Non-Intrusive BMP Verification

Standard of Procedure

VERSION 6.0

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Prepared By: Larson Design Group

Joshua E. Glace and Teah E. Gray

Reviewed By:

Pennsylvania Department of Environmental Protection (DEP)

Jill Whitcomb, Kathryn Beats, Kristen Wolf, Erin Penzelik, Scott Heidel, Kathryn Bresaw

Independently Reviewed By:

Tetra Tech

Jon Harcum, PhD

Adopted By:

Clinton County Conservation District

Lackawanna County Conservation District

Luzerne Conservation District

Susquehanna County Conservation District

Potter County Conservation District

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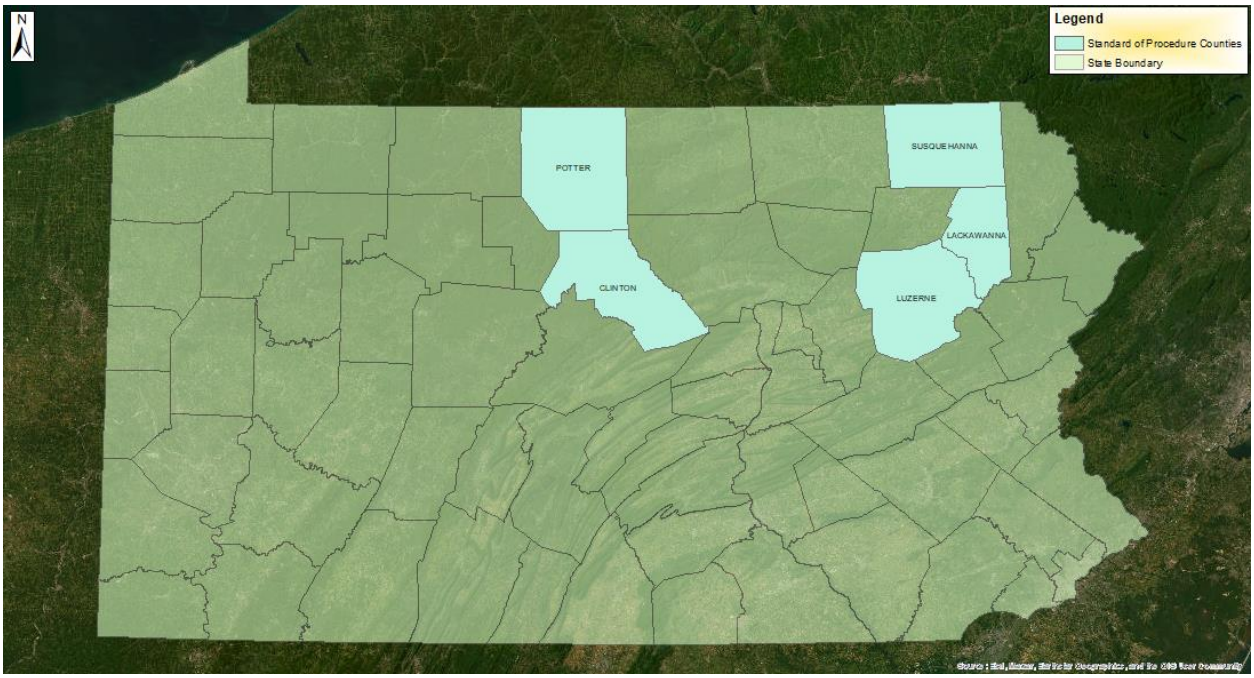
Abstract

Non-Intrusive Best Management Practice (BMP) verification is the process of using publicly accessible data and observation methods to identify and verify the functionality of targeted agricultural conservation practices, also known as BMPs, without intruding on the privacy of landowners. The methodology for this program uses publicly accessible data, remote imagery interpretation, historical practice implementation documents, and observations from public roadways to confirm and identify a BMP is present and functioning as intended. By using this methodology, certain BMPs can be collected and verified in a reduced timeframe and at a reduced financial cost, while also not requiring any release of private records by the landowner.

Scope

Multiple Conservation Districts within the Northern Tier of Pennsylvania have identified a need for the creation of a BMP verification program that can be conducted with non-invasive methods. Conservation Districts within Clinton, Potter, Lackawanna, Luzerne, and Susquehanna Counties recognized this priority through the adoption of the Commonwealth of Pennsylvania’s initiative to document, verify, and report implemented BMP projects for enhanced accuracy of environmental nutrient and sediment reduction calculations. This pilot program contains an established focus to limit the amount of additional staff time dedicated towards the identification, collection, and documentation while also limiting the reporting of private information required for BMP verification completion.



Counties included in Non-Intrusive BMP Verification Pilot Program are Clinton, Potter, Lackawanna, Luzerne, and Susquehanna.

Through the prioritization of BMP verification throughout Pennsylvania, the Department of Environmental Protection has utilized the Pennsylvania Clean Water Academy to release various tools and resources derived from the U.S. Environmental Protection Agency's (EPA) Chesapeake Bay Program Office (CBPO) to ensure approved verification methods are utilized throughout the Commonwealth. The establishment of the Non-Intrusive BMP Verification Program originated from the supplied resources and provides a procedural outline for Conservation Districts to utilize while completing BMP verification efforts to ensure proper data recording and landowner confidentiality.

BMP practices that were identified by the project as being best adapted for identification utilizing non-intrusive methods consist of six (6) Resource Improvement (RI) BMP practices outlined within the Chesapeake Bay RI Practice Definitions and Verification Visual Indicators Report (Table 1). This report is provided by the Pennsylvania Clean Water Academy's guidance materials for statewide BMP verification procedures. Please see Table 1 for the complete list of RI practices prioritized for verification within this program.

Throughout this project, there is a combination of both re-verified existing BMP practices and the discovery of new practices. Existing practices were collected from Conservation District and DEP files from programs over the last 30 years. As with both newly discovered and re-verified practices, the project only focused on the outlined six (6) RI practices. It is important to note that these practices do not require an owner interview as part of the verification process.

Traditional Process Limitations

Traditional verification methods for BMPs involve formal onsite inspections and landowner interviews to record practice information. This process often involves various outreach methods to accommodate landowner schedules and availability. Due to the increased amount of part-time agricultural operators, this process sometimes needs to be completed on their days off or evenings, which presents challenges for Conservation District staff as they are also operating outside of their normal work hours. Once onsite, the information that is attained is not always accurate due to poor record-keeping or a lack of insight. This leads to increased time onsite and may also result in the need for follow-up visits to acquire additional documentation.

Utilizing third parties to complete BMP verification to reduce full-time governmental staff obligations and yet to complete the necessary workload is also another option. However, third-party individuals do not have the authority to enter private property, and increased coordination with those individuals is required to achieve such access. Private landowners also retain the right to tell the third-party they are not allowed access. It is often difficult to receive approval for site access by a third-party entity without the accompaniment of governmental staff to ensure the security of the collected data and the legitimacy of the visit.

The Non-Intrusive BMP Verification procedure creates a partnership between governmental staff and third-party staff to ease workload while providing property access and landowner reassurance.

Qualified Professionals for the Methodology

Qualified individuals to complete this process consist of Group 1 and Group 2 professionals outlined within the On-Site BMP Verification Guidelines for Counties provided by the DEP Chesapeake Bay Office Ag Compliance Section. Please note that the qualifications outlined below can be achieved by governmental staff as well as third-party staff for the completion of this procedure.

Guidelines for Group 1 and Group 2 Qualified Professionals are outlined below as stated within the On-Site BMP Verification Guidelines for Counties, which are made available on the Pennsylvania Clean Water Academy.

Guidelines for Group 1 Qualified Professionals

Qualification Criteria: Individuals who may be considered Group 1 Qualified Professionals should have:

- Sufficient on-the-job training, with a former or current Natural Resources Conservation Service (NRCS) Job Approval Authority, or
- Have attended NRCS trainings such as the Conservation Planner Certification Curriculum, NRCS Basic, Agronomy, and/or Engineering Bootcamps (Levels 1 and 2), or the State Conservation Commission Nutrient Management Certification series.

Verifiers will have relevant training and experience in identifying the existence and visual identification of BMP functions. When possible, Group 1 Qualified Professionals should rely on their knowledge and familiarity with the standards and specifications in NRCS's Field Office Technical Guide (eFOTG), though when appropriate, Group 1 Qualified Professionals may verify RI Practices according to the *Chesapeake Bay Program Resource Improvement Practice Definitions and Verification Visual Indicators Report* (Attached).

Training Activities

1. Agriculture Conservation Level II – BMP Verification on the DEP Clean Water Academy (CWA), https://pacleanwateracademy.remote-learner.net/totara/program/view.php?id=26

Verification Activities

1. Verification of the county's priority BMPs according to NRCS standards and specifications found in eFOTG.
2. On-Site BMP and Plan Verification Checklist (attached) should be used as a checklist to verify plan and BMP verification on the operation during the site visit.
3. If RI practices are verified, the applicable RI checklists found in the *Chesapeake Bay Program Resource Improve Practice Definitions and Verification Visual Indicators Report* should be completed during the site visit.
    a. If BMPs are verified as an RI practice rather than an equivalent NRCS practice, the practice will require re-verification upon expiration of the credit duration of the RI practice, which is generally half the credit duration of the equivalent NRCS practice.

4. If the verification includes an assessment of NRCS standards and specifications, the verifier should rely on the appropriate documentation found in eFOTG and attach the documentation as applicable.

Guidelines for Group 2 Qualified Professionals:

Staff that do not meet the qualification criteria described under Group 1 Qualified Professionals should attend the following training activities. Once the training activities listed below are complete, staff will be considered Group 2 Qualified Professionals and should focus on the BMP verification activities listed below.

Training Activities

1. Agriculture Conservation Level I – New Staff Training on the DEP CWA, https://pacleanwateracademy.remote-learner.net/totara/program/view.php?id=21
2. Agriculture Conservation Level II – BMP Verification on the DEP CWA, https://pacleanwateracademy.remote-learner.net/totara/program/view.php?id=26
3. At least 40 hours of relevant on-the-job training and job shadowing by experienced professionals.

Verification Activities

1. Data entry of Manure Management Plans and Ag E&S Plans, verified as complete by experienced staff, into the Practice Keeper database
2. Data entry of BMPs into the Practice Keeper database
3. Verification of RI practices identified as priorities in the county's County Wide Action Plan (CAP)
4. On-Site BMP and Plan Verification Checklist (attached) should be completed during the site visit.
    a. The Group 2 Qualified Professional should rely on the determinations of administrative completeness completed by experienced staff when completing the On-Site BMP and Plan Verification Checklist.
5. The applicable RI checklists found in the *Chesapeake Bay Program Resource Improve Practice Definitions and Verification Visual Indicators Report* should be completed during the site visit.

This pilot program was completed within the State of Pennsylvania and complies with the existing Pennsylvania State Agricultural Training Programs as provided through Pennsylvania DEP, Pennsylvania Department of Agriculture, NRCS, and other associated training organizations. If this methodology is adapted for utilization within states outside of

Pennsylvania, comparable training or experience should be substituted to meet qualifications for both Group 1 and Group 2 professionals.

Please note that although the outlined trainings for qualified Group 1 and Group 2 professionals are not specific to the identification and verification of practices via remote sensing and aerial review, the outlined trainings do provide training on practice specific field and visual indicators to ensure proper practice functionality. Field and visual indicators outlined within the above trainings were utilized in partnership with the Chesapeake Bay Program RI Practice Definitions and Verification Visual Indicators Report to ensure proper practice conditions and operation and maintenance activities at each practice location during field verification.

As the utilization of Group 1 and Group 2 professionals varies within the execution of this methodology, the below chart depicts the responsible parties for the completion of the outlined pilot program. Group 1 professionals are tasked with making all final determinations of practices while utilizing this methodology.

