  Review of periodic subcontractor progress reports.  Telephone calls with select farm participants. Telephone calls with select TAPs and their subcontractor representative. 90% of farm participants responding were satisfied with services.
Satisfaction of farm participants with technical services received from CLEAN <sub>EAST</sub> Project.	Qualitative farm operator assessment of EA and NMP assistance services, as applicable, received from TAP.	90% of respondents strongly agreed or somewhat agreed that the process increased their awareness of environmental challenges the operation may face. 93% strongly agreed that the CLEAN <sub>EAST</sub> TAP who assisted the farm provided a high-quality final report.

## 4.6 Farm Participant Response to CLEAN<sub>EAST</sub> Project Services Provided

### 4.6.1 Farm Operator Satisfaction Survey Results

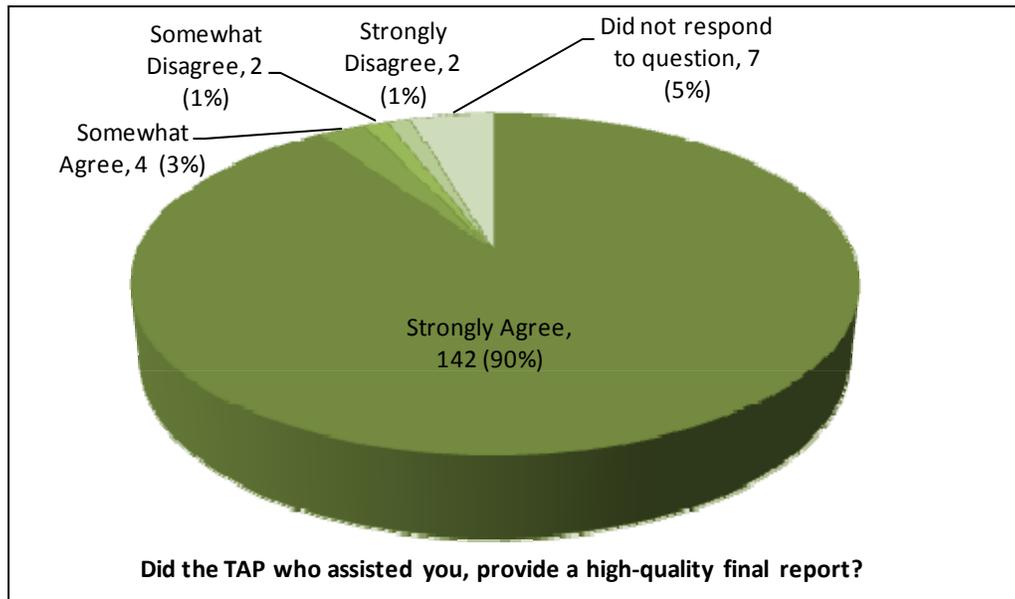
Upon completion of services to each farm, the farm participant was asked to complete a survey questionnaire regarding satisfaction. (**Appendix E**). A total of 157 farm operations (or 37% of

participating farms) completed and returned the survey questionnaire to RTI. An analysis of survey responses indicated that 90% of respondents strongly agreed or somewhat agreed that the process increased their awareness of the environmental challenges faced by their operations (**Figure 4-19**). In addition, 93% strongly agreed that the CLEAN<sub>EAST</sub> TAP who assisted the farm provided a high-quality final report (**Figure 4-20**).



**Figure 4-19. CLEAN<sub>EAST</sub> project benefit: Farm participants increased awareness of environmental challenges their operations may face.**

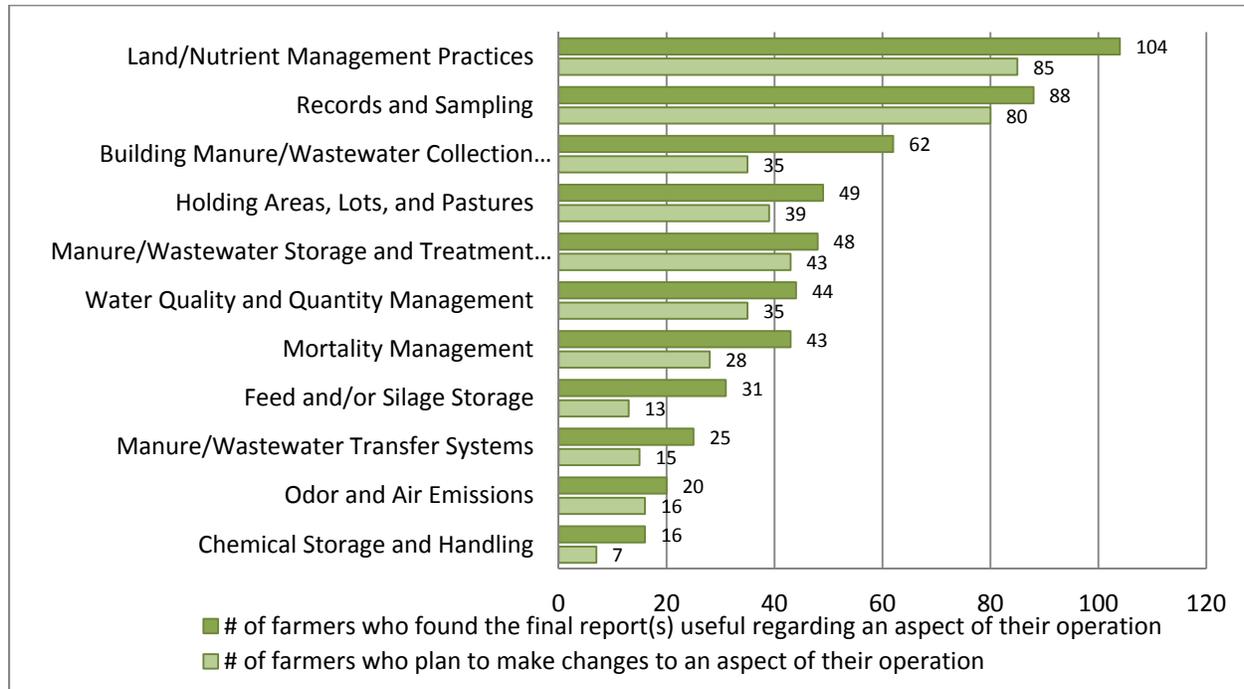
Note: 37% of participants responded to the survey questionnaire.



**Figure 4-20. CLEAN<sub>EAST</sub> project quality: Farm participants' views on quality of EA Reports and NMPs.**

Note: 37% of participants responded to the survey questionnaire.

The survey respondents also indicated the usefulness of TAP recommendations shown in **Figure 4-21**. For example, participants indicated whether they found the EA or NMP useful regarding an aspect of their operation and if they intended to adopt the TAP recommended changes regarding that area of the operation. Regarding farms' intent to make changes to particular aspect of their operation based on a TAP recommendation, farmers expressed intent 40% or more of the time. For 6 out of 11 aspects of the operation, farm participants expressed their intent to implement TAP recommendations 80% or more of the time. Depending on the recommendation, intentions to adopt ranged from approximately 40% (e.g., feed and/or silage storage and chemical storage and handling) to more than 90% (e.g., records and sampling, as well as manure/wastewater storage and treatment).



**Figure 4-21. Impact of CLEAN EAST based on responses to Participant Evaluation Survey.**

Note: 37% of participants responded to the survey questionnaire.

#### 4.6.2 Results of Farm Contacts to Assess Project Performance

The CLEAN EAST Project Team conducted follow-up site visits and telephone calls to 268 (64%) farm participants (i.e., 56 follow-up site visits and 212 follow-up telephone calls) to assess the operators' extent of implementing TAP recommendations. CLEAN EAST Project staff and/or the TAPs reviewed each recommendation or BMP noted in the final EA Reports and/or NMPs for the farm operation to determine whether the participant implemented the recommendation. If it was found that the operation did not implement the recommendation, staff documented the reasons why any recommendation was not implemented.

### 4.6.2.1 Follow-up Site Visit Results

Out of the 56 follow-up site visits, 47 operations had an EA report and 55 had NMP services. A total of 830 recommendations, total EA plus NMP, were made for the 56 farms receiving follow-up site visits. Of these 830 recommendations, a total of 480 recommendations were implemented. [It should be noted that TAPs occasionally provided the same recommendations in both the EA and NMP to the farm participant in their final EA and NMP reports; therefore, the recommendation may appear as an EA recommendation and an NMP recommendation in summary tables below. RTI chose to keep all occurrences of recommendations because the two reports were provided for different purposes: the EA recommendations were provided to address a variety of environmental issues<sup>9</sup> ranging from overall operations conditions and irrigation/hydrological features to animal manure storage conditions and conservation management practices, whereas the NMP recommendations were given to specifically address nutrient management and often addressed state requirements. In addition, the recommendation counts for the 56 farms cited for follow-up site visits reflect more detailed articulation of basic recommendations (and are thus greater in number) than the remainder of farms' recommendations in the project.

#### Environmental Assessment Recommendations

A total of 385 EA recommendations were made to the 47 farms with EA reports who received follow-up site visits. Based on the analysis of discussions with these 47 farm participants in the follow-up site visits, approximately 44% of the TAP EA recommendations (168) were implemented by the time of the follow-up site visit. **Table 4-22** provides the list of the EA recommendations with implementation rate at the 47 farms receiving follow-up site visits. It is important to note that a BMP can be provided more than one time at a single farm operation (e.g., there may be more than one manure storage unit per farm).

**Table 4-22. TAP Environmental Assessment Recommendations Ranked by Implementation Frequency at Farms Receiving Follow-up Site Visits**

NRCS BMP Code <sup>b</sup>	Common practices recommended by CLEAN EAST TAPs	Frequency recommended at farms receiving follow-up Site visit	No. of farms implementing BMP (confirmed by follow-up site visit)	% Implemented
412	Grassed Waterway	1	1	100%
442	Irrigation System, Sprinkler	1	1	100%
575	Animal Trails and Walkways	1	1	100%
578	Stream Crossing	1	1	100%
N/A	Develop Conservation Plan	1	1	100%
N/A	Domestic Waste Management	1	1	100%
590	Nutrient Management Modifications	37	28	76%
N/A	Lot Runoff Control Measures	4	3	75%
393	Filter Strip	3	2	67%

(continued)

<sup>9</sup> See EA Tool, Appendix G for complete questionnaire used to assist with TAP farm assessment.

