Recommendations for Tracking and Reporting BMP Implementation for TMDL Progress of the Conowingo Watershed Implementation Plan

R. John Dawes, Executive Director, The Commons

Katie Walker, Geospatial Program Manager, Chesapeake Conservancy

November 2024

PROJECT INTRODUCTION

The Conowingo Watershed Implementation Plan (CWIP) and associated two-year milestones were developed to address unanticipated nutrient loading associated with the infill of the Conowingo Dam. Additional actions beyond what is laid out in the jurisdictional WIPs need to be taken in order to meet Chesapeake Bay water quality goals, and this plan reflects the agreed upon strategy for addressing this additional load.

The other activities in this grant were addressing the development and implementation of the CWIP and its associated milestones, and a financing strategy to support the additional cost of the work needed to implement the CWIP. This activity was intended to address the tracking, verification, and reporting of the CWIP and its associated milestones. This report documents recommendations for a reporting workflow, and highlights its proof of concept through feature developments in the FieldDoc platform. This workflow includes methods for streamlining project tracking with multiple funding sources to reduce the potential for duplicate records. It also explores innovative strategies for automated validation of reported data.

BEST MANAGEMENT PRACTICES (BMP) REPORTING CYCLE

Within the Chesapeake Bay watershed, restoration efforts and land management strategies are tracked and reported to ensure progress towards Total Maximum Daily Load (TMDL) standards. Two-year milestones are established for each WIP to outline targeted actions and manageable progress towards the larger goal. Each lead agency is then responsible for tracking actions taken to be submitted annually to the Environmental Protection Agency (EPA) Chesapeake Bay Program Office (CBPO). This information is shared via the National Environmental Information Exchange Network (NEIEN) and used to estimate progress through the Watershed Model, accessible through the Chesapeake Assessment Scenario Tool (CAST).

CHALLENGES FOR BMP REPORTING

With the incredible amount of land management happening on the ground in any given year, it can be challenging to capture all of that information for annual reporting efforts. One of the key factors impacting BMP reporting is the number of organizations involved in the process: federal agencies, state agencies, county conservation districts, non-profit restoration practitioners, non-profit and private funding agents, and for-profit restoration practitioners. Each funding program has its own reporting requirements to track implementation and intended outcomes, and many implementation projects are co-funded from multiple funding sources. This reality creates significant opportunity for duplication of records and puts an additional administrative burden on local implementers.

Challenge 1: BMP Data Compilation at Varying Geographic Scales

Bay jurisdictions such as Pennsylvania Department of Environmental Protection (PADEP), Virginia Department of Environmental Quality (VADEQ), New York Department of Environmental Quality (NYDEQ), Department of Energy and Environment (DOEE), West Virginia Department of Environmental Quality (WVDEP), Delaware Department of Natural Resources and Environmental Control (DNREC), and Maryland Department of the Environment (MDE) are ultimately the lead reporting entities to compile and report BMP data to the Chesapeake Bay Program (CBP) for crediting. These data are sourced from a variety of programs that all leverage independent tracking and reporting systems to document portions of required NEIEN attributes. With data being sourced from many different pipelines, it becomes time consuming and complex to assemble an authoritative set of practices for reporting to the CBP.

Compounding these challenges are the varying approaches to gathering locational information. Due to a variety of factors, jurisdictions may or may not be easily able to share comprehensive practice information due to state privacy laws or not possess the systems that enable easy management of spatial data. As a result, the NEIEN Schema supports states reporting BMP location data at varying scales, for example:

- A coordinate pair (Latitude and Longitude) **or**
- County or Watershed (HUC12)

The NEIEN Schema's flexibility to accommodate data at **different** geographic scales is supportive to enabling jurisdictions to more flexibly report practice information, however, once practices are included the task of verification and ensuring practices still in operation can have their lifespan renewed becomes increasingly difficult if not impossible. For example, if manure storage facilities are reported in aggregate at a county scale, verifying said practices would require identifying where in the county a given manure storage facility exists, and sending field staff out to confirm it is still operational and providing environmental benefit. Jurisdictional resources for verification are limited and the approach to back trace explicit locations of practices requires time and resources that preclude successful verification of practices, ultimately resulting in these practices expiring and losing credit toward Chesapeake Bay Water quality goals.