Responsibility	Group 1 Qualified Professional	Group 2 Qualified Professional	Responsible Party for SOP Completion
Utilize Aerial Imagery Platform to identify possible BMP locations.	X	X	CCD, LDG
Record possible BMP locations within the Aerial Imagery Platform.	X	X	CCD, LDG
Complete Non-Intrusive Field Verification efforts from publicly accessible roadways.	X	X	CCD, LDG
Completed BMP Verification Windshield Survey and report collected data into Practice Keeper Database.	X	X	CCD, LDG
Review and approval of Practice Keeper Database entries for final submittal.	X		CCD, PADEP
Program Management and Oversight	X		CCD, LDG, PADEP

Responsible Parties during the completion of the Non-Intrusive BMP Verification Pilot Program.

Methodology

To support the Non-Intrusive BMP Verification Program, various tools were developed by Larson Design Group for assistance in locating, routing, collecting, verifying, and reporting purposes. The creation of such tools allows for a standard in functionality for entities to accurately capture, verify, and record data. The methodology for the application of the developed tools was provided through in-person training and is outlined below.

This pilot program methodology was developed for utilization within the northern Chesapeake Bay Region of Pennsylvania. This is a large area with agricultural activities scattered across the landscape. This trend in land use contributes to substantial driving time to travel to farms and properties within an agency's area. This methodology was developed to address this concern and allow coverage of large, expansive areas in a timely manner.

Although this methodology was created for a specific region of Pennsylvania, this program can be adapted to be utilized across various geographic areas. The tools constructed for program implementation can be utilized across the Chesapeake Bay with increased success in areas with minimal topography due to increased sight distance. This also can minimize re-verification efforts for BMPs that require more frequent visits by reducing the overall coordination time and removing the variable of changing landowners, where a new discussion and access permissions would be required.

The Non-intrusive BMP Verification methodology is a complete program that is designed to effectively and efficiently identify, review, and report specific BMPs. This methodology is required to visually inspect all BMPs. All steps of the methodology need to be followed in order to accurately record each BMP verification. Extrapolation of data collected utilizing the outlined methodology cannot be completed as it would impact the integrity of the Pilot Program results.

Various tools were created for utilization throughout this program to aid in data identification, tracking, collection, and reporting. Below are descriptions of the various tools employed for program completion.

Aerial Desktop Review

For a preliminary review of each county's landscape, an aerial desktop review was completed using a developed ArcGIS Map Portal. Mapping portals allow you to create a published version of an ArcGIS map through a web browser. The mapping portal platforms are created on a county level and hold county-specific data sets that are publicly accessible.

As most counties have historical reporting and practice implementation information on file, these documents were utilized to establish a set of previously implemented practices that were evaluated during the completion of this program. It was often the case that the governmental agencies had documentation of previous practices that received financial and/or technical

assistance for completion, though, due to the age of the practice's implementation, they were out of lifecycle or hadn't had a recent inspection completed. Practices identified within this documentation were added to the aerial desktop review platform for inclusion in Non-intrusive Field Verification.

The aerial desktop review platform is also utilized by governmental agencies as well as third-party individuals to identify additional potential practices throughout each county. Not only can multiple entities utilize the portal at the same time, but it is also updated in real time for increased efficiency between office and field workflows.

Layers utilized within the portal creation included aerial imagery, roadways, parcel lines, mapped streams, and county municipality boundaries. All map layers are county specific references to aid in the detection of BMP locations across each landscape.

The county mapping portals also contain a specialized subset of data specific to each county. Specialized subset data consists of items such as stream buffer zones, a grid layer, and layers relative to land use type and/or parcel size. The stream buffer zone shapefile was created to display a 35-foot buffer zone around all mapped waterways within each county. This layer allows the user to identify buffer zones less than or greater than 35 feet without having to measure each potential buffer zone.

The inclusion of the associated county grid overlay allows the user to track progress within areas of the map that have been assessed for aerial BMP identification. Each grid cell can be marked as assessed so that multiple users can keep track of areas of the county that have not been evaluated. Layers for categorized land use or parcel size were requested by multiple counties to assist with the prioritization of verification areas due to their county size. Counties utilized this data layer to set priorities, such as parcels greater than 40 acres in size or parcels that are deeded for agricultural land use. The inclusion of this data subset created another tool for workflow efficiency within counties that display large amounts of agricultural activity.

Practices targeted for verification through aerial desktop review included six (6) RI BMP practices outlined within the Chesapeake Bay Program's RI Practice Definitions and Verification Visual Indicators Report. The six (6) targeted practices for aerial identification through Non-Intrusive BMP Verification were selected based upon their compliance with completing field

verification with minimal to no requirement for landowner interviews. These practices consist of Grassed Nutrient Exclusion Area on Watercourse (RI-7), Grass Buffer on Watercourse (RI-8), Forest Nutrient Exclusion Area on Watercourse (RI-9), Forest Buffer on Watercourse (RI-10), Barnyard Clean Water Diversion (RI-16), and Watering Trough (RI-18).
To assist with practice identification within the Aerial Desktop Review Platform, each platform contains toolbars to allow the functionality to measure, analyze, and mark possible BMP locations. BMP pins can be placed within the mapping portal to depict possible practice locations and can be coded by practice type. Each pin placement within the map portal is recorded into the mapping portal database for future navigation to each practice for field verification.

Implementation dates of the targeted practices are identified with the use of historical imagery within the aerial review platform through the depiction of a change or conversion of land use or landscape. If the landowner was available to provide an estimated date of practice implementation, that date was utilized for practice implementation over the aerial imagery date. If the practice was unable to be determined by historical imagery, as the resolution often provides limited ability to depict the presence or absence of older practices, practices were recorded with an implementation date of the date the practice was visited. By completing the BMP verification in this manner, it allows the county to document the practice is functioning and assign the practices the appropriate timeframe for re-verification inspections.

All identified practices are also reviewed through Practice Keeper and hard copy files to verify the practice data is not currently existing and if the practice was part of a cost sharing program provided by a state or local government agency. By reporting these historical practices, it records that the practice is present and functioning as intended, even though it may be outside of its original BMP lifecycle. The verification of this practice considers the date the inspection was completed to establish the renewed lifespan of the practice and ensure that continuous inspections occur on an appropriate timeline for each practice type.

Each of the six (6) targeted practices for verification through this methodology contains aerial review checkpoints to help with identification within the aerial mapping platform. Third-party individuals and governmental agencies utilize these checkpoints to assist with determining potential BMP locations within the aerial mapping platform, which are provided below.

Grassed Nutrient Exclusion Area on Watercourse RI-7 & Grass Buffer on Watercourse RI-8

The identification of a Grassed Nutrient Exclusion Area on Watercourse or Grass Buffer on Watercourse consists of a similar visual observation within aerial imagery. Both practices are depicted along a stream or aquatic feature that does not display disturbance from livestock or machinery and does not contain more than 50% canopy cover. This indicator is often easily displayed on aerial imagery taken during the growing season, as any disruption to the vegetation will create a contrast between a disturbance and its intended use. Once an area of grass buffer is identified, it will be classified as RI-7 if it is between 10 and 34 feet in width, or RI-8 if it is greater than 35 feet in width. This width measurement can be approximated based on the aerial desktop review measure tool, with confirmation of width occurring during non-intrusive field verification.

The visual indicators outlined within the Chesapeake Bay Program RI Practice Definitions and Verification Visual Indicators Report for RI-7 and RI-8 will be observed and recorded within the developed data collection forms during the onsite windshield survey at each practice location.

Forest Nutrient Exclusion Area on Watercourse RI-9 & Forest Buffer on Watercourse RI-10

The identification of a Forest Nutrient Exclusion Area on Watercourse or Forest Buffer on Watercourse consists of a similar visual observation within the aerial review platform. Both practices will be depicted along a stream or aquatic feature that contains a canopy cover greater than 50%. The vegetation within this buffer type consists of woody trees and shrubs that are naturally regenerated or planted. The indication of a forested buffer system along aquatic resources is best observed by the overlay of the Mapped Streams layer with forested, leafy vegetation within the aerial imagery. It is useful to utilize the mapped streams layer as stream features are often difficult to see within aerial imagery layers taken during the growing season in areas that do contain greater than 50% canopy cover.

The visual indicators outlined within the Chesapeake Bay Program RI Practice Definitions and Verification Visual Indicators Report for RI-9 and RI-10 will be observed and recorded within the developed data collection forms during the onsite windshield survey at each practice location.

Barnyard Clean Water Diversion RI-16

A Barnyard Clean Water Diversion is identified within the aerial imagery platform by the presence of a barn structure. Due to the nature of this practice and limitations on consistent

indication or poor aerial image resolutions, barn structures were identified and visited to complete non-intrusive field verification of this practice.

Barn structures identified within the aerial imagery were visited from the closest public roadway to record the presence or absence of barnyard clean water diversion practices at each site. The visual indicators outlined within the Chesapeake Bay RI Practice Definitions and Verification Visual Indicators Report were followed during the completed field verification.

Watering Trough RI-18

The identification of a Watering Trough system within the aerial imagery platform was located through the presence of a pasture or grazing system. Due to the nature of this practice and limitations on consistent indication or poor aerial image resolution, pasture and grazing systems were identified and visited to complete non-intrusive field verification as per the Chesapeake Bay Program RI Practice Definitions and Verification Visual Indicators Report guidelines for the Watering Trough practices.

Driving Route Creation

The mapping portal database located within the aerial review platform can be utilized to develop a driving route to field-verify each practice appropriately. The creation of driving routes for field practice verification efforts is an optional step within this procedure; however, this step has been found to increase program implementation efficiency.

The Excel database located within the Aerial Desktop Review Platform was utilized to create these routes, as this table can be reordered by any of the column headings, such as municipality or latitude and longitude, to export an organized excel data set. This data set was then used to develop a consecutive list of verification sites to ensure efficient routing was established. Routing has been found to be most effective when organized by municipality to ensure repetitive travel on roadways is minimized.

In addition to driving route creation, each aerial desktop review portal can be opened within an application called ArcGIS Field Maps. This application allows you to view the aerial desktop map on a compatible mobile device or tablet and navigate to each identified BMP utilizing a navigation application such as Google Maps.

A combination of qualified Group 1 and Group 2 staff were involved in the completion of the driving route creation as well as field inspection visits.

Data Collection Forms

Data collection forms were created through the utilization of the Survey123 Application. Survey123 is a web-based, form-centric application employed for field survey and data collection processes for various in-field tasks. The Survey123 Data Forms can be customized for specified requirements for any given project and can be accessed through the Survey123 App on a compatible mobile device or tablet. Please see Figure 1 for an example of the developed data collection forms.