**Table 4-22. TAP Environmental Assessment Recommendations Ranked by Implementation Frequency at Farms Receiving Follow-up Site Visits (continued)**

NRCS BMP Code <sup>b</sup>	Common practices recommended by CLEAN <sub>EAST</sub> TAPs	Frequency recommended at farms receiving follow-up Site visit	No. of farms implementing BMP (confirmed by follow-up site visit)	% Implemented
629	Waste Treatment	3	2	67%
N/A	Miscellaneous Repair	20	13	65%
748	Recordkeeping	30	18	60%
N/A	Export Manure	5	3	60%
558	Roof Runoff Structure	11	6	55%
316	Animal Mortality Facility	19	10	53%
312	Improve Leachate Collection	10	5	50%
342	Critical Area Planting	2	1	50%
360	Waste Facility Closure	2	1	50%
614	Watering Facility	2	1	50%
317	Composting Facility	9	4	44%
N/A	Trash Handling Alternative	9	4	44%
472	Access Control/ Livestock Exclusion Area	26	11	42%
359	Waste Treatment Lagoon	19	7	37%
313	Waste Storage Facility	84	29	35%
587	Structure For Water Control	3	1	33%
N/A	Clean-Up Spilled Feed	3	1	33%
710	Secondary Containment (Fuel)	14	4	29%
355	Well Water Testing	12	3	25%
561	Heavy Use Area Protection	4	1	25%
309	Agrichemical Handling Facility (O&M)	9	2	22%
N/A	Calibrate Application Equipment	6	1	17%
528	Prescribed Grazing	7	1	14%
570	Stormwater Runoff Control	6	0	0%
634	Waste Transfer	6	0	0%
635	Vegetative Treatment Area	4	0	0%
N/A	Develop Emergency Response Plan	4	0	0%
380	Windbreak/Shelterbelt Establishment	3	0	0%
449	Irrigation Water Management	1	0	0%
468	Lined Waterway Or Outlet	1	0	0%
554	Drainage Water Management	1	0	0%
	<b>TOTAL</b>	<b>385</b>	<b>168</b>	<b>44%</b>

### Nutrient Management Plan Recommendations

A total of 445 NMP recommendations were made to the 55 farms with NMPs who received follow-up site visits. Based on the analysis of discussions with those farm participants, approximately

70% (or 312) of the TAP NMP recommendations had been implemented. **Table 4-23** provides the list of the NMP recommendations given and their frequency of implementation at the farms receiving follow-up visits.

**Table 4-23. TAP Nutrient Management Plan Recommendations Ranked by Implementation Frequency at Farms Receiving Follow-up Site Visits**

NRCS BMP Code <sup>b</sup>	Common practices recommended by CLEAN EAST TAPs	Frequency recommended at farms receiving follow-up site visit	No. of farms implementing BMP (confirmed by follow-up site visit)	% Implemented
N/A	3rd Party Applicator Agreement	6	6	100%
359	Waste Treatment Lagoon	5	5	100%
554	Drainage Water Management	4	4	100%
629	Waste Treatment	3	3	100%
561	Heavy Use Area Protection	2	2	100%
362	Diversion	1	1	100%
393	Filter Strip	1	1	100%
560	Access Roads	1	1	100%
587	Structure for Water Control	1	1	100%
614	Watering Facility	1	1	100%
558	Roof Runoff Structure	20	18	90%
313	Waste Storage Facility	71	58	82%
316	Animal Mortality Facility	30	24	80%
317	Composting Facility	10	8	80%
412	Grassed Waterway	13	10	77%
468	Lined Waterway or Outlet	11	8	73%
590	Nutrient Management Modifications	172	122	71%
472	Access Control/ Livestock Exclusion Area	3	2	67%
634	Waste Transfer	3	2	67%
748	Recordkeeping	27	16	59%
309	Agrichemical Handling Facility (O&M)	7	4	57%
N/A	Export Manure	7	4	57%
342	Critical Area Planting	2	1	50%
N/A	Calibrate Application Equipment	40	10	25%
N/A	Develop Emergency Response Plan	3	0	0%
574	Spring Development	1	0	0%
	<b>TOTAL</b>	<b>445</b>	<b>312</b>	<b>70%</b>

As of the dates of follow-up visits, 350 of the 830 recommendations had not been implemented (i.e., 217 EA recommendations and 133 NMP recommendations). Farm participants cited a number of reasons for n instances where they did not implement the recommendations provided in their final EA or NMP. Figure 4-22 provides reasons for the 133 unimplemented NMP recommendations and for the 217 unimplemented EA recommendations. As noted above, EA recommendations were implemented at a

lower rate than the NMP recommendations (44% vs. 70%, respectively). The reasons for not implementing the recommendations also varied slightly based on whether the recommendation came from the EA or NMP (Figure 4-22). Of the 350 unimplemented recommendations (cumulative EA and NMP recommendations), 29% were due to the farm operator’s differing opinion; 12% were due to lack of funding to support; 13% were due to farm operators not considering certain recommendations a priority; and 14% of were due to certain recommendations not yet being applicable (e.g., several recommendations for NRCS BMP Code 590-Nutrient management modifications pertaining to application rates were not yet applicable in several cases because the operation had not applied manure since receiving their final NMP.)

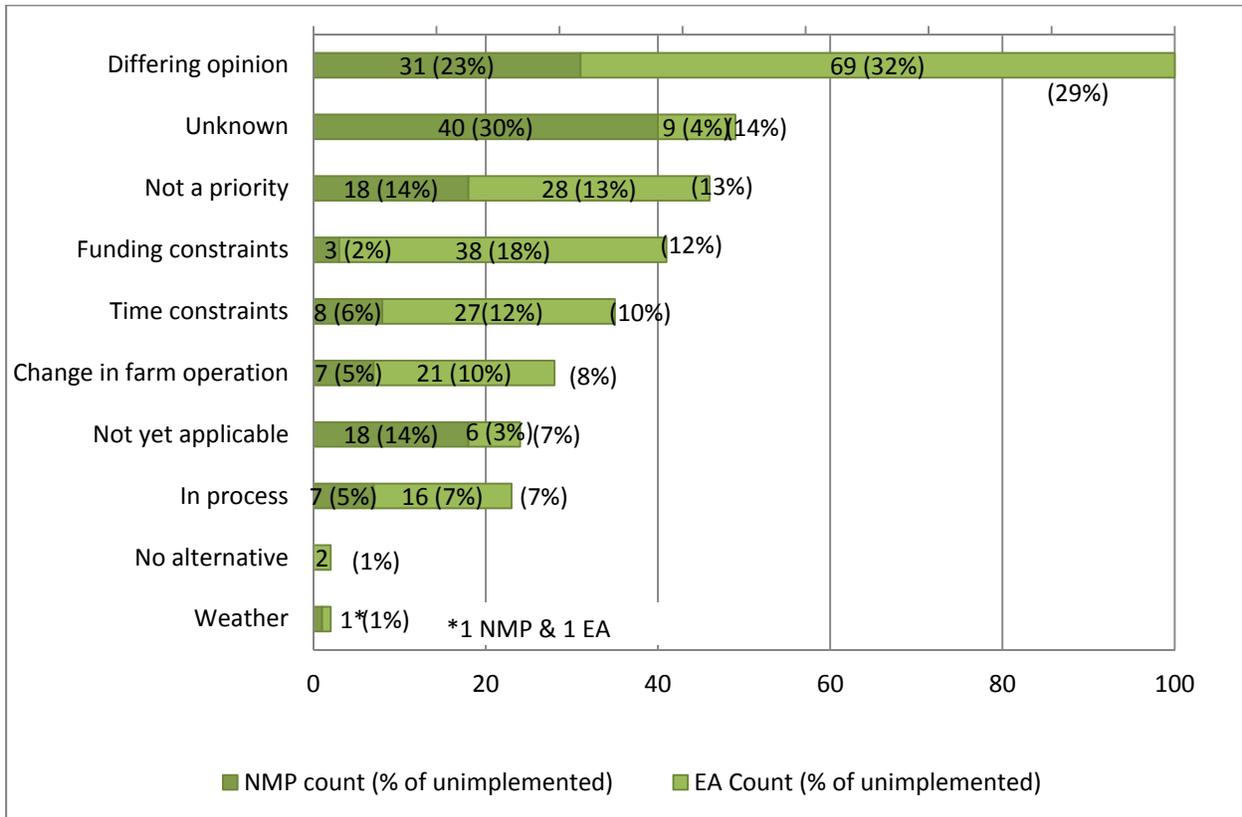


Figure 4-22. Frequency of reasons given for why EA and NMP recommendations were not implemented (Based on 56 follow-up site visits and 830 total recommendations; farm operations provided reasons for unimplemented recommendations).

#### 4.6.2.2 Follow-up Telephone Call Results

A total of 418 recommendations (EA plus NMP recommendations) were made to 212 farms that received follow-up telephone calls. Based on the analysis of discussions with farm participants in the follow-up telephone calls to 212 farm participants, approximately 50% of the TAP recommendations (211 recommendations) have been implemented as of September 2012. **Table 4-24** provides the list of the most frequent recommendations implemented at the farms receiving follow-up telephone calls and **Table 4-25** lists the least-implemented recommendations. See Appendix T for a full list of implemented recommendations. It is important to note that a BMP can be recommended more than one time at a single farm operation (e.g., there may be more than one manure storage unit per farm). Some of the TAP

recommendations with 100% implementation rates include adding access roads and filter strips, cleaning up spilled feed, implementing conservation crop rotations and implementing critical area planting strategies. (Note: The recommendations with 100% implementation were only given on 5 or less occasions each). Making improvements to recordkeeping and adding and modifying waste treatment lagoons were recommended more frequently and also had high implementation rates (85% and 81%.)