Outside of BMP verification, collection of location information at varying scales degrades data quality. If data providers produce an array of agricultural practices in aggregate for reporting to NEIEN and another third party provides data with explicit locational information, i.e. a coordinate pair, it becomes nearly impossible to know with a high degree of confidence if the practice with the explicit location is included in an aggregated report. Jurisdictions often try to throttle these potential avenues for duplication by only accepting certain BMP types from specific reporting sources. However, this precludes and disincentivizes third parties outside of these data sources to submit BMP data for credit due to a fear of double counting and the ability to confidently understand if practices with higher resolution location information are already included in what jurisdictions receive from their core programmatic reporting sources.

Challenge 2: Funding Source and Funding Program Semantic Confusion

Most restoration practices and environmental interventions implemented on the ground are sourced with public and private resources or funding. Equally important to documenting the attribute details of practices implemented is ensuring funding source and funding program attributes are thoroughly documented and that the NEIEN Schema accurately represent and capture the full chain of support that resulted in a BMP being installed. Currently the NEIEN Schema provides a field and data element to disclose "funding source." This is broadly used by reporting entities to disclose the primary grant program that covered the cost of implementation for the given practice. Currently, this field only accepts one funding program and is loosely defined. In reality, most practitioners working to install BMPs leverage funding from a number of federal, state, and private funding sources that lead to successful practice installation. It's also important to note that funding source is not always synonymous with a respective grant program. For example, when a grantee receives a National Fish and Wildlife Foundation (NFWF) Small Watershed Grant (SWG), this grant may be awarded through the SWG program but is sourced by a number of larger grant disbursements to NFWF emanating from EPA, US Fish and Wildlife Service and others. Similar examples include the PADEP's Countywide Action Plans (CAP) Implementation Grant Program where again the grant program at PADEP that practitioners apply to is funded by a variety of different funding sources.

The main difficulties and problems associated with not accurately associating funding sources and programs with installed BMPs include:

1. Incomplete Data Representation: If the full range of funding sources and programs isn't documented, the data on BMPs will be incomplete. This lack of comprehensive data makes it difficult to trace the financial pathways that supported the project, which is crucial for transparency, accountability, and reporting.
2. Misrepresentation of Comprehensive Financial Contributions: Without capturing all funding sources, the contributions of various stakeholders—such as federal, state, and private entities—may be underrepresented or overlooked. This can lead to an inaccurate understanding of the financial landscape behind the implementation of BMPs.
3. Challenges in Reporting and Compliance: Many grant programs require detailed reporting on how funds are used. If only a single funding source is recorded (and often loosely defined), it may not meet reporting requirements, which can result in compliance issues or challenges in securing future funding.
4. Difficulty in Fairly Evaluating Program Effectiveness: Understanding which programs and funding sources contribute to successful BMP installations is essential for evaluating the effectiveness of different funding strategies. Without this information, it becomes challenging to assess the impact of specific programs or funding streams and to refine funding strategies for future projects.
5. Inability to Demonstrate Collective Impact: Accurate documentation of all funding sources and programs is necessary to demonstrate the collective impact of various funding efforts. Failing to do so could undermine efforts to showcase the collaborative nature of funding and the combined efforts of multiple entities in achieving environmental outcomes.
6. Obscured Financial Accountability: If the data only reflects a single funding source, it could obscure the financial accountability of involved parties, making it harder to track how funds were allocated, spent, and matched with specific BMPs.

Challenge 3: Distributed Technical Infrastructure for Jurisdictional BMP Reporting

The decentralized approach to managing BMP data across different jurisdictions, driven by state resources and the need for flexibility, has allowed each jurisdiction to establish its own technical solution for maintaining and reporting BMP data to the CBP. This open approach ensures that jurisdictions can design, maintain, and implement solutions that align with their internal data management workflows while adhering to the reporting standards set by the CBP. However, while distributed technical infrastructure provides short-term flexibility and autonomy to platform owners and operators, it introduces significant challenges when it comes to enforcing and maintaining consistent data management practices and conforming to evolving standards.