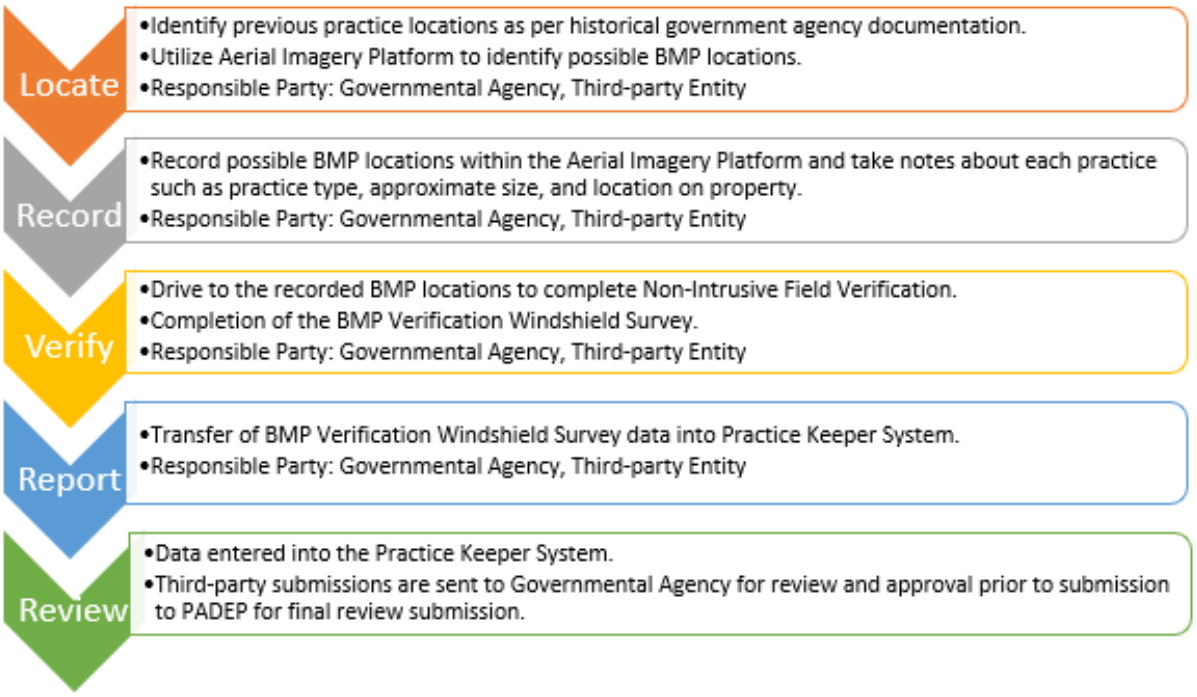
Survey123 Data Forms created for utilization through the Non-Intrusive BMP Verification Program were developed for each BMP type outlined within the Chesapeake Bay RI Practice Definitions and Verification Visual Indicators Report. Please see Table 1 for a list of these practices.

Field data forms were constructed in reference to the verification checklists and visual indicators outlined within the Chesapeake Bay RI Practice Definitions and Verification Visual Indicators Report, as well as the sample data collection forms provided by Franklin County Conservation District that received approval for program utilization through the DEP Chesapeake Bay Office.

All data collected within the Survey 123 Data Forms was reviewed and approved by a Group 1 professional before being recorded into the Practice Keeper Database.

Procedure

Through the utilization of the tools listed prior, a five-step procedure was created to locate, record, verify, report, and review the six (6) targeted RI practices for Non-Intrusive BMP Verification.



Step 1 – Locate

The first step in Non-Intrusive BMP Verification is to locate possible BMPs on the existing landscape. This process is completed utilizing historical governmental agency documentation as well as aerial desktop review through the utilization of the developed Aerial Desktop Review Platform.

As most Counties have historical reporting and practice implementation information on file, these documents were utilized to establish a set of previously implemented practices that were evaluated during the completion of this program. It was often the case that the governmental agencies, such as the Conservation District or DEP Regional Office, had documentation of previous practices that received financial and/or technical assistance for completion, though, due to the age of the practice's implementation, they were out of lifecycle or hadn't had a recent inspection completed. Practices identified within this documentation were added to the aerial desktop review platform for inclusion in Non-intrusive Field Verification.

The Aerial Desktop Review Platform is a secondary source for locating potential BMP locations and is accessible through a web browser for each specified county. This platform utilizes the

most current aerial imagery to be viewed at various scales to aid with identifying specified practice types on the landscape.

Aerial imagery utilized was provided by ESRI Wayback World imagery base mapping. This Imagery is tiled at various scales from various sources, most of which take advantage of satellite flight, although some of the data is derived from aircraft. The Wayback base map compiles all available aerial imagery layers to provide the most up-to-date data set for reference based on the location of the practice. The Imagery dataset utilized to determine current land use throughout the pilot program is dated 01/12/22.

Historical aerial imagery can also be referenced during this step to form comparisons and depict changes in land use or the estimated date of implementation or construction of a new practice. Throughout this procedure, historical imagery was utilized only when an implementation date for a practice was unknown by the verifier and by the landowner. Historical imagery used to determine practice implementation dates did not predate 1994 due to imagery clarity.

The sources of the aerial imagery data set are sited to Esri, Here, Garmin, SafeGraph, GeoTechnologies, METI/NASA, USGS, Bureau of Land Management, EPA, NPA, US Census Bureau, and USDA.

Identification of aerial signatures was completed by qualified Group 2 professionals with oversight and approval by qualified Group 1 professionals. Remote sensing and aerial photo standards are common practices throughout this procedure for identifying signatures on the landscape that may indicate specific practices or structures.

During practice identification, practice sites were pre-screened to remove locations that would have limited access or visibility during the field verification step. This pre-screening limited extra drive time and ensured that most practices recorded for field verification could be seen from a public roadway. Pre-screening criteria allowed for the removal of sites with practices that were greater than 1000 feet from a public roadway or sites that contained heavy canopy cover. Topography was not utilized to negate sites as elevation visibility varies greatly based on vegetative cover, although topography did pose the most significant setback from seeing practices from public roadways during the field verification step.

Step 2- Record

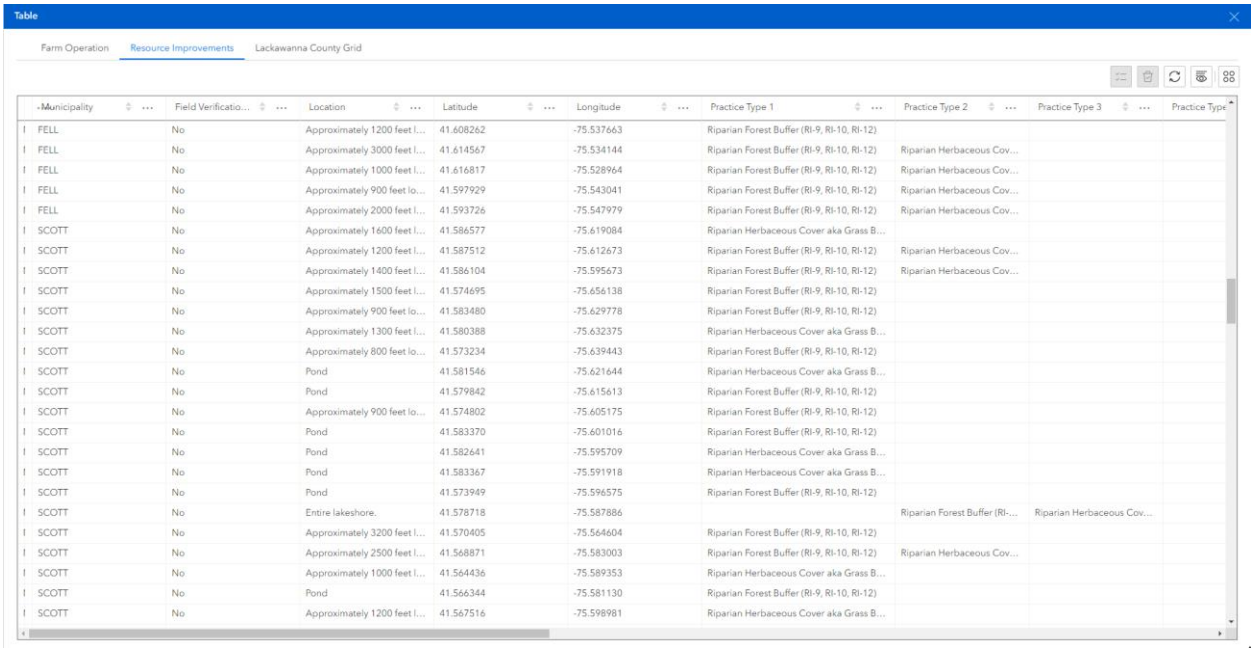
The second step of the procedure is to record potential practices that are identified in the aerial imagery. This will be completed by qualified Group 2 professionals with oversight and approval from Group 1 professionals. This task can be accomplished through the Aerial Desktop Review Platform by starting an edit session and placing pins at the determined practice locations. The “Edit” toolbar within the platform will be utilized to allow a “Resource Improvement” pin to be dropped at the approximate practice location on the landscape. Once the pin is placed on the map, a pop-up dialogue will appear, which will be filled in with site and practice specifics. The data collected within this dialogue will be recorded into the platform’s database in correlation to each RI practice pin. Information collected within this dialogue includes preliminary data such as municipality, latitude and longitude, practice type, practice size, and associated practice notes. During this step, practices are measured utilizing the measure tool within the Aerial Desktop Review Platform. The measurement of the practice can be calculated in various units, such as linear feet or acres, for the various practice types. Measurements that are recorded during this step are referenced during the completion of Step 3 to confirm practice measurements are accurate, or are field adjusted to reflect current practice conditions.

Aerial Review Platform with riparian buffer zone identified for further non-intrusive field verification.

Step 3- Verify

The next step after preliminary data recording is to complete field verification. Please note that the verification procedures outlined within this program are provided to complete this step with minimal to no intrusion onto private property.

All data recorded into the Aerial Review Platform can be exported in the form of an Excel sheet from the “Table” Tool located within the platform for utilization during this step. Once the data is exported, it can be organized to form a driving route based on the municipality and latitude and longitude of each BMP pin. It is good practice to create a separate driving route per municipality so that field verification is completed efficiently.



Municipality	Field Verificatio...	Location	Latitude	Longitude	Practice Type 1	Practice Type 2	Practice Type 3	Practice Type
FELL	No	Approximately 1200 feet l...	41.608262	-75.537663	Riparian Forest Buffer (RI-9, RI-10, RI-12)			
FELL	No	Approximately 3000 feet l...	41.614567	-75.534144	Riparian Forest Buffer (RI-9, RI-10, RI-12)	Riparian Herbaceous Cov...		
FELL	No	Approximately 1000 feet l...	41.616817	-75.528964	Riparian Forest Buffer (RI-9, RI-10, RI-12)	Riparian Herbaceous Cov...		
FELL	No	Approximately 900 feet lo...	41.597929	-75.543041	Riparian Forest Buffer (RI-9, RI-10, RI-12)	Riparian Herbaceous Cov...		
FELL	No	Approximately 2000 feet l...	41.593726	-75.547979	Riparian Forest Buffer (RI-9, RI-10, RI-12)	Riparian Herbaceous Cov...		
SCOTT	No	Approximately 1600 feet l...	41.586577	-75.619084	Riparian Herbaceous Cover aka Grass B...			
SCOTT	No	Approximately 1200 feet l...	41.587512	-75.612673	Riparian Forest Buffer (RI-9, RI-10, RI-12)	Riparian Herbaceous Cov...		
SCOTT	No	Approximately 1400 feet l...	41.586104	-75.595673	Riparian Forest Buffer (RI-9, RI-10, RI-12)	Riparian Herbaceous Cov...		
SCOTT	No	Approximately 1500 feet l...	41.574695	-75.656138	Riparian Forest Buffer (RI-9, RI-10, RI-12)			
SCOTT	No	Approximately 900 feet lo...	41.583480	-75.629778	Riparian Forest Buffer (RI-9, RI-10, RI-12)			
SCOTT	No	Approximately 1300 feet l...	41.580388	-75.632375	Riparian Herbaceous Cover aka Grass B...			
SCOTT	No	Approximately 800 feet lo...	41.573234	-75.639443	Riparian Forest Buffer (RI-9, RI-10, RI-12)			
SCOTT	No	Pond	41.581546	-75.621644	Riparian Herbaceous Cover aka Grass B...			
SCOTT	No	Pond	41.579842	-75.615613	Riparian Forest Buffer (RI-9, RI-10, RI-12)			
SCOTT	No	Approximately 900 feet lo...	41.574802	-75.605175	Riparian Forest Buffer (RI-9, RI-10, RI-12)			
SCOTT	No	Pond	41.583370	-75.601016	Riparian Forest Buffer (RI-9, RI-10, RI-12)			
SCOTT	No	Pond	41.582641	-75.595709	Riparian Herbaceous Cover aka Grass B...			
SCOTT	No	Pond	41.583367	-75.591918	Riparian Herbaceous Cover aka Grass B...			
SCOTT	No	Pond	41.573949	-75.596575	Riparian Forest Buffer (RI-9, RI-10, RI-12)			
SCOTT	No	Entire lakeshore.	41.578718	-75.587886		Riparian Forest Buffer (RI-...	Riparian Herbaceous Cov...	
SCOTT	No	Approximately 3200 feet l...	41.570405	-75.564604	Riparian Forest Buffer (RI-9, RI-10, RI-12)			
SCOTT	No	Approximately 2500 feet l...	41.568871	-75.583003	Riparian Forest Buffer (RI-9, RI-10, RI-12)	Riparian Herbaceous Cov...		
SCOTT	No	Approximately 1000 feet l...	41.564436	-75.589353	Riparian Herbaceous Cover aka Grass B...			
SCOTT	No	Pond	41.566344	-75.581130	Riparian Forest Buffer (RI-9, RI-10, RI-12)			
SCOTT	No	Approximately 1200 feet l...	41.567516	-75.598981	Riparian Herbaceous Cover aka Grass B...			