**Table 4-24. Categories of TAP Recommendations with the 15 Highest Implementation Rates at Farms Receiving Follow-up Telephone Calls**

NRCS BMP Code <sup>a</sup>	Common Practices Recommended by CLEAN <sub>EAST</sub> TAPs	Frequency Recommended at Farms Receiving Follow-Up Phone Call	No. of Farms Implementing BMP (confirmed by follow-up phone call)	% Implemented
560	Access Roads	1	1	100%
N/A	Clean-Up Spilled Feed	4	4	100%
328	Conservation Crop Rotation	2	2	100%
340	Cover Crop	3	3	100%
342	Critical Area Planting	4	4	100%
554	Drainage Water Management	1	1	100%
393	Filter Strip	5	5	100%
329	Residue And Tillage Management, No-Till/Strip Till	3	3	100%
587	Structure For Water Control	1	1	100%
748	Recordkeeping	34	29	85%
332	Contour Buffer Strips (Land Application Setbacks)	6	5	83%
359	Waste Treatment Lagoon	16	13	81%
N/A	Lot Runoff Control Measures	5	4	80%
590	Nutrient Management (Application Method)	9	7	78%
528	Prescribed Grazing	8	6	75%

<sup>a</sup> NRCS Best Management Practice codes that most closely matches the TAP recommendation.

**Table 4-25. Categories of TAP Recommendations with the 15 Lowest Implementation Rates at Farms Receiving Follow-up Telephone Calls**

NRCS BMP Code <sup>a</sup>	Common Practices Recommended by CLEAN <sub>EAST</sub> TAPs	Frequency Recommended at Farms Receiving Follow-Up Phone Call	No. of Farms Implementing BMP (confirmed by follow-up phone call)	% Implemented
312	Improve Leachate Collection	14	6	43%
558	Roof Runoff Structure	50	18	36%
313	Waste Storage Facility	72	25	35%

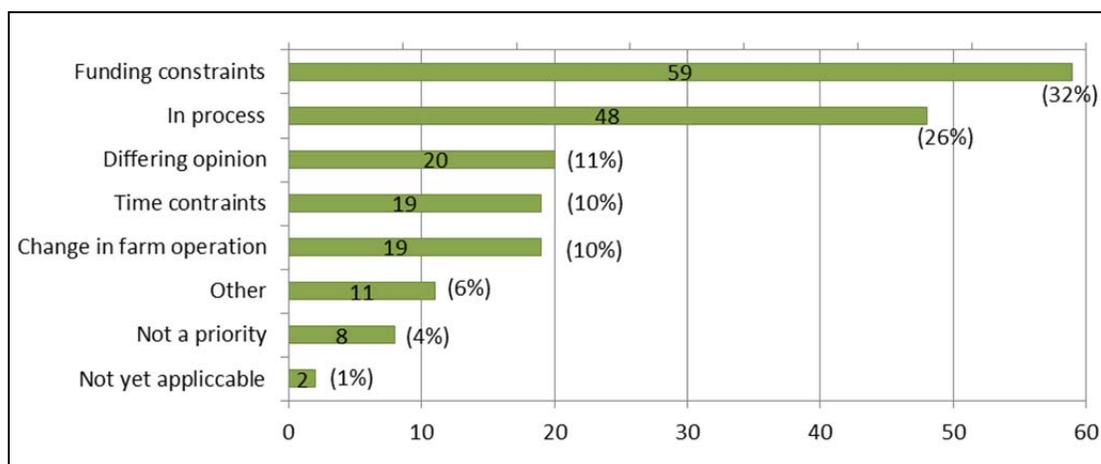
(continued)

**Table 4-25. Categories of TAP Recommendations with the 15 Lowest Implementation Rates at Farms Receiving Follow-up Telephone Calls (continued)**

NRCS BMP Code <sup>a</sup>	Common Practices Recommended by CLEAN EAST TAPs	Frequency Recommended at Farms Receiving Follow-Up Phone Call	No. of Farms Implementing BMP (confirmed by follow-up phone call)	% Implemented
362	Diversion	9	3	33%
578	Stream Crossing	6	2	33%
317	Composting Facility	19	6	32%
620	Underground Outlet	5	1	20%
634	Waste Transfer	6	1	17%
309	Agrichemical Handling Facility (O&M)	1	0	0%
316	Animal Mortality Facility	2	0	0%
N/A	Develop Emergency Response Plan	1	0	0%
468	Lined Waterway Or Outlet	1	0	0%
710	Secondary Containment (Fuel)	7	0	0%
629	Waste Treatment	2	0	0%
380	Windbreak/Shelterbelt Establishment	2	0	0%

<sup>a</sup> NRCS Best Management Practice codes that most closely matches the TAP recommendation.

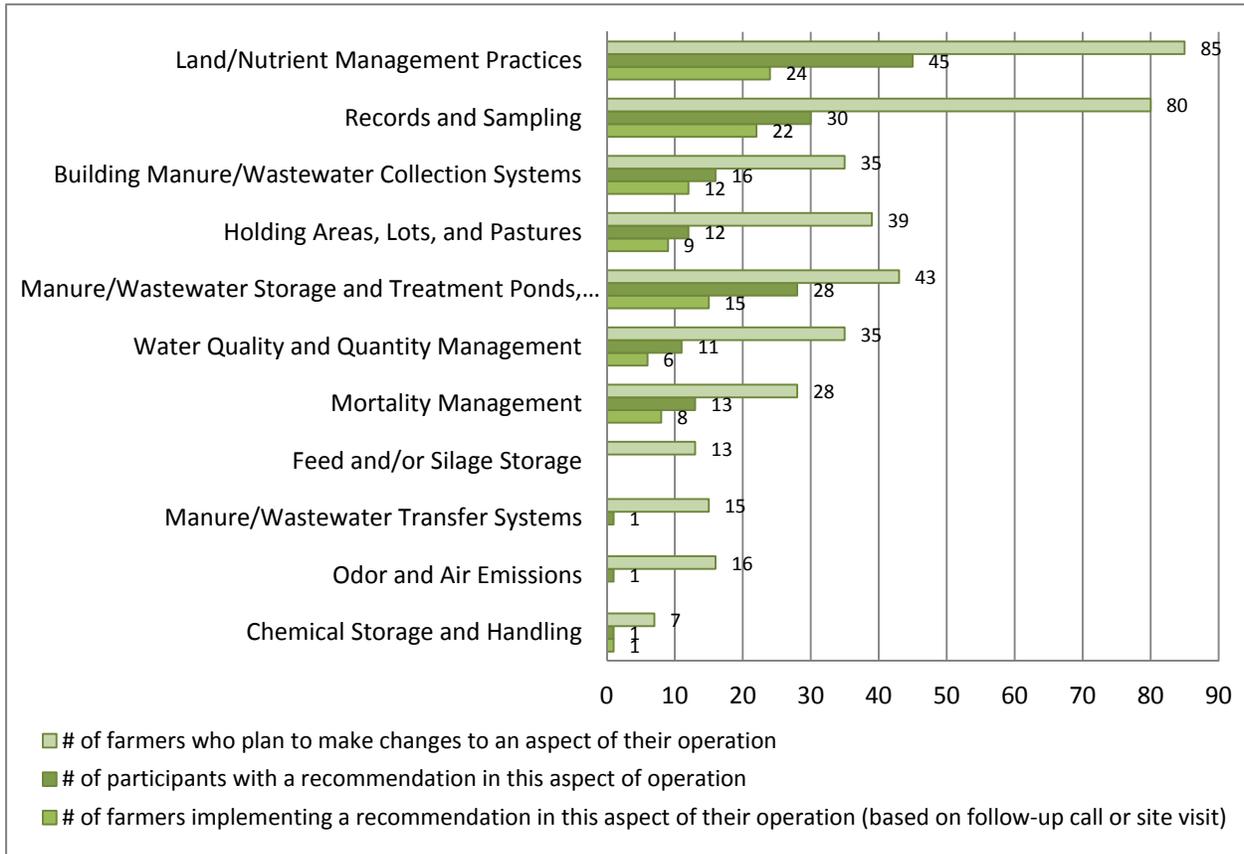
Where recommendations were not implemented (186 recommendations), farm participants cited reasons such as lack of funds (32%), or indicated the recommendation was in the process of being implemented (26%). Other reasons included the participant having a differing opinion on the recommendation (11%), time constraints (10%), and in some cases, the operation had made changes that made the recommendation no longer valid (10%) (**Figure 4-23**).



**Figure 4-23. Frequency of reasons given for why EA and NMP recommendations were not implemented (Based on 212 follow-up telephone calls and 186 recommendations not implemented)**

4.6.2.3 Results of Project Performance by Survey Participants

Of the 157 participants who returned the participation survey, 105 also participated in either a follow-up telephone call or site visit. **Figure 4-24** provides information from the follow-up telephone calls or site visits on the number of farm participants that actually implemented a recommendation related to a given aspect of their operation.



**Figure 4-24. Implementation of CLEAN<sub>EAST</sub> recommendations based on responses to the participant evaluation survey and follow-up telephone call or site visit.**

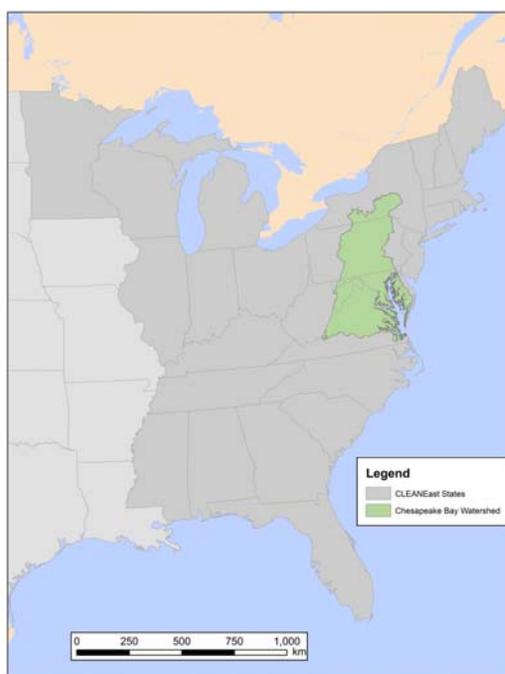
## Section 5. Estimated Water Quality Impacts of CLEAN<sub>EAST</sub> Recommendations: A Case Study in the Chesapeake Bay Watershed

### 5.1 Introduction

The Chesapeake Bay is the largest estuary in the United States, with a watershed of eight major river basins that encompasses 64,000 square miles and covers parts of six states and the entire District of Columbia. The Bay is listed as an impaired water under CWA Section 303(d) for failing to support aquatic habitat due to low dissolved oxygen and poor water clarity. In 2010, the EPA established a total maximum daily load (TMDL) for the Chesapeake Bay. This clean water blueprint sets limits on the average annual amount of nitrogen (N), phosphorus (P), and sediment that may enter the Bay from each of its main tributaries in order to meet water quality criteria in the Bay. By 2025, controls must be in place that will achieve a reduction of 57.8 million pounds of N and 6.7 million pounds of P relative to current conditions, which is equivalent to a 22% decrease in N and a 35% decrease in P (U.S. EPA, 2010).