Aerial Desktop Review Table for creating driving route.

The developed driving route Excel sheets or ArcGIS Field Maps application tables are utilized to find and navigate to each practice site. If utilizing a driving route, coordinates are placed into a dashboard GPS system to ensure public roadways are utilized while accessing each site.

Once it is safe to do so, the vehicle is parked along the closest public roadway that allows the practice to be visible to the verifier. If the practice cannot be seen from the closest public roadway, that practice cannot be verified and cannot be reported as an implemented and verified practice unless a landowner interview occurs and direct onsite access is provided.

Practices that are being visually verified are within 1000 feet of the closest roadway. Based on the specific practices, the distance at which the practice can be verified from the road may vary. Depending on the vantage point of the visual inspections, the distance at which practices can be identified will vary. The use of binoculars can aid in the visual inspections and also assist in determining the functionality of any practice. At this point, it is the responsibility of the Group 1 individual to determine if all visual indicators can be seen and verified at any distance.

If the practice can be seen from the closest public roadway, BMP practice information is collected utilizing the established Survey123 Online Data Forms. After all visual indicators that ensure the practice is functioning properly can be confirmed, a data form will be completed and submitted for that practice. Please see Figure 1 for an example of a Survey 123 Online Data Form.

A Survey123 Online Data Form will be completed for each practice that is recorded and verified and is setup to collect information specific to each RI practice type. The proper data form will be selected within the drop-down dialogue of the Survey123 Online Data Form and can be filled in based on the definitions, checklist, and visual indicators listed within the Chesapeake Bay Program RI Practice Definitions and Visual Indicators Report. If practice information cannot be answered confidently and/or data outlined within the aforementioned report cannot be provided, the practice cannot be recorded at that time unless a landowner interview occurs and onsite access is provided.

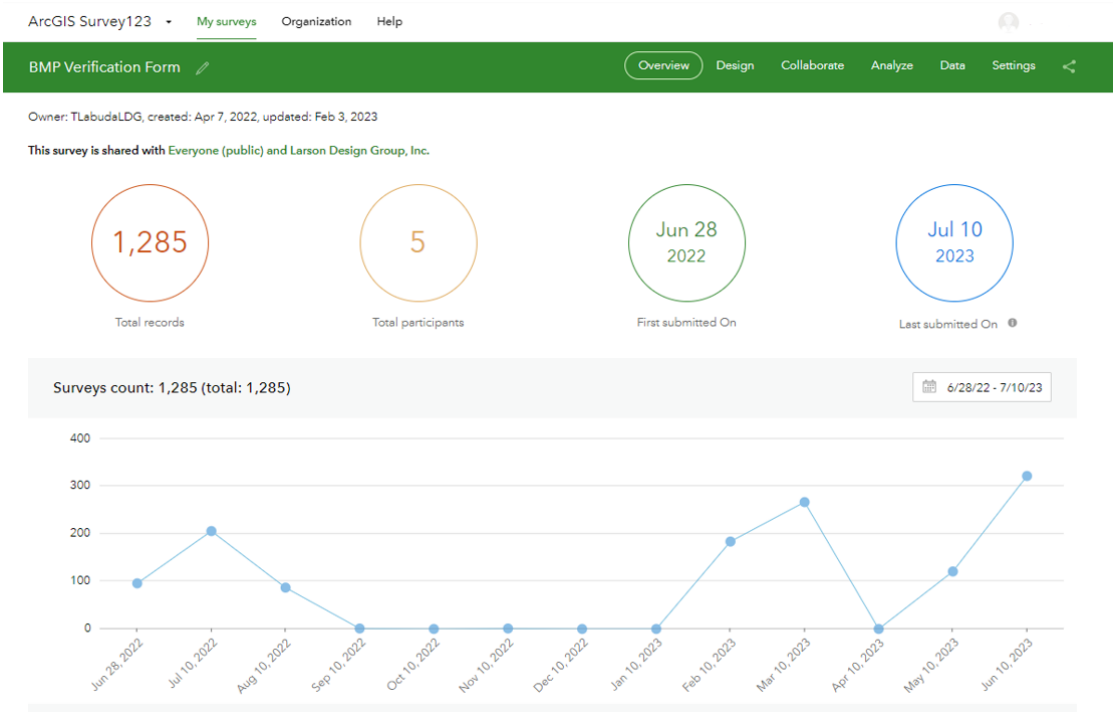
Practices that are successfully verified will have all data collected based on the visual indicators and associated practice checklist. Each data form will be submitted electronically to the online ArcGIS Hub Site.

This step can be completed by a qualified Group 2 professional with oversight and approval from a qualified Group 1 professional. Additional practices that are observed in the field but not during Step 1, can be collected as well. While visiting sites any of the 6 RI practices that all visual indicators can be observed can be added during the survey.

Step 4 – Report

Data forms that are submitted through the Survey123 application get returned electronically to the online ArcGIS Hub Site. The data forms populated within the Hub Site are then downloaded

by county and stored within an external Excel-oriented database. Each county database contains additional columns for data review and data entry tracking to ensure reporting quality. Additional tracking material includes information such as the practice submission date, submission entity, and status of submission approval.



ArcGIS Hub Site

All practices verified through this program are entered into Pennsylvania's BMP collection database, Practice Keeper, for recording purposes. All Practice Keeper reporting efforts were completed by qualified Group 2 professionals with oversight and approval from qualified Group 1 professionals.

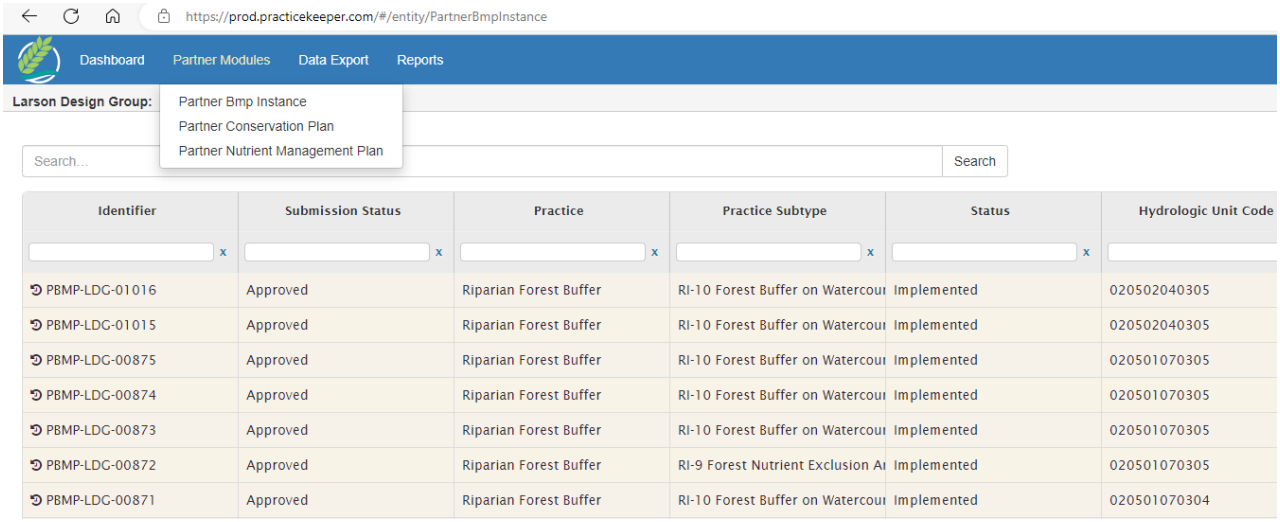
The Practice Keeper Portal requests specific information about each practice to ensure proper reporting. In order to keep data reporting consistent, the information required by Practice Keeper was utilized in the creation of the Survey123 Data Forms. Below is a comparison of the information recorded by the Practice Keeper Portal as well as the Survey123 Data Forms.

Question	Practice Keeper	Survey123 Online Data Form
Landowner Name	X	X
Practice Type	X	X
Practice Subtype	X	X
Practice Status	X	X
Latitude/Longitude	X	X
County	X	X
Address	X	X
Planned On	X	X
Implemented On	X	X
Conservation Plan Details	X	X
Practice Measures	X	X
Funding Type	X	X
Photos	X	X
RI-Checklist Questions		X

Practice Keeper and Survey123 Data Collection Comparison

Practices that have been entered into Practice Keeper by a third-party entity are submitted through a partnership portal to the associated governmental agency for final review. The qualified Group 1 governmental agency staff then must review and approve the practice before final submittal to the state.

The Practice Keeper Database has an established Standard of Procedure to ensure the quality of data reporting. This Standard Operating Procedure (SOP) was utilized and referenced throughout the completion of the Non-Intrusive BMP Verification Pilot Program.



Identifier	Submission Status	Practice	Practice Subtype	Status	Hydrologic Unit Code
PBMP-LDG-01016	Approved	Riparian Forest Buffer	RI-10 Forest Buffer on Watercour	Implemented	020502040305
PBMP-LDG-01015	Approved	Riparian Forest Buffer	RI-10 Forest Buffer on Watercour	Implemented	020502040305
PBMP-LDG-00875	Approved	Riparian Forest Buffer	RI-10 Forest Buffer on Watercour	Implemented	020501070305
PBMP-LDG-00874	Approved	Riparian Forest Buffer	RI-10 Forest Buffer on Watercour	Implemented	020501070305
PBMP-LDG-00873	Approved	Riparian Forest Buffer	RI-10 Forest Buffer on Watercour	Implemented	020501070305
PBMP-LDG-00872	Approved	Riparian Forest Buffer	RI-9 Forest Nutrient Exclusion Ar	Implemented	020501070305
PBMP-LDG-00871	Approved	Riparian Forest Buffer	RI-10 Forest Buffer on Watercour	Implemented	020501070304

Third-Party Partner BMP Instance Portal

Step 5 - Review

After the entry of the BMP into the Practice Keeper System, the BMP instance is submitted to the associated governmental agency for qualified Group 1 professionals to review. This procedure ensures that the practices that are entered are accurate and confirms that this is not an existing practice in the Practice Keeper database to prevent duplication of record submissions. All practices have required data that needs to be entered in order to receive credit for the BMP. Any accuracy issues with the recorded BMPs are rejected and sent back to the partnership portal to be corrected and re-submitted for review. Any identified duplicate practices are removed from the Practice Keeper system.

Results

Upon the conclusion of the Non-Intrusive BMP Verification Pilot Program, a case study was performed to ensure program sufficiency. The case study was conducted by completing an on-site inspection at a minimum of 10% of the Non-Intrusive Field Verified BMP locations. As 810 BMP locations were verified through the utilization of this pilot program, 81 sites were then inspected via traditional on-site inspection methods.

Traditional on-site inspections were completed by a third-party while accompanied by the appropriate governmental agency, as third-party contractors do not have the authority to access private property without consent from the landowner.

The traditional on-site inspections were completed at previous non-intrusive, verified BMP locations via random selection. As per the traditional inspection methods, the landowners associated with the location of each of the 81 BMPs were contacted via mail or phone prior to the inspection to set up a field inspection date if possible. If no response was received, a range of possible field dates was provided to the landowner so they were aware someone from their County Conservation District would be visiting their property.

Of the contacted landowners, 20 responded to the letter or phone call to either determine a meeting time or deny access to their property. It was then assumed that the remainder of the contacted landowners had no issue with the presence of Conservation District Staff on site to complete the inspection on the range of possible dates provided.

After completing all 81 traditional on-site inspections, the field data forms were compared to determine if there was consistency between the traditional on-site inspection and the developed Non-Intrusive BMP Verification Pilot Program.

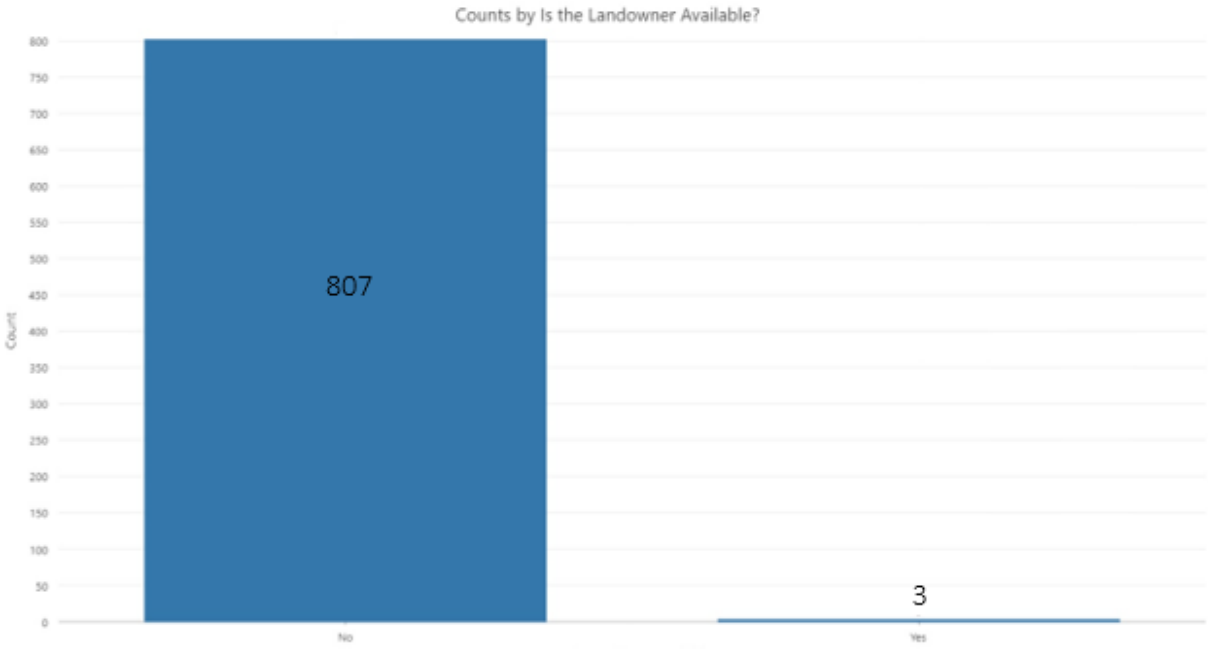
The comparison of this data was completed by cross-referencing the amount of data fields completed within the Survey123 Data Forms, which were used for both types of BMP verification, as well as the validity of the data collected by both methods.

After completing the comparison of the amount of data collected, the percentage of data form fields able to be completed during both verification methods remained relatively constant, with the exception of an updated landowner name being available during the traditional on-site inspections if the landowner was available, as well as more detailed BMP photographs due to access to private property.

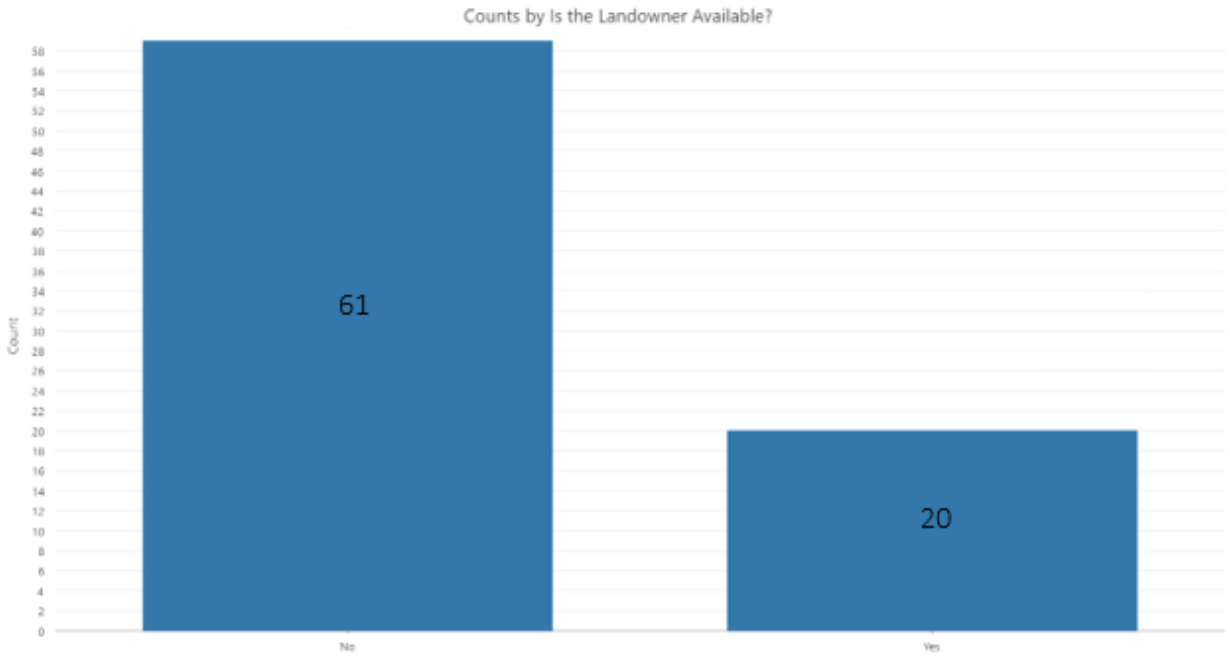
The comparison of the validity of the data collected also provided similar results between the traditional on-site inspection and the Non-Intrusive BMP Verification Pilot Program methodology. The validity of the data remained consistent with non-intrusive methods due to the limited contact with the landowner, even after reaching out to schedule field visits. The data available for collection remained the same as what was available to the verifiers during the non-intrusive methods at the sites where landowners were not present.

Differentiation of data availability occurred only at the properties where the landowner was available on site to have a meeting about the practice in question. This instance occurred at 20 of the 81 sites inspected using traditional on-site methods. Although the landowner was available, they often had minimal additional information to provide about the RI practices in question. Most practices were either implemented by the landowner voluntarily or by a previous owner had implemented the practices resulting in unknown implementation dates unless the landowner received funding for completion. There was little to no additional practice information provided by the landowner for the six (6) RI BMPs targeted for verification.

After this data collection comparison, it has been identified that even if landowner availability is confirmed, both methods achieve the same accuracy of data collection.



Landowner contact during Non-Intrusive BMP Verification – 4-1-2022 to 3-31-2023



Landowner contact during Traditional BMP Inspection – 4-1-2023 to 7-12-2023

Overall data collection results were also evaluated through conducting analysis of the validity of aerial identification methods as well as field verification methods, utilizing metrics considered to assess overall methodology accuracy. Rates calculated for analysis consist of the False Alarm Ratio (FAR), Hit Rate (HR), Critical Success Index (CSI), Post Agreement Rate (PAG), and Proportion Correct (PC) (Schaefer 1990). Below is an explanation of the calculated metrics used for procedure analysis. The base data for these calculations is located in Tables 2, 3, and 4 with the appendix of the methodology. A Confidence Level of 95% was used for all Confidence Interval for Proportions calculations. Additional calculation metrics are located in the tables below.

RI Practice Type	Critical Success (CS)	False Alarm Ratio (FAR)	Hit Rate (HR)	Post Agreement Rate (PAG)	Proportion Correct (PC)	Frequency Bias (FB)
RI-7	0.76	0.24	1.00	0.76	0.76	1.32
RI-8	0.32	0.00	0.32	1.00	0.32	0.32
RI-9	0.38	0.62	1.00	0.38	0.38	2.61
RI-10	0.86	0.14	1.00	0.86	0.86	1.17
RI-16	0.93	0.00	0.93	1.00	0.93	0.93
RI-18	0.28	0.00	0.28	1.00	0.28	0.28

Confidence Interval for Proportions									
Practice Type	p=Criterical Success Index		Margin of Error	p=False Alarm Rate		Margin of Error	p=Hit Rate		Margin of Error
	Low	High		Low	High		Low	High	
RI-7	0.6224	0.8976	14%	0.1024	0.3776	14%	0.9579	1.0221	3%
RI-8	0.219	0.4271	10%				0.219	0.4271	10%
RI-9	0.2932	0.4668	9%	0.5332	0.7068	9%	0.9722	1.0078	2%
RI-10	0.8303	0.8852	3%	0.1148	0.1148	3%	0.9821	0.9979	1%
RI-16	0.8821	0.9779	5%				0.8821	0.9779	5%
RI-18	0.07258	0.4874	21%				0.07258	0.4874	21%

RI-7 Grassed Nutrient Exclusion Area, Narrow

Metrics calculated for the evaluation of Narrow Grassed Nutrient Exclusion Areas (RI-7) displayed a Critical Success Rate of 0.76. This rate reflects a successful overall accuracy of observations that were confirmed on the ground level.

The FAR reflects the fraction of remotely detected projects that were not able to be confirmed during the windshield survey. For RI-7, this value is 0.24, as limited practices identified on aerial imagery were not able to be verified during an on-site inspection.

The HR factor indicates the fraction of remotely-detected BMPs that were confirmed or found through our windshield surveys. HR values range from 0 to 1, with a value of 1 indicating all BMPs were found. For Narrow Grassed Nutrient Exclusion Areas, this value was calculated at 1.0.

RI-8 Grassed Nutrient Exclusion Area, Wide

Metrics calculated for the evaluation of Wide Grassed Nutrient Exclusion Areas (RI-8) displayed a Critical Success Rate of 0.32. This rate reflects a low rate of overall accuracy of observations that were confirmed through the windshield survey. This is due to a lower number of RI-8 practices identified on aerial imagery as compared to what was successfully observed through the windshield survey. This increased amount of verified RI-8 practices originated from practices that were identified on aerial imagery as an RI-7 practice but met the classification of an RI-8 practice during the windshield survey.

The FAR reflects the fraction of remotely detected projects that were not able to be confirmed during field verification. For RI-8, this value is 0, as all of the practices identified on aerial imagery were able to be verified during the windshield survey.