According to the USDA’s Conservation Effects Assessment Program (CEAP) study of the Chesapeake Bay Watershed, approximately 55,600 farms within the Chesapeake Bay reported livestock sales in 2007. These farms produced 10% of the nation’s poultry and egg sales (\$3.7 billion) and 7% of U.S. dairy products (\$2.2 billion), with a substantial number of other livestock, including pastured cattle, horses, and swine (NRCS, 2011). The manure produced by these animals is responsible for an estimated 15% of N and 36% of P delivered to the Bay (Chesapeake Bay Commission, 2012). Several actions are recommended to manage manure better within the Bay watershed, including implementing NMPs; improving compliance with manure, erosion, and sediment control rules; and improving on-farm infrastructure (Kleinman et al., 2012).

Since 2007, the CLEAN<sub>EAST</sub> Project has provided technical services (EAs and/or NMPs) to 429 livestock and poultry operations across 20 of the 27 eastern states (**Figure 5-1**). Of these 429 operations, 104 (24%) are located within the Chesapeake Bay watershed. Restoration efforts for the Bay watershed have resulted in the extensive generation of water quality data and the development of water quality models. The availability of these resources enabled RTI to assess the potential water quality benefits to the Bay of the 104 volunteer farm participants implementing CLEAN<sub>EAST</sub> recommendations.



**Figure 5-1. Chesapeake Bay watershed within states eligible for CLEAN<sub>EAST</sub> Project.**

## 5.2 Data Sources

The primary data sources for this case study are the Chesapeake Bay Watershed Model (CBWM) Phase 5.3.2 (U.S. EPA, 2010) and information supplied by the 104 CLEAN<sub>EAST</sub> farm participants and/or gathered by RTI TAPs. The CBWM divides the watershed into 2,448 land-river segments and estimates the average annual nutrient loads within each land-river segment by source category, including seven unique classifications of agricultural land use. RTI has previously relied on CBWM data to develop an optimization model that explores tradeoffs among alternative policies to achieve the TMDL (U.S. EPA, 2011a).

In addition to the nutrient loads by land-river segment and source, the CBWM estimates nutrient reductions from a variety of BMPs. For the farms in this analysis, these BMPs can be divided into five land-use categories:

- Animal production area BMPs;
- NMPs<sup>10</sup>;
- Conservation Plans<sup>11</sup>;
- Stream access BMPs; and
- Pasture BMPs.

In addition to these BMPs for which nutrient reductions can be calculated, the CLEAN<sub>EAST</sub> Project TAPs made other recommendations, such as improved recordkeeping and equipment repair and calibration. An important caveat for this case study analysis is that nutrient reductions are estimated based on average loading rates and recommended BMPs. Due to data limitations, including not observing practices already adopted at a farm, we have not adjusted loading rates to reflect heterogeneous practice adoption within land-river segments. Thus, practices applied to areas with above average loading rates would experience greater reductions, while practices applied to areas with below average loading rates would yield lower reduction.

## 5.3 Spatial Identification

The first step of this analysis is to identify the location of the CLEAN<sub>EAST</sub> farms served. Using GIS data, we determined that the 104 farms within the Chesapeake Bay watershed are located within 67 unique land-river segments across four of the six Bay states: New York, Pennsylvania, Maryland, and Virginia (**Figure 5-2**).

---

<sup>10</sup> Nutrient Management Plans (NMPs) provide the farm operator with a site-specific plan for managing manure and organic by-products in a manner that minimizes runoff and maximizes nutrient utilization.

<sup>11</sup> Conservation Plans involve adopting a suite of practices primarily designed to minimize soil erosion, such as grassed waterways and field borders, and do not relate rate and timing of nutrient application prescribed in NMPs.

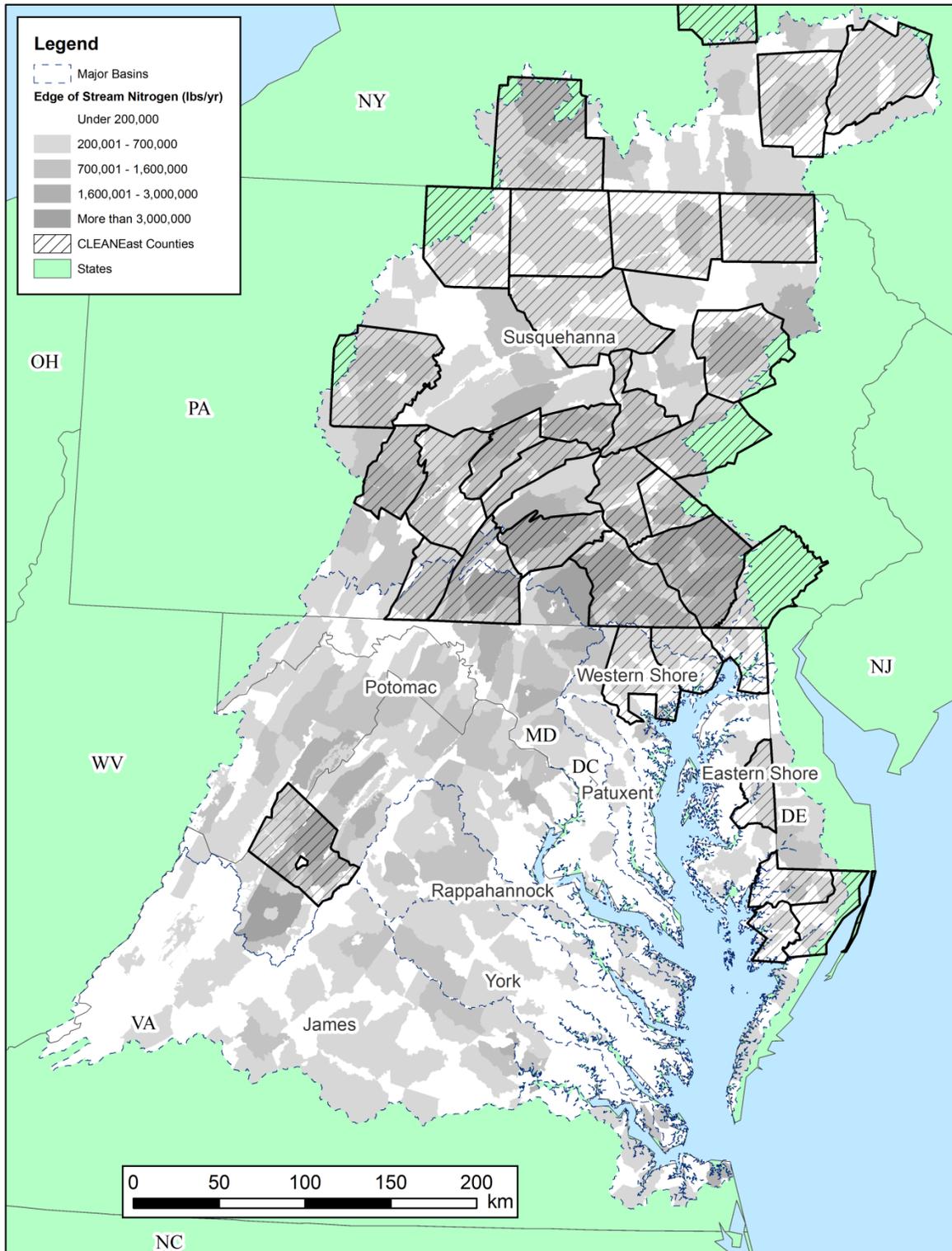


Figure 5-2. Counties with CLEAN<sub>EAST</sub> farms and 2010 land-river segment edge of stream nitrogen (lbs/yr).

## 5.4 Potential Nutrient Reductions Assumed to Achieve 100% Implementation of CLEAN<sub>EAST</sub>-recommended BMPs

### 5.4.1 Animal Production Area BMPs

Animal production areas<sup>12</sup> are areas around barns and locations where manure storage is likely to occur. Watershed-wide, these areas account for 7.2 million pounds of N and 1.5 million pounds of P delivered to the Chesapeake Bay. To achieve the TMDL for the watershed, these N and P loads are expected to be reduced by 55% and 61%, respectively (U.S. EPA, 2010).

Four of the BMPs recommended by CLEAN<sub>EAST</sub> TAPs are specific to managing manure on and runoff from animal production areas.<sup>13</sup> To estimate the nutrients reduced by these implementation of the animal production area BMPs, we first estimated the total area of the 104 Chesapeake Bay watershed farm participants categorized as animal production areas. The CBWM estimates the total animal production area by applying uniform estimates of acres per farm by animal type (**Table 5-1**) and multiplying by the number of farms reported in the USDA’s 2007 Ag Census. Since CLEAN<sub>EAST</sub> farm participants reported their number of livestock and/or poultry, RTI applied the CBWM value to estimate the number of AFO acres within that farm. Based on these estimates, the 104 served farms have a total of 56 AFO acres classified as animal production areas.

**Table 5-1. Animal Production Area Acreage for CLEAN<sub>EAST</sub> Farms by Animal Type**

Animal Type	Acreage/ Farm	Bay Watershed CLEAN <sub>EAST</sub> Farms <sup>a</sup>	Total Production Area Acres
Dairy	0.5	66	33
Poultry	0.25	31	7.75
Beef	0.5	27	13.5
Swine	0.2	8	1.6
Sheep	0.1	5	0.5

<sup>a</sup> Some farm participants had more than one animal category, resulting in multiple animal production areas per farm.