The HR factor indicates the fraction of remotely detected BMPs that were confirmed or found through the windshield survey. HR values range from 0 to 1, with a value of 1 indicating all BMPs were found. For Wide Grassed Nutrient Exclusion Areas, this value was calculated at 0.32. This value states that this practice was under identified on the windshield survey upon what was located during the aerial review.

RI-9 Forested Nutrient Exclusion Area, Narrow

Metrics calculated for the evaluation of Narrow Forested Nutrient Exclusion Areas (RI-9) displayed a Critical Success Rate of 0.38. This rate reflects a low rate of overall accuracy of observations that were confirmed on the windshield survey. This is due to a higher number of RI-9 practices identified on aerial imagery as compared to what was successfully verified on the windshield survey.

The FAR reflects the fraction of remotely detected projects that were not able to be confirmed during the windshield survey. For RI-9, a rate of 0.61 of the practices identified on aerial imagery were not able to be verified during the windshield survey. This percentage was reflected as high due to the majority of practices identified on aerial imagery as narrow forested buffers being considered wide forest buffers when the windshield survey occurred.

The HR factor indicates the fraction of remotely detected BMPs that were confirmed or found through the windshield survey. HR values range from 0 to 1, with a value of 1 indicating all BMPs were found. For Narrow Forested Nutrient Exclusion Areas, this value was calculated at 1.0.

RI-10 Forested Nutrient Exclusion Area, Wide

Metrics calculated for the evaluation of Wide Forested Nutrient Exclusion Areas (RI-10) displayed a Critical Success Rate of 0.86. This rate reflects a successful overall accuracy of the observations that were confirmed on the windshield survey.

The FAR reflects the fraction of remotely detected projects that were not able to be confirmed during the windshield survey. For RI-10, a rate of 0.14 of the practices identified on aerial imagery were not able to be verified during the windshield survey.

The HR factor indicates the fraction of remotely detected BMPs that were confirmed or found through the windshield survey. HR values range from 0 to 1, with a value of 1 indicating all BMPs were found. For Wide Forested Nutrient Exclusion Areas, this value was calculated at 1.0. This value states that all practices identified on aerial imagery were able to be verified on the windshield survey.

RI-16 Barnyard Clean Water Diversion

Metrics calculated for the evaluation of Barnyard Clean Water Diversion (RI-16) displayed a Critical Success Rate of 0.93. This rate reflects a successful overall accuracy of the observations that were confirmed on the windshield survey.

The FAR reflects the fraction of remotely detected projects that were not able to be confirmed during the windshield survey. For RI-16, this value is 0, as all of the practices identified on aerial imagery were able to be verified during the windshield survey.

The HR factor indicates the fraction of remotely detected BMPs that were confirmed or found through the windshield survey. HR values range from 0 to 1, with a value of 1 indicating all BMPs were found. For Barnyard Clean Water Diversions, this value was calculated at 0.93. This value states that almost all practices identified via aerial imagery were able to be verified on the windshield survey.

RI-18 Watering Trough

Metrics calculated for the evaluation of Watering Troughs (RI-18) displayed a Critical Success Rate of 0.28. This rate reflects a low rate of overall accuracy of observations that were confirmed on the windshield survey. This is due to a lower number of RI-18 practices identified on aerial imagery as compared to what was successfully verified on the windshield survey.

The FAR reflects the fraction of remotely detected projects that were not able to be confirmed during the windshield survey. For RI-18, this value is 0, as all of the practices identified on aerial imagery were able to be verified during the windshield survey.

The HR factor indicates the fraction of remotely detected BMPs that were confirmed or found through the windshield survey. HR values range from 0 to 1, with a value of 1 indicating all BMPs were found. For Watering Troughs, this value was calculated at 0.28. This value states

that this practice was under identified on the ground based upon what was located during the aerial review.

Throughout the analysis, several results showed both favorable and unfavorable metric calculations. However, in several of the RI practices, a limited data set is impacting this analysis. This methodology is still valid, and certain RIs can be verified utilizing this verification method. It was determined that some of the practices were not successfully identified through the aerial imagery but could be verified while conducting the verification process for additional RI practices. Overall, this methodology is effective for the identified RI practices.

Cost and Time Analysis

Below is an estimated time analysis comparison of the Non-Intrusive BMP Verification method and the traditional Field Inspection method. This comparison of average hours per task is based on the verification completion of 50 RI BMPs.

The timeframes depicted below are representations of the time needed to complete the BMP verification processes. Time commitments were taken from both government and third-party personnel to complete the methodology's timeframe estimation. Outside variables are present that could affect the averages outlined below. Possible variables include drive time, location of surveyed areas, existing data, and interactions with the landowner.

Non-Intrusive BMP Methodology

Task	Time Requirement – Per 50 BMP's	Comments
Database Development	24 Hours	Only needed at start of the program
Complete Aerial Review	4-hour average	Can differ based on concentration of farming operations. Includes base data collection
Complete Driving Routes	3 hours	
Windshield Survey	11-hour average	Includes drive time and form completion
Data Entry and Review	12-hour average	
Total	54 Hours – 30 hours without Data base development	

Traditional Field Inspection

Task	Time Requirement – Per 50 BMP's	Comments
Landowner Notification – Mailings, email, or calls	18 hours	Average 15 minutes per parcel with 50% needing a follow up communication.
BMP Identification	16 hours	Plan review or previously implemented BMP
Complete Inspections with Landowner	80 hours	Assume a 1.5-hour drivetime per day and 15 minutes between operations. Assuming 2 BMPs per site and 10 per day. Variable can occur and reduce number of site visits.
Data Entry and Review	12-hour average	
Total	126 hours	

It was found that Non-Intrusive BMP methods can be completed in roughly 25% of the time needed for traditional field inspection. The negative aspect is that only about 75% of the BMP can be seen and verified from the road, whereas traditional inspection can account for every BMP.

To establish a cost analysis between the two methodologies, 810 BMPs were identified as part of the pilot program. Based on an average of hours, it would take roughly 550 hours to complete the Non-Intrusive BMP methodology and 1,920 hours to complete the traditional field inspection for the same 810 BMPs. When compared to an average 2,080-hour work year, that is 27% of a person's yearly job duties for Non-intrusive BMP verification and 92% of a person's yearly job duties for traditional field inspections.

Conclusion

The Non-Intrusive BMP Verification methodology is an effective and cost-efficient protocol that can be used to capture RI BMPs. This method can be utilized to collect new BMPs or re-verify existing BMPs with the added functionality of data reporting consolidation within the Online ArcGIS Hub Site. This tool provides organization for agency staff and allows the ability to utilize third-party consultants to assist in the completion of this program. Although this methodology does vary from traditional inspection reporting, overall data collection and accuracy are comparable to traditional field inspection methods.

References

Bureau of Clean Water, Standard Operating Procedure (SOP) Practice Keeper - Best Management Practice (BMP) Module SOP No. CBO-DATA-003 (2021). Department of Environmental Protection.

Ensor, R., Absher, D., Moore, G., Garber, L., McGee, B., Albrecht, G., Weibley, E., Wootton, C., & Hill, J. (2014). Appendix H - Chesapeake Bay Program Resource Improvement Practice Definitions and Verification Visual Indicators Report. *Pennsylvania Clean Water Academy*. PA Clean Water Academy (remote-learner.net)

Pennsylvania Department of Environmental Protection. (n.d.). *Practicekeeper*. PracticeKeeper. https://prod.practicekeeper.com/#/

Schaefer, J.T. 1990. The critical success index as an indicator of warning skill. Weather and Forecasting. 5:570-575

Tables

Table 1

Resource Improvement Practices

Code	Resource Improvement Practice Name	Additional Practice Information
RI-1	Dry Waste Storage Structure	
RI-2	Animal Compost Structure	
RI-3	Alternative Crop/Switchgrass	
RI-4A	Watercourse Access Control-Narrow Grass	10'-34' Width Exclusion Area, Natural Grass or planted
RI-4B	Watercourse Access Control-Narrow Trees	10'-34' Width Exclusion Area, Native Trees or planted
RI-5	Watercourse Access Control-Grass	35'+ Width Exclusion Area, Natural or planted Grass
RI-6	Watercourse Access Control-Trees	35'+ Width Exclusion Area, Natural or planted Trees
RI-7	Grass Nutrient Exclusion Area on Watercourse	10'-34' Width Nutrient Exclusion Area
RI-8	Grass Buffer on Watercourse	35'+ Width Buffer
RI-9	Forest Nutrient Exclusion Area on Watercourse	10'-34' Width Nutrient Exclusion Area
RI-10	Forest Buffer on Watercourse	35'+ Width Buffer
RI-11	Vegetative Environmental Buffer for Poultry-Grass	Warm Season Grass
RI-12	Vegetative Environmental Buffer for Poultry-Trees	Trees
RI-13	Conversion to Pasture	
RI-14	Conversion to Hayland	
RI-15	Rotational Grazing	
RI-16	Barnyard Clean Water Diversion	
RI-17	Water Control Structure	
RI-18	Watering Trough	

Note: Table 1 refers to all RI Practices outlined within the Chesapeake Bay Program RI Practice Definitions and Verification Visual Indicators Report. Six (6) of the practices outlined within this complete list were utilized throughout the identification, verification, and recording process of BMP locations reported within the Practice Keeper Database for nutrient and sediment load reduction calculations. The six (6) practices evaluated consisted of Grass Nutrient Exclusion Area on Watercourse (RI-7), Grass Buffer on Watercourse (RI-8), Forest Nutrient Exclusion Area on Watercourse (RI-9), Forest Buffer on Watercourse (RI-10), Barnyard Clean Water Diversion (RI-16), and Watering Trough (RI-18).

Table 2

Verification Metrics

Code	Resource Improvement Practice Name	Verification Metrics
RI-1	Dry Waste Storage Structure	~
RI-2	Animal Compost Structure	~
RI-3	Alternative Crop/Switchgrass	~
RI-4A	Watercourse Access Control-Narrow Grass	~
RI-4B	Watercourse Access Control-Narrow Trees	~
RI-5	Watercourse Access Control-Grass	~
RI-6	Watercourse Access Control-Trees	~
RI-7	Grass Nutrient Exclusion Area on Watercourse	28
RI-8	Grass Buffer on Watercourse	82
RI-9	Forest Nutrient Exclusion Area on Watercourse	46
RI-10	Forest Buffer on Watercourse	527
RI-11	Vegetative Environmental Buffer for Poultry-Grass	~
RI-12	Vegetative Environmental Buffer for Poultry-Trees	~
RI-13	Conversion to Pasture	~
RI-14	Conversion to Hayland	~
RI-15	Rotational Grazing	~
RI-16	Barnyard Clean Water Diversion	109
RI-17	Water Control Structure	~
RI-18	Watering Trough	18
	Total Practices Verified	810

Note: Table 2 presents the dataset of BMPs verified within Clinton, Lackawanna, Luzerne, Susquehanna, and Potter Counties through the completion of the Non-Intrusive BMP Verification procedure from April 2022 to March 2023. All practices listed above were verified based upon the visual indicator checklists outlined within the Chesapeake Bay Program RI Practice Definitions and Verification Visual Indicators Report. Practices verified consisted of Grass Nutrient Exclusion Area on Watercourse (RI-7), Grass Buffer on Watercourse (RI-8), Forest Nutrient Exclusion Area on Watercourse (RI-9), Forest Buffer on Watercourse (RI-10), Barnyard Clean Water Diversion (RI-16), and Watering Trough (RI-18).