Based on the CBWM acreage/farm assumption, 81 (78%) of the 104 CLEAN<sub>EAST</sub> farm participants, comprising an estimated 44 acres of animal production areas, had recommendations for improved management of animal production areas (44 acres equals about 1% of the animal production areas in the 67 land-river segments served and 0.2% of all animal production areas in the watershed’s 2,448 land-river segments.) Using the CBWM’s land-river segment per acre nutrient loading values, we

<sup>12</sup> EPA defines the production area as a part of an AFO that includes the animal confinement area, the manure storage area, the raw materials storage area, and the waste containment areas. The animal confinement area includes, but is not limited to, open lots, housed lots, feedlots, confinement houses, stall barns, free stall barns, milkrooms, milking centers, cow yards, barnyards, medication pens, walkers, animal walkways, and stables. The manure storage area includes, but is not limited to, lagoons, run-off ponds, storage sheds, stockpiles, under house or pit storages, liquid impoundments, static piles, and composting piles. The raw materials storage area includes, but is not limited to, feed silos, silage bunkers, and bedding materials. The waste containment area includes, but is not limited to, settling basins and areas within berms and diversions that separate uncontaminated stormwater. Also included in the definition of production area is any egg-washing or egg-processing facility, and any area used in the storage, handling, treatment, or disposal of mortalities.

<sup>13</sup> The CBWM does not estimate nutrient reductions for composting/mortality management, which was recommended on nine farms.

estimate that baseline (i.e., before CLEAN<sub>EAST</sub> service) runoff from these 44 acres estimated to contribute 31,925 pounds of N and 4,721 pounds of P to surface waters, which, in turn, delivers 19,933 pounds of N and 2,591 pounds of P to the Bay. This represents the best-available estimate based on the data limitations discussed in **Section 5.2**.

Based on estimated efficiencies for these BMPs (**Table 5-2**), we estimate that complete implementation of the CLEAN<sub>EAST</sub>-recommended BMPs on animal production areas has the potential to decrease 17,671 pounds of N and 2,471 pounds of P in runoff to surface waters, which, in turn, equals a decrease in 11,080 pounds of N and 1,238 pounds of P delivered to the Bay.

**Table 5-2. Animal Production Area BMP Efficiency and Frequency of CLEAN<sub>EAST</sub> Recommendations**

<b>Recommendation</b>	<b>Farms receiving CLEAN<sub>EAST</sub> Recommendations<sup>a</sup></b>	<b>Nitrogen Efficiency (%)</b>	<b>Phosphorus Efficiency (%)</b>
Waste Management System	49	80	80
Heavy Use Protection Area	53	20	20
Roof Runoff	29	20	20
Vegetative Treatment Area	19	80	70

<sup>a</sup> Farms may receive more than one recommendation

### 5.4.2 Nutrient Management Plans

To estimate the decrease in cropland nutrient runoff resulting from the implementation of CLEAN<sub>EAST</sub> NMPs, we first estimated the area on each farm managed using high-till and low-till practices. Eighty-two of the 104 CLEAN<sub>EAST</sub> Project farms in the case study area reported their tillage practices. For the farms that did not report tillage, we assumed their percentage in high and low tillage is equal to the percentage of cropland within the CBWM land-river segment. We then multiplied the reported number of cropland acres at each farm served by the CLEAN<sub>EAST</sub> Project by the difference between the per-acre loading for baseline high-till or low-till with manure and the loading for high-till or low-till with manure after implementation of the CLEAN<sub>EAST</sub> NMP recommendations. Because of the methods used by the CBWM to estimate the benefits of nutrient management, land in nutrient management at the land-river segment scale may, in some cases, have higher nutrient loads than the non-nutrient-managed counterpart. Incrementally adding land to nutrient management, however, always reduces nutrient loadings at the land-river segment level (if not apparent at each land use). In areas where nutrient-managed land is estimated to have higher loadings than non-nutrient managed land, we conservatively estimate that no reductions are associated with nutrient management on cropland. Where load estimates for a land-river segment were not available, we used the average nutrient load rates for the 67 land-river segments included in the analysis.

To estimate the nutrient reductions from the implementation of NMPs on pasture, we multiplied the reported number of pasture acres at each CLEAN<sub>EAST</sub> Project farm by the difference between the per-acre loading for baseline pasture management and post-CLEAN<sub>EAST</sub> Project pasture presumed to be in nutrient management. Where load estimates for a land-river segment were not available, we used the average nutrient load rates for the 67 land-river segments included in the analysis.

Sixty-six of the 104 (63%) CLEAN<sub>EAST</sub> Project farms in the Bay watershed are associated with a new TAP-developed NMP, totaling 13,492 acres of cropland and 2,680 acres of pasture. These 16,172 acres of crop and pastureland are estimated to contribute 760,991 pounds of N and 24,059 pounds of P to surface waters, which, in turn, delivers 393,332 pounds of N and 9,702 pounds of P to the Bay. Using the methods described above, we estimate that the complete implementation of the CLEAN<sub>EAST</sub> Project NMPs has the potential to reduce a total of 49,627 pounds of N and 3,280 pounds of P to surface waters which, in turn, equals 28,384 pounds of N and 1,553 pounds of P delivered to the Bay. Conservatively, no reductions were assumed for updated NMPs.

### 5.4.3 Conservation Plans

The CBWM groups 24 unique BMPs, such as grassed waterways and filter strips, as “Conservation Plan” BMPs. Conservation Plans are estimated to reduce N loads by 8% and P loads by 15% on high-till cropland; 3% and 5%, respectively, on low-till cropland; and 5% and 10%, respectively, on pasture.

Thirty-seven of the 104 (36%) CLEAN<sub>EAST</sub> Project farms, covering a reported 9,948 acres of cropland and 1,524 acres of pastureland, received TAP recommendations for BMPs that fell into the Conservation Plan category. These 11,473 acres of crop and pastureland are estimated to contribute 362,183 pounds of N and 12,090 pounds of P to surface waters, or 267,366 pounds of N and 6,557 pounds of P delivered to the Bay. Applying the aforementioned reduction efficiencies of Conservation Plans to CLEAN<sub>EAST</sub> Project farms’ nutrient management high-till cropland and nutrient management pastureland, we estimate a potential 19,131 pounds of N and 1,344 pounds of P are prevented from reaching surface waters, which, in turn, equals 14,265 pounds of N and 745 pounds of P prevented from reaching the Bay.

### 5.4.4 Stream Access Control BMPs

In-stream livestock watering directly contributes nutrients to surface water. Applying the CBWM, RTI estimates that degraded riparian pasture contributes 2.9 million pounds of N and 475,000 pounds of P to the Chesapeake Bay. By excluding livestock from 69% of these areas to achieve the TMDL, these delivered N and P loads are expected to be reduced by 74% and 67%, respectively.

Fourteen of the 104 (13%) CLEAN<sub>EAST</sub> Project farms received TAP recommendations for improved stream access control (i.e., “livestock exclusion”). To estimate the nutrient reductions associated with this livestock exclusion, we first estimated the area to be excluded at these farms by assuming that 1% of the farm area was degraded riparian pasture (consistent with CBWM assumptions). On these 14 farms, an estimated 43 acres are degraded riparian pasture.

Using CBWM land-river segment per acre nutrient loading values, RTI estimates that baseline runoff from these 43 acres is estimated to contribute 5,720 pounds of N and 514 pounds of P to surface waters, which, in turn, equals 3,055 pounds of N and 207 pounds of P delivered to the Bay. By replacing this degraded riparian pasture load estimate with the CBWM load estimate from the land use “hay without nutrients” to represent CLEAN<sub>EAST</sub> TAP-recommended stream exclusion, we estimate that these loads

will be reduced by 5,550 pounds of nitrogen and 495 pounds of P to surface waters, which, in turn, equals a reduction of 2,966 pounds of N and 199 pounds of P delivered to the Bay.

#### 5.4.5 Pasture BMPs

In addition to the BMPs described above, two TAP recommendations are specific to improved management of pastureland. Prescribed grazing allows forage recovery and is estimated by the CBWM to reduce N and P runoff by 11% and 24%, respectively. An alternate watering facility discourages animals from watering in-stream and is estimated by the CBWM to reduce N and P runoff by 5% and 8%, respectively.

Fourteen (13%) of the 104 CLEAN<sub>EAST</sub> Project farms in the Chesapeake Bay watershed received TAP recommendations for prescribed grazing, and one received a TAP recommendation for an alternate watering facility. These 15 farms contain 1,312 acres of pastureland that are estimated to contribute 21,295 pounds of N and 1,330 pounds of P to surface waters, or 11,094 pounds of N and 776 pounds of P delivered to the Bay. Applying the aforementioned reduction efficiencies of prescribed grazing and alternate watering facilities to CLEAN<sub>EAST</sub> Project farms' nutrient-managed pastureland (assuming prior implementation of conservation plan BMPs, if recommended), we estimate that a potential 2,158 pounds of N and 288 pounds of P are prevented from reaching surface waters, which, in turn, equals 1,171 pounds of N and 174 pounds of P prevented from reaching the Bay.

### 5.5 Conclusion

Based on the methodology described above, we estimate the CLEAN<sub>EAST</sub> TAP-recommended BMPs at the 104 Bay-area farms will result in a reduction of 94,137 pounds of N and 7,877 pounds of P to surface waters, which, in turn, equals 57,865 pounds of N and 3,910 pounds of P delivered to the Bay (**Table 5-3**). These nutrient reductions represent a small fraction of the reductions required to achieve the Chesapeake Bay TMDL (**Table 5-4**) because fewer than 1% of farms with livestock operations in the Chesapeake Bay watershed participated in the CLEAN<sub>EAST</sub> Project. However, if these Chesapeake Bay watershed farm participants are assumed to be representative of the total livestock and poultry farm population (55,600) in the Bay watershed, and we assumed each non-participating farm achieved the level of N and P reductions estimated for the farm participants, then those reductions would achieve 78% of the N-reduction goal and 39% of the P-reduction goal for the entire watershed's agricultural sector (comprised of 83,775 farms).

**Table 5-3. Estimated Nutrient Reductions Achieved by Fully Implementing CLEAN<sub>EAST</sub> TAP-recommended Practices**

Practice Type	Nitrogen Reduced, pounds/year Edge of Stream	Nitrogen Reduced, pounds/year Delivered	Phosphorus Reduced, pounds/year Edge of Stream	Phosphorus Reduced, pounds/year Delivered
Animal Production Area BMPs	17,671	11,080	2,471	1,238
Nutrient Management Plans	49,627	28,384	3,280	1,553
Conservation Plans	19,131	14,265	1,344	745
Stream Access BMPs	5,550	2,966	495	199
Pasture BMPs	2,158	1,171	288	174
<b>Total</b>	<b>94,137</b>	<b>57,865</b>	<b>7,877</b>	<b>3,910</b>

Note: Loading reductions are adjusted to account for multiple BMPs placed on the same acre of land to prevent double-counting.

**Table 5-4. State-Level Estimated Reductions from CLEAN<sub>EAST</sub> TAP-recommended Practices Relative to Anticipated Reductions from Agricultural to Meet the TMDL**

State	Delivered Nitrogen CLEAN <sub>EAST</sub> Reduction (pounds/year)	Delivered Nitrogen Agricultural Reduction for TMDL (pounds/year)	Delivered Nitrogen % of TMDL	Delivered Phosphorus CLEAN <sub>EAST</sub> Reduction (pounds/year)	Delivered Phosphorus Agricultural Reduction for TMDL (pounds/year)	Delivered Phosphorus % of TMDL
Maryland	5,662	6,351,431	0.09	590	440,517	0.13
New York	4,009	1,508,875	0.27	423	250,236	0.17
Pennsylvania	48,146	27,066,661	0.18	2,851	1,763,390	0.16
Virginia	48	4,903,535	0.00	47	2,929,512	0.00
<b>Total</b>	<b>57,865</b>	<b>39,830,503</b>	<b>0.15</b>	<b>3,910</b>	<b>5,383,655</b>	<b>0.07</b>

## Section 6. Project Successes, Challenges, and Lessons Learned

In response to the cooperative agreement’s Programmatic Conditions, this section presents conclusions derived from implementation of the CLEAN<sub>EAST</sub> Project, as described in **Section 2** and **Section 3**, and from the project’s results, as presented in **Section 4**. **Section 6.1** presents the CLEAN<sub>EAST</sub> Project’s successes in achieving Congress’s intent. **Section 6.2** discusses challenges experienced during project development and implementation. **Section 6.3** presents “lessons learned” by the CLEAN<sub>EAST</sub> Project Team that could help overcome structural, organization, or technical obstacles to implementing similar projects involving voluntary farm assistance in the future.

### 6.1 Project Successes

More than 400 farm operations in 20 eastern states volunteered and received technical assistance from the CLEAN<sub>EAST</sub> Project for preparing EAs and NMPs for their farms. The CLEAN<sub>EAST</sub> Project was a success as measured by the overall achievement of the defined project-specific performance indicators (see **Section 4.5**), and by the responses provided by the farm participants regarding the services they received from the project (see **Section 4.6**). The major successes of the CLEAN<sub>EAST</sub> Project can be stated as outlined below.



1. *A voluntary project modeled after the CLEAN<sub>EAST</sub> Project has a high potential to succeed long-term.*

A total of 429 dairy, beef, swine, and poultry operators in 20 states elected to participate in a voluntary project that included the following:

- Confidentiality of individual farm-specific information,
- No cost to the farm participant,
- Receipt of technical services from NRCS-registered professionals,
- Nondisclosure of farm-specific information to regulatory agencies,
- Delivery of standardized NMPs and EA Reports from a nationally recognized project, and
- Production of documentation to support applications for USDA NRCS EQIP cost-share funding and federal and/or state regulatory compliance.

Some farm operators need periodic NMP updates (and in some cases, EA Reports) for their AFOs to comply with federal and state regulatory requirements or to fulfill information requirements for cost-share programs. In addition, farm operators need professional assessment of new or modified farm operations for investment decision-making; to identify BMPs; or for re-calculation of agronomic land

application rates. Such needs from the owners of large, medium, and small farms in the eastern 27 states likely can sustain the long-term demand for and provision of farm assistance services by programs similar to the CLEAN<sub>EAST</sub> Project. The CLEAN<sub>EAST</sub> Project enabled smaller farm operators who do not normally require NMPs to also receive beneficial services. Farm operators seemed more willing to participate given that they were assured their records would be managed as confidential. Overall, farm participants exhibited a growing awareness of the nutrient benefits of manure management, viewed manure as a valuable product, and were receptive to having a TAP provide helpful advice.

In addition to the technical assistance services provided to the farm participants, RTI was also able to conduct follow-up contacts and a second round of site visits to approximately 13% of the farm participants. These return visits were conducted to assess the degree to which the site-specific TAP recommendations provided in the EA or NMP prepared for the farm were implemented.

Given the availability of the standardized tools developed and demonstrated by the CLEAN<sub>EAST</sub> Project for preparing EAs and NMPs, in combination with the established programmatic and contracting systems used to administer the project, a voluntary farm assistance project modeled after the CLEAN<sub>EAST</sub> Project could be implemented successfully with minimal startup expenditures and cost-efficient administration.

In addition to the number and geographic coverage of farms participating in the project, other indicators of project success included the following:

- Seventy-two percent (72%) of participants were in counties designated with a high-priority<sup>14</sup> watershed CLEAN<sub>EAST</sub> Project rating.
  - The NERPI could be applied to 133 of 393 farm participants. Of these 133 farms, 85% were predicted to have decreases in nitrogen (N) and/or phosphorus (P) after full implementation of CLEAN<sub>EAST</sub> NMPs (see **Section 4.4.3.1**).
  - Based on the Chesapeake Bay case study presented in **Section 5**, if the Bay watershed CLEAN<sub>EAST</sub> farm participants are assumed to be representative of the total livestock and poultry farm population (55,600) in the Bay watershed, and it is assumed each non-participating farm achieved the level of N and P reductions estimated for the farm participants, then those reductions would achieve 78% of the N-reduction TDML goal and 39% of the P-reduction TMDL goal for the entire watershed's agricultural sector (comprised of 83,775 farms).
2. *Using a voluntary approach for implementing a farm assistance program can be successful with key stakeholder support and a vote of confidence from the NRCS, regulatory, TSP, and growers' communities.*

Overall, a voluntary approach to increasing environmental awareness in farm operators and motivating them to request and implement nutrient management practices can succeed. From 2008–2011, RTI and its sub-agreement partner, NCSU, together with the assistance of state government officials, local agents, sector representatives, and TAPs, were able to recruit more than 400 applicants and produce almost 700 EA Reports and NMPs.

---

<sup>14</sup> CLEAN<sub>EAST</sub> determined high-priority watersheds as described in Section 4.2.3.

3. *Tools developed by the RTI Team demonstrated their utility in the field as well as in final analyses and reporting.*

The Farm Operation Introductory Profile, Farm Operation On-Site Environmental Assessment Tool, and Farm Operation Profile Supplement (NMP Supplement) used by the CLEAN<sub>EAST</sub> Project for preparing EAs and NMPs (see Table 3-6 in **Section 3**) were designed by RTI, in collaboration with the technical expertise and extensive farm experience provided by NCSU and the project’s agricultural engineering subcontractor, AWT. Each tool was field tested at actual operating farms and further refined before distribution for project-wide use. In addition, each TAP was trained on using the tools before performing services for farm participants. Once completed, these tools were posted on the CLEAN<sub>EAST</sub> Project’s website, making these tools publicly available for download and use by farm operators and TSPs independent of the CLEAN<sub>EAST</sub> Project. This provided an additional, free-of-charge benefit to both the farming and environmental communities. In addition, the tools enabled aggregated analysis of individual farm data collected by TAPs performing CLEAN<sub>EAST</sub> Project services to allow efficient data extraction and entry into a confidential relational database developed by RTI. That database was used to generate aggregated, non-confidential project results for public presentation.



4. *Farm participants were satisfied with CLEAN<sub>EAST</sub> services overall.*

Approximately 37% of the 429 of the farm participants completed and returned the Participant Evaluation Survey. Ninety percent (90%) of respondents strongly agreed or somewhat agreed that the process increased their awareness of environmental challenges the operation may face. Ninety-three percent (93%) strongly agreed that the CLEAN<sub>EAST</sub> TAP who assisted the farm provided a high-quality final work product (EA Report, NMP update, new NMP). As with any large, service-oriented project that serves many clients, some farm participants were not fully satisfied with the services they received from the CLEAN<sub>EAST</sub> Project due to farm-specific reasons. In those cases, RTI made every effort to follow up with each farm participant to address expressed concerns, as reasonable.

5. *RTI’s sub-agreement partnership arrangement with NCSU was effective and efficient.*

NCSU’s strong knowledge base, from both its Center for Animal and Poultry Waste Management and its extension program, complemented RTI’s technical and program management skills well. University technical staff played a prominent role in outreach, TAP training, and data evaluation throughout this 5-year project.

6. *The CLEAN<sub>EAST</sub> Project’s Advisory Committee on Science and Strategy was valuable.*

RTI and its sub-agreement partner, NCSU, established the Advisory Committee to provide guidance on tool development and outreach strategies. Committee members represented livestock and poultry experts from academia, the USDA, trade associations, an environmental interest group, and growers. They provided input on contacts in the farming community for promoting the project and recruiting volunteers, and they reviewed and commented on tools in development and TAP training

curricula. In addition to a kickoff meeting at the beginning of the project, the Advisory Committee conducted periodic conferences calls and/or project updates.

## 6.2 Project Challenges

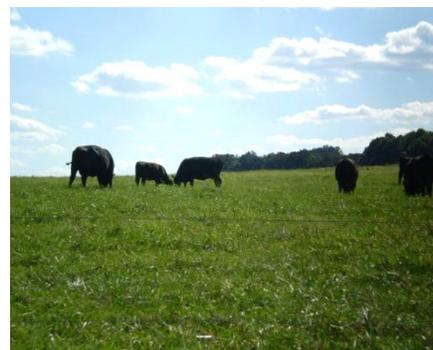
The successes of the CLEAN<sub>EAST</sub> Project were achieved by thorough initial planning; the formation of an effective collaborative team of professionals who had the skills and expertise to perform the array of tasks needed to develop and implement the project; early solicitation of input from the Advisory Committee that included key stakeholders; and ultimately, recruitment of a large and diverse pool of farm participants. However, as the project work progressed through each of the phases described in **Section 2.6**, the CLEAN<sub>EAST</sub> Project Team identified occasional unexpected challenges that required adaptive management of certain project tasks. The more noteworthy challenges to implementing the CLEAN<sub>EAST</sub> Project were as follows.