Table 3

Aerial Identification Metrics

Code	Resource Improvement Practice Name	Aerial Identification Metrics
RI-1	Dry Waste Storage Structure	~
RI-2	Animal Compost Structure	~
RI-3	Alternative Crop/Switchgrass	~
RI-4A	Watercourse Access Control-Narrow Grass	~
RI-4B	Watercourse Access Control-Narrow Trees	~
RI-5	Watercourse Access Control-Grass	~
RI-6	Watercourse Access Control-Trees	~
RI-7	Grass Nutrient Exclusion Area on Watercourse	37
RI-8	Grass Buffer on Watercourse	26
RI-9	Forest Nutrient Exclusion Area on Watercourse	120
RI-10	Forest Buffer on Watercourse	614
RI-11	Vegetative Environmental Buffer for Poultry-Grass	~
RI-12	Vegetative Environmental Buffer for Poultry-Trees	~
RI-13	Conversion to Pasture	~
RI-14	Conversion to Hayland	~
RI-15	Rotational Grazing	~
RI-16	Barnyard Clean Water Diversion	101
RI-17	Water Control Structure	~
RI-18	Watering Trough	5
	Total Practices Identified Via Aerial Imagery	1007

Note: Table 3 presents the dataset of BMPs identified via aerial imagery within Clinton, Lackawanna, Luzerne, Susquehanna, and Potter Counties through the completion of the Non-Intrusive BMP Verification procedure from April 2022 to March 2023. All practices listed above were identified based on the visual indicators outlined for aerial desktop analysis. Practices identified consisted of Grass Nutrient Exclusion Area on Watercourse (RI-7), Grass Buffer on Watercourse (RI-8), Forest Nutrient Exclusion Area on Watercourse (RI-9), Forest Buffer on Watercourse (RI-10), Barnyard Clean Water Diversion (RI-16), and Watering Trough (RI-18).

Table 4

Quality Assurance Verification Metrics

Code	Resource Improvement Practice Name	Aerial Identification Metrics
RI-1	Dry Waste Storage Structure	~
RI-2	Animal Compost Structure	~
RI-3	Alternative Crop/Switchgrass	~
RI-4A	Watercourse Access Control-Narrow Grass	~
RI-4B	Watercourse Access Control-Narrow Trees	~
RI-5	Watercourse Access Control-Grass	~
RI-6	Watercourse Access Control-Trees	~
RI-7	Grass Nutrient Exclusion Area on Watercourse	4
RI-8	Grass Buffer on Watercourse	6
RI-9	Forest Nutrient Exclusion Area on Watercourse	6
RI-10	Forest Buffer on Watercourse	46
RI-11	Vegetative Environmental Buffer for Poultry-Grass	~
RI-12	Vegetative Environmental Buffer for Poultry-Trees	~
RI-13	Conversion to Pasture	~
RI-14	Conversion to Hayland	~
RI-15	Rotational Grazing	~
RI-16	Barnyard Clean Water Diversion	14
RI-17	Water Control Structure	~
RI-18	Watering Trough	5
	Total Practices Identified Via Aerial Imagery	81

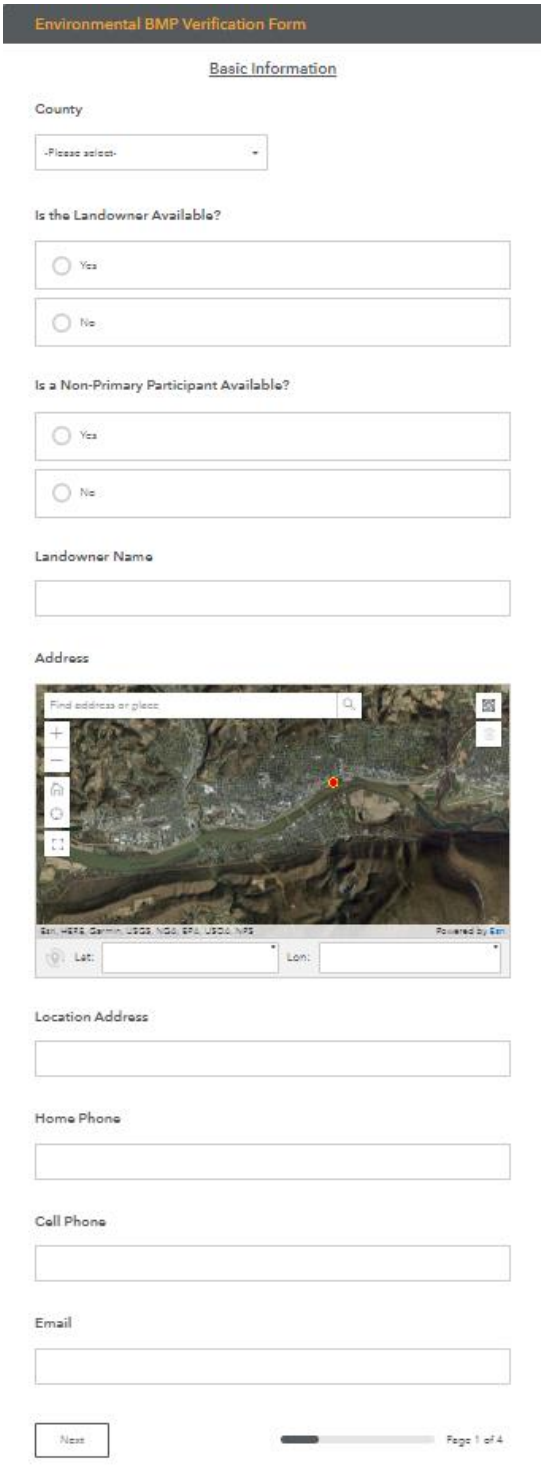
Note: Table 4 presents the dataset of BMPs verified through the completion of the Quality Assurance Non-Intrusive BMP Verification procedure from June 2023 to August 2023. All practices listed above were verified based upon the visual indicator checklists outlined within the Chesapeake Bay Program RI Practice Definitions and Verification Visual Indicators Report and on-site verification methodology. Practices verified consisted of Grass Nutrient Exclusion Area on Watercourse (RI-7), Grass Buffer on Watercourse (RI-8), Forest Nutrient Exclusion Area on Watercourse (RI-9), Forest Buffer on Watercourse (RI-10), Barnyard Clean Water Diversion (RI-16), and Watering Trough (RI-18).

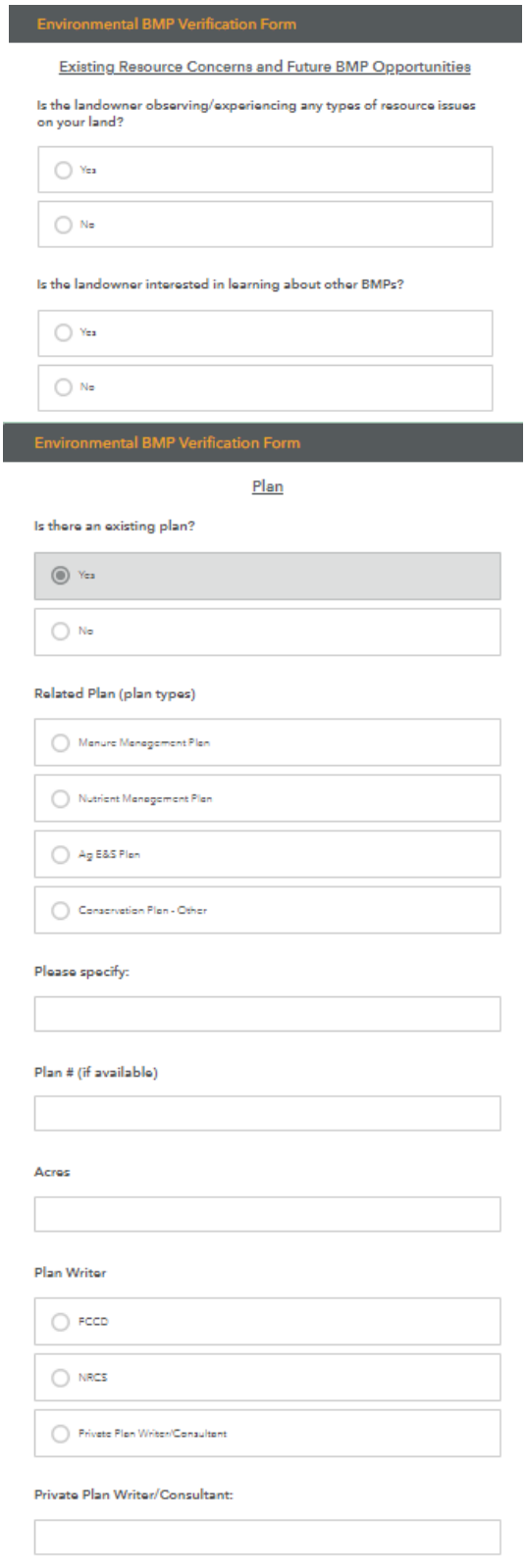
Figures

Figure 1.

Non-Intrusive BMP Verification – Survey 123 Online Data Form Examples

Overall Form Questions





Overall Form Questions

Release Needed

- Yes
- No

Type of Release Signed

- NRCS
- Private/DEP
- Other

Other:

Significant Dates

Implemented On:

MM/DD/YYYY

Planned On:

MM/DD/YYYY

Inventory Evaluation On:

MM/DD/YYYY

Surveyed On:

MM/DD/YYYY

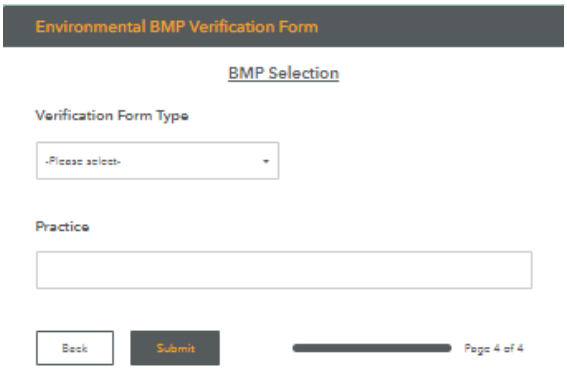
Design Approved On:

MM/DD/YYYY

Implemented Cost

Additional Notes

255



RI-7 Form Questions

Environmental BMP Verification Form

Riparian Herbaceous Cover / Riparian Grass Buffer

Practice Subtype

- [x] RI-7 Grass Nutrient Exclusion Area on Watercourse (10'-34')
- [ ] RI-8 Grass Buffer on Watercourse (35'+)
- [ ] RI-11 Environmental Buffer for Poultry

How was this BMP Implemented?

- [ ] NRCS
- [ ] Growing Greener
- [ ] Landowner
- [ ] Grant Award
- [ ] Other

Funding Date:

MM/DD/YYYY

Implemented Date:

MM/DD/YYYY

Implemented Cost

Location Notes

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Horizontal buffer width ≥ 10', measured perpendicular to top-of-bank intermittent stream, ditch or tidal area.

- ○ Yes
- ○ No
- ○ N/A

Width is ≥ 35' if receiving dissolved contaminants (e.g. nutrients, pesticides).

- ○ Yes
- ○ No
- ○ N/A

Overland flow through buffer is maintained as sheet flow.

- ○ Yes
- ○ No
- ○ N/A

All excessive sheet-rill and concentrated flow are controlled in areas immediately adjacent & up gradient of buffer, before entering.

- ○ Yes
- ○ No
- ○ N/A

No livestock are present no have access.

- ○ Yes
- ○ No
- ○ N/A

Plant species are native (preferred), or introduced and non-invasive, with stiff stems and high stem density.

- ○ Yes
- ○ No
- ○ N/A

Plants are compatible in growth rate, tolerant of flooding/saturation and shade.

- ○ Yes
- ○ No
- ○ N/A

RI-7 Form Questions

Minimum of 75% perennial grass cover is present.