### 1. *Identification of TAPs to serve CLEAN<sub>EAST</sub> Project states.*

In RTI's procurement process to subcontract TAPs, states coverage was a key goal. Bidders ranged from firms with staff holding NRCS TSP registrations in all states to as few as one states. Staff size for bidders ranged from 1 to more than 20 individuals. RTI made every effort to award subcontracts to firms that enabled the project to serve all 27 states; however, more important was RTI's goal of providing quality, timely service at a reasonable rate. Upon award, subcontract awardees held NRCS TSP registrations in all of the 27 states. Although TAPs held registrations in the project's states, they were not always based in each state. Farm operators sometimes expressed a preference for locally based TAPs. Where available, RTI made every effort to schedule and assign a local TAP from the project team, if requested. If needed, RTI assigned NRCS-registered TAPs based in nearby states or TAPs with prior experience in the state. Only in rare cases did farms decline services when local TAPs were not available through existing subcontracts. In addition, it is possible that some farms did not apply because local TAPs were not subcontracted.

### 2. *Farm recruiting techniques – what worked and what did not?*

Successful recruiting can be a function of the animal sector's support, local water quality interests, enforcement cases, and farm operators' desire to seek cost-share for new investments, such as storage units through USDA NRCS EQIP. Outreach and communication techniques need to account for geographically and organizationally varied messengers (e.g., farmers, local soil and water conservation agents, varied venues by state based on how a state is organized). Aspects of the project that were valuable in developing and implementing recruiting practices included RTI's Economic Incentives Analysis in Year 1, the Advisory Committee, and contacts initiated via meetings and technical conferences. Similarly, RTI's GIS analysis of farm and animal density relative to impaired waters, NRCS TSPs, and other parameters also proved beneficial. For this project, it appeared farm operators were particularly motivated to apply for services given there was no



cost to the farm operator and that farm-specific information collected would be managed as confidential. It would be useful to understand better what other factors motivates farm operators to volunteer. Such information can be used to communicate more effectively with farm operators and achieve more voluntary and proactive practices that can benefit the environment. RTI is evaluating the completed project database for farm participant responses to key questions indicative of how they decide to volunteer and implement recommendations. We plan to present these findings in the future.

*3. Farm operators are more motivated to request NMPs over EAs.*

Although the EPA conceived of and included EAs in the scope of this cooperative agreement, the introduction of a new Farm Operation On-Site Environmental Assessment Tool, and the absence of federal and state officials' public endorsement and promotion of EAs made it more challenging to acquaint the larger farm community with the tool and persuade them to sign up for services. A (significant) fraction of the farm participants seeking NMPs were also willing to receive EAs after RTI familiarized the farm operator with its contents, explaining that the EA was broader than the traditional NMP and that it can increase an operator's understanding of environmental sensitivities. In some cases, farm operators were willing to receive EAs even though they did not need an NMP due to exemption/exclusion from regulatory programs. This willingness is most likely attributed to one or more factors, such as (1) the Farm Operation On-Site Environmental Assessment Tool being endorsed and recommended by a trusted local official or TSP, (2) the tool being recommended by a state official as a result of a negotiated enforcement action, (3) the tool being provided free of charge, (4) the farm participant wanting to be more informed and demonstrate environmental stewardship in his community, and (5) in some respects, the tool assessing nutrient management in the same way as an NMP and having the additional benefit of informing the design and operational effectiveness of the farm from an overall environmental perspective. Two of the CLEAN<sub>EA</sub> states (Pennsylvania and New York) had their own version of EAs in place as state programs. In these states, it was more challenging to persuade farm operators to request EAs because their state's EA may have been structured somewhat differently, and states were reluctant to certify that the CLEAN<sub>EA</sub> EA could be equivalent to the state's EA.

*4. There was limited interest in receiving NMPs by farm operators not required to have NMPs.*

For those who volunteered for the CLEAN<sub>EA</sub> Project, anecdotally, those farm operators were often motivated by the need for new construction or equipment purchases. USDA NRCS EQIP requires NMPs in some circumstances to approve cost share for construction and/or equipment purchases. Other farm operators appeared to be simply motivated to be more informed and better environmental stewards, as well as to be considered by their peers and surrounding community as an environmentally progressive farm operator. They may also have observed that implementing practices and new technologies could leverage more cost savings, higher crop yields, and better-quality herds or flocks with fewer mortalities (e.g., installing shelters that divert run-on and controls runoff, provide winter warmth, reduce the risk of livestock being exposed to waterborne diseases, and reduce the risk of injury due to wet ground). RTI promoted the benefits of an NMP in its outreach efforts. In cases where a farm operator was weighing whether to request an NMP, RTI reviewed the benefits described above.

Those farm operators not required to have NMPs who participated in the project may be reluctant to continue updating their NMPs in the future due to cost. Offering services at no cost can be a strong incentive to farm operators requesting, implementing, and updating their NMPs and, in turn, produce environmental benefits.

## 6.3 Lessons Learned

Based on the successes achieved by the CLEAN<sub>EAST</sub> Project and the challenges faced in its implementation, a set of “lessons learned” was compiled by the Project Team that can be applied to similar farm assistance projects. These lessons are grouped below by structural, organizational, and technical subcategories.

### 6.3.1 Structural

1. *The EPA’s structuring of the project into three tasks [(1) Outreach and Communication, (2) TAP Management and Farm Visit, and (3) Tool Development and Data Analysis] worked reasonably well from a staffing, execution, and logistics perspective.*

There were occasions where Tasks 2 and 3 were interrelated as TAPs provided feedback on how well tools worked in the field and where data analysis revealed the need for additional TAP input.

2. *Structurally, the creation and provision of two basic services (EAs and NMPs) was manageable.*

As described in **Section 4**, farm participants could request one or both services from the CLEAN<sub>EAST</sub> Project. Since RTI trained all TAPs to provide both types of services, no issues arose on the availability of TAPs. Since EAs were a new form of service unfamiliar to farms (unless their state had a similar EA program), more effort was expended by the Project Team to inform farm operators about EAs and their utility. As noted previously, although RTI proposed goals of producing more EAs than NMPs, NMP demand was greater due to post-2008 NPDES regulatory amendments. The creation of EAs did cause some confusion in two states with comparable tools: Pennsylvania and New York. In both cases, RTI explored seeking state buy-in to accept CLEAN<sub>EAST</sub> EAs as equivalent to their programs; however, equivalency was not achieved readily, and RTI determined it was not cost-effective to pursue an equivalency determination.

3. *The Agency decision to exclude soil and manure sampling from the cooperative agreement’s scope proved to be a scheduling impediment.*

In order to develop an NMP, it is necessary to have accurate analyses of manure, as well as analyses of soils for each field where land application can occur. CLEAN<sub>EAST</sub> applications included a question asking operators if they had soil and manure analyses available. Farm operators’ answers fell into one of three categories: “Yes,” “No,” or “No response.” When RTI contacted farm operators upon receipt of their applications, RTI always sought to confirm whether operators had complete, up-to-date manure and soil analyses readily available for the assigned TAP. Early in recruiting, if the operator responded that s(he)



did not have the analyses needed, RTI would provide guidance about what agencies in the operator's state could help facilitate soil and manure sampling and analysis. In the closing year of the recruiting, if the operator did not have the analyses needed, RTI was less inclined to accept the application due to the time required for TAP service and report production. If the farm applicant could demonstrate that (s)he could obtain the analyses within a reasonable timeframe, then the applicant was accepted for services. A third scenario occurred where, based on information collected, the farm operator appeared to have soil and manure analyses, and RTI assigned a TAP, but the TAP later discovered that the analyses were either incomplete or outdated. In that circumstance, the TAP would provide guidance to the farm operator to obtain the analyses within the required timeframe. In the third scenario, the farm operator's unanticipated delay in presenting the appropriate analyses to the TAP resulted in a longer amount of time than normal from the date of TAP assignment to delivery of the EA Report and/or NMP. As described in all three scenarios above, the inability to provide soil and manure sampling within the scope of the cooperative agreement impeded delivery of services.

*4. Delivery of draft reports for farm participants' review often delayed finalizing reports.*

The CLEAN EAST protocol was to deliver the draft EA Report or draft NMP to the farm participant, allow review and receive their comment, and then revise and deliver a final EA Report or NMP. It was not uncommon that gaining farm participants' comments or approval was delayed. As a result, the time from acceptance into the CLEAN EAST Project to the time of final product delivery was longer than anticipated. This situation can be improved in the future by delivering the report to the farm participant as final with the understanding that s(he) can seek revisions upon request.

*5. Farm participants could have benefited from one or more follow-up visits.*

For example, it would have been beneficial if TAPs could have scheduled a visit to review and explain how to apply the EA Report and NMP recommendations. Such visits could also reinforce the educational aspect of the project and serve as a reminder to farm participants about the practices they should or could implement.

*6. The scope of work's absence of tracking farms' implementation of TAP recommendations reduced the certainty of the project's benefits.*

The project had a significant potential to contribute to restoration of nutrient-impaired watersheds. However, to measure the level of contribution, one needs to understand what role the livestock and poultry sectors play in water quality (e.g., the fraction of the total nutrient load to an impaired water that the sector contributes and to verify proper implementation of NMPs). RTI was able to contact a subset of farm participants to assess their degree of implementation; however, a more comprehensive effort to measure implementation would have been beneficial. The project served a relatively small number of farms in the eastern United States. If the project were implemented and served a larger fraction, the potential for water quality improvement would increase. However, the proximity of the farm population to nutrient-sensitive waters can be as important as the number of farms (and their livestock) served. Even serving a limited number of farms strategically located near impaired streams and water bodies can make a difference in water quality locally. Benefiting water quality on a larger scale,

such as reducing the livestock industry’s total load to the Chesapeake Bay, would require additional resources and the willingness of a significant percentage of the Bay watershed’s total farm community to volunteer for NMPs and EAs. **Section 5** of this report presented an analysis of CLEAN<sub>EAST</sub> Project farms located in the Chesapeake Bay watershed and demonstrated how the benefits of implementing CLEAN<sub>EAST</sub> Project TAP recommendations can be estimated.

### 6.3.2 Organizational

*CLEAN<sub>EAST</sub> and its western United States counterpart, CLEAN<sub>mp</sub>-West, appear to have taken different approaches to conducting competition for TAPs and, in turn, assigning TAPs to participating farms.* The CLEAN<sub>EAST</sub> Project issued two RFPs for TSP subcontract support: (1) Northeast and Mid-Atlantic, and (2) Southeast and Midwest. Once the subcontracts were awarded and rates were established for EA and NMP services based on animal category and farm size, RTI would assign a farm to one of the multiple subcontracted TAP firms based on several criteria, including demonstrated certification in the state of interest and provision of the best value to the project. RTI learned that its approach to organizing the TSP subcontract competitions and issuing technical directives to each farm applicant based on predetermined criteria worked well for RTI given our business systems design.

### 6.3.3 Technical

1. *Using the USDA NRCS Animal Waste Management (AWM) model to build the NERPI resulted in limited applicability.*

The AWM software was selected for adaptation since developing new, complex mass balance models was not part of the project’s charge. This AWM software uses procedures and calculations from the USDA-NRCS *Agricultural Waste Management Field Handbook* to calculate a gross nutrient balance based on a farm’s animal categories and populations, animal waste management practices, and crops receiving land application of animal manure and wastewater. This application of AWM is not its stated purpose; therefore, the results should be treated as general approximations, presuming each farm operation fully implements the CLEAN<sub>EAST</sub> TAP NMP recommendations. Further, AWM modeling may not show a nutrient benefit for certain operational circumstances such as when the CLEAN<sub>EAST</sub> NMP recommends spreading to fewer acres; the NMP is written to respond to the farm operator’s request for an increase in animal population; or the farm operator’s current documented practices are identical to the CLEAN<sub>EAST</sub> NMP recommendations. Approximately 66% (259) of the 393 farm participants receiving CLEAN<sub>EAST</sub> NMPs experienced one of these three scenarios and, therefore, required qualitative reviews beyond the NERPI-computed results. For the qualitative analysis, EA Reports and NMP documents were reviewed to catalogue the TAP-recommended, water quality–related BMPs for each farm operation.

2. *NRCS-registered TSPs can benefit from additional training and technical guidance.*

The TSPs can benefit from additional training and guidance, particularly in areas not as commonly regulated, such air quality and mortality management, as well as new land application technologies and biofuel technology such as anaerobic digestion. For example, project results indicated that, based on the air quality-related experience of the CLEAN<sub>EAST</sub> Project, air quality issues are not

routinely addressed by farm TSPs; the need exists for implementing a tool to predict the benefits of BMPs for air quality, such as RTI’s AAEMI, and the need exists for expanded guidance and training for TSPs on use of BMPs to improve air quality. The NRCS does have a TSP certification for air quality management; however, evidence of states promoting air quality-related projects is limited.

**Table 6-1. Summary of Cooperative Agreement Successes, Challenges, and Lessons Learned**

<b>Successes</b>
The no-cost, voluntary approach for implementing a farm assistance project was successful given 429 farms received technical services consisting of 297 EAs and 393 NMPs.
The no-cost, voluntary approach for implementing a farm assistance project was successful given key stakeholder support and a vote of confidence from the NRCS, regulatory, TSP, and growers’ communities.
Farm assistance tools developed by the RTI Team demonstrated their utility both in the field and in final analyses and reporting.
Ninety percent (90%) of responding farm participants were satisfied with CLEAN <sub>EAST</sub> services overall.
RTI’s sub-agreement partnership arrangement with NCSU was effective and efficient.
The CLEAN <sub>EAST</sub> Project’s Advisory Committee on Science and Strategy proved valuable on outreach and tools.
Seventy-two percent (72%) of participants were in counties designated with a high priority watershed CLEAN <sub>EAST</sub> Project rating.
Based on the Chesapeake Bay case study in <b>Section 5</b> , if the Bay-area CLEAN <sub>EAST</sub> farm participants are assumed to be representative of the total livestock and poultry farm population (55,600) in the Bay watershed, and it is assumed each non-participating farm achieved the level of nitrogen (N) and phosphorus (P) reductions estimated for the farm participants, then those reductions would achieve 78% of the N-reduction goal and 39% of the P-reduction goal for the entire watershed’s agricultural sector (comprised of 83,775 farms).
The Nutrient Environmental Release Potential Indicator Tool (NERPI) could be applied to 133 of 393 farm participants. 85% of the 133 farms were predicted to have decreases in N and/or P after presumed full implementation of CLEAN <sub>EAST</sub> NMPs.
<b>Challenges</b>
Identification of TAPs residing in certain CLEAN <sub>EAST</sub> Project states. (Addressed by subcontracting NRCS-registered TAPs based in nearby states or TAPs with prior experience in state.)
Recruiting farm operators in certain regions and animal sectors. (Addressed by reaching out to local officials such as soil and water conservation agents)
Motivating farm operators to request EAs. (Addressed benefits of EA through calls with farm applicants and outreach activities; sought state and local officials’ support for EAs.)
Motivating farm operators to request NMPs if they were not required to have NMPs. (Addressed benefits NMPs through calls with farm applicants and outreach activities.)
<b>Lessons Learned – Structural</b>
EPA’s structuring the project into 3 tasks [(1) Outreach and Communication, (2) TAP Management and Farm Visit, and (3) Tool Development and Data Analysis] worked reasonably well from a staffing, execution, and logistics perspective.
Structurally, the creation and provision of two basic services—EAs and NMPs—was manageable.
The Agency decision to exclude soil and manure sampling from the cooperative agreement’s scope proved to be a scheduling impediment because farm participants may not have up-to-date samples, cost of analysis, knowledge on how to sample. Recommend inclusion in the future.
The scope of work’s absence of tracking farms’ implementation of TAP recommendations reduced the certainty of the benefits of the project. Recommend including implementation verification in the future.

(continued)

**Table 6-1. Summary of Cooperative Agreement Successes, Challenges, and Lessons Learned  
(continued)**

<b>Lessons Learned – Organizational</b>
Despite CLEAN <sub>EAST</sub> and its western United States counterpart taking different approaches to conducting competition for TAPs and, in turn, assigning TAPs to participating farms, CLEAN <sub>EAST</sub> 's approach was successful for RTI.
<b>Lessons Learned – Technical</b>
Adapting the existing USDA-NRCS' AWM model software to build the NERPI resulted in limited applicability. AWM's design was moderately relevant, being intended for design engineering AFOs rather than mass balance modeling.
NRCS-registered TSPs can benefit from additional training and technical guidance in reducing air emissions. TAPs were not inclined to recommend emission reducing BMPs due, in part, to limited training and guidance, as well as cost to the farm participant.

---

## References

- Chesapeake Bay Commission. 2012. *Manure to energy: sustainable solutions for the Chesapeake Bay Region*. Available at <http://www.chesbay.us/Publications/manure-to-energy%20report.pdf>
- Kellogg, R.L. 2002. *Profile of farms with livestock in the United States: A statistical summary*. February 4. Retrieved August 8, 2012, from the Natural Resources Conservation Service website: [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/rca/?&cid=nrcs143\\_01412](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/rca/?&cid=nrcs143_01412)  
1.
- Kleinman, P., K.S. Blunk, R. Bryant, L. Saporito, D. Beegle, K. Czymmek, Quirine Ketterings, et al. 2012. Managing manure for sustainable livestock production in the Chesapeake Bay Watershed. *Journal of Soil and Water Conservation* 67 (2) (March 1): 54A–61A. doi:10.2489/jswc.67.2.54A.
- Natural Resources Conservation Service. 2009. *Part 651, Agricultural Waste Management Field Handbook*. Retrieved September 9, 2012, from the Natural Resources Conservation Service website: <http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/quality/?&cid=stelprdb104593>  
5.
- Natural Resources Conservation Service. 2010. Animal Waste Management Software. U.S. Department of Agriculture. Retrieved September 9, 2012, from the Natural Resources Conservation Service website: <http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/quality/?&cid=stelprdb104697>  
7.
- Pennsylvania State University. 2010. *Pennsylvania's Nutrient Management Act (Act 38): Who Is affected? Agronomy facts #54*. Publications Distribution Center, Pennsylvania State University, University Park, PA.
- Poe, G.L., N.L. Bills, B.C. Bellows, P. Crosscombe, R.K. Koelsch, M.J. Kreher, and P. Wright. 2001. Will voluntary and educational programs meet environmental objectives? Evidence from a survey of New York dairy farms. *Review of Agricultural Economics* 23(2): 473-491.
- Purdue University. 2010. *Manure Management Planner*. Purdue University, West Lafayette, IN. Available at [www.agry.purdue.edu/mmp](http://www.agry.purdue.edu/mmp).
- Natural Resources Conservation Service. 2011. *Conservation Effects Assessment Project (CEAP): Assessment of the effects of conservation practices on cultivated cropland in the Chesapeake Bay Region*. U.S. Department of Agriculture. Available at [http://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/stelprdb1042076.pdf](http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1042076.pdf)

- U.S. Department of Agriculture. 2004. *2002 Census of Agriculture*. U.S. Department of Agriculture, National Agricultural Statistics Service. Washington, DC. June.  
<http://www.agcensus.usda.gov/Publications/2002/index.php>
- U.S. Department of Agriculture. 2007. *Census of Agriculture 2007 Census Publications*,  
[http://www.agcensus.usda.gov/Publications/2007/Online\\_Highlights/Desktop\\_Application/](http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/Desktop_Application/).  
Accessed 9/9/2012.
- U.S. Environmental Protection Agency. 2005a. *EPA Order Classification No.: 5700.7*. Available at  
<http://www.epa.gov/ogd/grants/award/5700.7.pdf>.
- U.S. Environmental Protection Agency. 2005b. *National Emission Inventory of Ammonia Emissions from Animal Agricultural Operations*. Draft Final Report. April 22, 2005.
- U.S. Environmental Protection Agency) 2006. *2006–2011 EPA Strategic Plan: Charting Our Course*.  
September 30, 2006.
- U.S. Environmental Protection Agency. 2010. *Chesapeake Bay Phase 5.3 Community Watershed Model*.  
EPA 903S10002–CBP/TRS-303-10. U.S. Environmental Protection Agency, Chesapeake Bay  
Program Office, Annapolis MD. December 2010.
- U.S. Environmental Protection Agency. 2011a. *An optimization approach to evaluate the role of  
ecosystem services in Chesapeake Bay restoration strategies*. U.S. EPA/600/R-11/001.
- U.S. Environmental Protection Agency. 2011b. *Regulatory definitions of large CAFOs, medium CAFOs,  
and small CAFOs. 5/18/2011*. [http://www.epa.gov/npdes/pubs/sector\\_table.pdf](http://www.epa.gov/npdes/pubs/sector_table.pdf). Accessed  
8/8/2012
- U.S. Environmental Protection Agency. 2012. *What is a CAFO?* <http://www.epa.gov/region07/water/cafo>