- Yes
- No
- N/A

RI-7: 10'-34' Width Nutrient Exclusion Area

Length Feet:

Width Feet:

Measures

(acres of buffer OR watercourse subtype - NOT both)

Implemented Amount

Acres of Riparian Herbaceous Cover/Riparian Grass Buffer

Acres of Grass Buffer on Watercourse

Acres of Grass Nutrients Exclusion Area on Watercourse (Narrow

Is this a BMP reverification?

- Yes
- No

BMP Photo 1

Drop image here or select image

BMP Photo 2

Drop image here or select image

Parameters for Renewed Credit?

Riparian Herbaceous Cover/Riparian Grass Buffer - Proper O&M?

- Yes
- No

** If recording Subtype of BMP on this form, please use the space below to note any of the BMPs described on this form that are eligible for renewed credit. Also be sure to note any of the BMPs described on this form that are NOT eligible for renewed credit.**

Subtype: Grass Buffer on Watercourse - Proper O&M?

- Yes
- No

Subtype: Grass Nutrient Exclusion Area on Watercourse (Narrow) - Proper O&M?

- Yes
- No

Notes

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RI-8 Form Questions

Environmental BMP Verification Form

Riparian Herbaceous Cover / Riparian Grass Buffer

Practice Subtype

- [ ] RI-7 Grass Nutrient Exclusion Area on Watercourse (10'-34')
- [x] RI-8 Grass Buffer on Watercourse (35'+)
- [ ] RI-11 Environmental Buffer for Poultry

How was this BMP Implemented?

- [ ] NRCS
- [ ] Growing Greener
- [ ] Landowner
- [ ] Grant Award
- [ ] Other

Funding Date:

MM/DD/YYYY

Implemented Date:

MM/DD/YYYY

Implemented Cost

Location Notes

255

Horizontal buffer width ≥ 10', measured perpendicular to top-of-bank intermittent stream, ditch or tidal area.

- ○ Yes
- ○ No
- ○ N/A

Width is ≥ 35' if receiving dissolved contaminants (e.g. nutrients, pesticides).

- ○ Yes
- ○ No
- ○ N/A

Overland flow through buffer is maintained as sheet flow.

- ○ Yes
- ○ No
- ○ N/A

All excessive sheet-rill and concentrated flow are controlled in areas immediately adjacent & up gradient of buffer, before entering.

- ○ Yes
- ○ No
- ○ N/A

No livestock are present no have access.

- ○ Yes
- ○ No
- ○ N/A

Plant species are native (preferred), or introduced and non-invasive, with stiff stems and high stem density.

- ○ Yes
- ○ No
- ○ N/A

Plants are compatible in growth rate, tolerant of flooding/saturation and shade.

- ○ Yes
- ○ No
- ○ N/A

RI-8 Form Questions

Minimum of 75% perennial grass cover is present.

- Yes
- No
- N/A

RI-8: 35'+ Width Buffer

Length Feet:

Width Feet:

Measures

(acres of buffer OR watercourse subtype - NOT both)

Implemented Amount

Acres of Riparian Herbaceous Cover/Riparian Grass Buffer

Acres of Grass Buffer on Watercourse

Acres of Grass Nutrients Exclusion Area on Watercourse (Narrow

Is this a BMP reverification?

- Yes
- No

BMP Photo 1

Drop image here or select image

BMP Photo 2

Drop image here or select image

Parameters for Renewed Credit?

Riparian Herbaceous Cover/Riparian Grass Buffer - Proper O&M?

- Yes
- No

** If recording Subtype of BMP on this form, please use the space below to note any of the BMPs described on this form that are eligible for renewed credit. Also be sure to note any of the BMPs described on this form that are NOT eligible for renewed credit.**

Subtype: Grass Buffer on Watercourse - Proper O&M?

- Yes
- No

Subtype: Grass Nutrient Exclusion Area on Watercourse (Narrow) - Proper O&M?

- Yes
- No

Notes

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RI-9 Form Questions

Environmental BMP Verification Form

Riparian Forest Buffer

Practice Subtype

- [x] RI-9 Forest Nutrient Exclusion Area on Watercourse (10'-34')
- [ ] RI-10 Forest Buffer on Watercourse (35'+)
- [ ] RI-12 Environmental Buffer for Poultry

How was this BMP Implemented?

- [ ] NRCS
- [ ] Growing Greener
- [ ] Landowner
- [ ] Grant Award
- [ ] Other

Funding Date:

MM/DD/YYYY

Implemented Date:

MM/DD/YYYY

Implemented Cost

Location Notes

255

Dominant vegetation (>50% canopy cover) consists of existing, naturally regenerated, or planted trees and/or shrubs.

- ○ Yes
- ○ No
- ○ N/A

Perpendicular distance from top-of-bank of stream, ditch or tidal area ≥ 10' minimum average for width of buffer.

- ○ Yes
- ○ No
- ○ N/A

Overland/sheet flow through buffer is maximized (no concentrated flow)

- ○ Yes
- ○ No
- ○ N/A

Structural measures are present where vegetation practice is insufficient to control erosion.

- ○ Yes
- ○ No
- ○ N/A

RI-9: 10'-34' Width Nutrient Exclusion Area

Length Feet:

Width Feet:

Measures

(acres of buffer OR watercourse subtype - NOT both)

Implemented Amount

Acres of Riparian Forest Buffer

Acres of Forest Buffer on Watercourse

Acres of Forest Nutrients Exclusion Area on Watercourse (Narrow)

RI-9 Form Questions

Is this a BMP reverification?

- Yes
- No

BMP Photo 1

Drop image here or select image

BMP Photo 2

Drop image here or select image

Parameters for Renewed Credit?

Riparian Forest Buffer - Proper O&M?

- Yes
- No

** If recording Subtype of BMP on this form, please use the space below to note any of the BMPs described on this form that are eligible for renewed credit. Also be sure to note any of the BMPs described on this form that are NOT eligible for renewed credit.**

Subtype: Forest Buffer on Watercourse - Proper O&M?

- Yes
- No

Subtype: Forest Nutrient Exclusion Area on Watercourse (Narrow) - Proper O&M?

- Yes
- No

Notes

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RI-10 Form Questions

Environmental BMP Verification Form

Riparian Forest Buffer

Practice Subtype

- [ ] RI-9 Forest Nutrient Exclusion Area on Watercourse (10'-34')
- [x] RI-10 Forest Buffer on Watercourse (35'+)
- [ ] RI-12 Environmental Buffer for Poultry

How was this BMP Implemented?

- [ ] NRCS
- [ ] Growing Greener
- [ ] Landowner
- [ ] Grant Award
- [ ] Other

Funding Date:

MM/DD/YYYY

Implemented Date:

MM/DD/YYYY

Implemented Cost

Location Notes

255

Dominant vegetation (>50% canopy cover) consists of existing, naturally regenerated, or planted trees and/or shrubs.

- ○ Yes
- ○ No
- ○ N/A

Perpendicular distance from top-of-bank of stream, ditch or tidal area ≥ 10' minimum average for width of buffer.

- ○ Yes
- ○ No
- ○ N/A

Overland/sheet flow through buffer is maximized (no concentrated flow)

- ○ Yes
- ○ No
- ○ N/A

Structural measures are present where vegetation practice is insufficient to control erosion.

- ○ Yes
- ○ No
- ○ N/A

RI-10: 35'+ Width Buffer

Length Feet:

Width Feet:

Measures

(acres of buffer OR watercourse subtype - NOT both)

Implemented Amount

Acres of Riparian Forest Buffer

Acres of Forest Buffer on Watercourse

Acres of Forest Nutrients Exclusion Area on Watercourse (Narrow)

RI-10 Form Questions

Is this a BMP reverification?

- Yes
- No

BMP Photo 1

Drop image here or select image

BMP Photo 2

Drop image here or select image

Parameters for Renewed Credit?

Riparian Forest Buffer - Proper O&M?

- Yes
- No

** If recording Subtype of BMP on this form, please use the space below to note any of the BMPs described on this form that are eligible for renewed credit. Also be sure to note any of the BMPs described on this form that are NOT eligible for renewed credit.**

Subtype: Forest Buffer on Watercourse - Proper O&M?

- Yes
- No

Subtype: Forest Nutrient Exclusion Area on Watercourse (Narrow) - Proper O&M?

- Yes
- No

Notes

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RI-16 Form Questions

Environmental BMP Verification Form

Watering Facility

Practice Subtype

- (●) RI-16 Barnyard Clean Water Diversion
- ( ) RI-17 Water Control Structure
- ( ) RI-18 Watering Trough

How was this BMP Implemented?

- [ ] NRCS
- [ ] Growing Greener
- [ ] Landowner
- [ ] Grant Award
- [ ] Other

Funding Date:

MM/DD/YYYY

Implemented Date:

MM/DD/YYYY

Implemented Cost

Location Notes

255

Surface outlet is stable; downspouts have elbow and dissipation device directed away from buildings, as appropriate.

- ( ) Yes
- ( ) No
- ( ) N/A

Gutter-less system has stone-filled, collection trench under entire roof drip line: width ≥ 24", depth ≥ 24".

- ( ) Yes
- ( ) No
- ( ) N/A

Drip line stone extends along side of and over pipe.

- ( ) Yes
- ( ) No
- ( ) N/A

Gutter is K-style, half-round or box-type on good-condition vertical fascia board, free floating on supports, and ≥ 5" top width. Roof rafter ends are sound.

- ( ) Yes
- ( ) No
- ( ) N/A

Downspout avoids mix with waste.

- ( ) Yes
- ( ) No
- ( ) N/A

The system is sound and functioning.

- ( ) Yes
- ( ) No
- ( ) N/A

Downspouts are securely fastened @ top & bottom, with intermediate supports ≤ 10', installed appropriately.

- ( ) Yes
- ( ) No
- ( ) N/A

RI-16 Form Questions

Gutter & downspouts are protected from livestock. Otherwise made of steel pipe, Sch40, or similar.

- Yes
- No
- N/A

Clean surface runoff is directed away from barnyard area.

- Yes
- No
- N/A

Number of Systems:

Implemented Amount

# of Watering Facilities

# of Watering Troughs

Is this a BMP reverification?

- Yes
- No

BMP Photo 1:

Drop image here or select image

BMP Photo 2:

Drop image here or select image

Parameters for Renewed Credit?

Watering Facility - Proper O&M?

- Yes
- No

If recording more than 1 BMP on this form, please use the space below. Also be sure to note any of the BMPs described on this form that are NOT eligible for renewed credit.

Subtype: Watering Trough - Proper O&M?

- Yes
- No

Notes

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RI-18 Form Questions

Environmental BMP Verification Form

Watering Facility

Practice Subtype

- ○ RI-16 Barnyard Clean Water Diversion
- ○ RI-17 Water Control Structure
- ◉ RI-18 Watering Trough

There is an adequate water supply?

- ○ Yes
- ○ No
- ○ N/A

Area around trough does not create a resource concern?

- ○ Yes
- ○ No
- ○ N/A

Automatic water level control is functioning without overtopping?

- ○ Yes
- ○ No
- ○ N/A

Overflow is piped to acceptable outlet?

- ○ Yes
- ○ No
- ○ N/A

Backflow prevention is installed and working, where connected to wells, domestic or municipal water systems and meets state and local regulations?

- ○ Yes
- ○ No
- ○ N/A

How was this BMP Implemented?

- ☐ NRCS
- ☐ Growing Greener
- ☐ Landowner
- ☐ Grant Award
- ☐ Other

Funding Date:

MM/DD/YYYY

Implemented Date:

MM/DD/YYYY

Implemented Cost

Location Notes

255

Implemented Amount

# of Watering Facilities

# of Watering Troughs

Is this a BMP reverification?

- ○ Yes
- ○ No

BMP Photo 1:

Drop image here or select image

BMP Photo 2:

Drop image here or select image

RI-18 Form Questions