A key issue with distributed infrastructure is the difficulty in maintaining uniformity across all jurisdictions. As each state develops and manages its own system, discrepancies in data formats, methodologies, and reporting processes can arise, leading to challenges in achieving true data interoperability. When reporting standards evolve—for example, by requiring the inclusion of new data elements, such as those identifying practices associated with the CWIP—each jurisdiction must independently modify its systems. These modifications are often influenced by varying financial and technical constraints, leading to a patchwork of solutions that differ in scope, quality, and timeliness.

This decentralized approach also complicates the process of updating reporting platforms. As data standards change, updates must be implemented separately across all seven jurisdictions. This results in a slow and cumbersome adaptation process, with some jurisdictions lagging behind others. The delay in implementing new standards can lead to inconsistencies in data reporting, reducing the overall effectiveness of the CBP's efforts to track and manage BMPs across the watershed.

Furthermore, maintaining compliance with the NEIEN Schema becomes increasingly challenging as changes are introduced. Although jurisdictions have made significant efforts to align their systems with the current schema, any future changes may require extensive revisions to existing platforms. Given the distributed nature of these systems, the time and resources required to make these updates can be substantial, leading to potential gaps in data accuracy and completeness during the transition period.

In summary, while distributed technical infrastructure offers initial flexibility, it poses long-term challenges in enforcing data management standards, ensuring data interoperability, and efficiently adapting to changes in reporting requirements. These challenges can ultimately hinder the ability to achieve a cohesive and effective BMP reporting system across the Chesapeake Bay watershed.

RECOMMENDATIONS FOR BMP REPORTING

Adopt Integrated Data Reporting Systems

The current landscape of BMP data management within the Chesapeake Bay watershed is characterized by fragmentation, with various programs relying on siloed reporting systems. This fragmentation not only creates inefficiencies in data collection and reporting but also leads to inconsistencies that undermine the reliability of the information used to assess progress toward Chesapeake Bay restoration goals. Many of these systems are designed with a narrow focus on program-specific needs, often neglecting the broader context of BMP tracking that involves multiple funding sources and stakeholders. For instance, many BMP tracking platforms have traditionally been developed to support program administrators by collecting structured data specific to their program, with little regard for relational characteristics and data reusability. As a result, there is often significant overlap in data management efforts, with practitioners having to enter the same data multiple times across different platforms.

To overcome these challenges, it is essential to transition to integrated data reporting systems that facilitate cross-program data management. The FieldDoc platform, enhanced by the Pacts module, provides a solution by allowing practitioners to align their internal tracking with multiple funding sources while reducing redundancy. This modular approach decouples BMP data management from traditional grant program reporting requirements, enabling practitioners to focus on accurately documenting their restoration activities without the burden of duplicating data entry. By consolidating data within a single platform like FieldDoc, organizations can achieve greater transparency, accuracy, and efficiency in reporting. This integrated approach ensures that all relevant stakeholders, from local conservation districts to state agencies, are working with consistent and reliable data, ultimately leading to more accurate assessments of progress toward Chesapeake Bay restoration goals.

Enhance Spatial Data Management Capabilities

Accurate spatial data management is crucial for effective BMP tracking and reporting, yet variations in geographic data practices across jurisdictions have led to significant **inconsistencies.** These inconsistencies not only hinder the verification of BMPs but also degrade data quality, making it difficult to ensure that reported practices are still in operation and providing the intended environmental benefits. For example, jurisdictions often report BMPs at varying geographic scales, such as at the county level or as coordinate pairs, which complicates the process of verifying the existence and functionality of practices like manure storage facilities. Without precise location data, field staff face significant challenges in locating and verifying practices, leading to gaps in reporting and the potential loss of credits toward Chesapeake Bay water quality goals.

Platforms like FieldDoc address these challenges by offering robust tools for mapping BMP locations with precision. FieldDoc supports a range of geometry types—points, polygons, linestrings—allowing for

detailed spatial management of BMPs at appropriate scales. By adopting these tools, organizations can ensure that spatial data is managed consistently across different scales, whether at the site, county, or watershed level. This improved spatial data management capability not only enhances the ability to verify BMPs but also ensures that data collected is of high quality and reliable for use in reporting to the CBP. Furthermore, FieldDoc's integration of spatial data management with other reporting requirements creates a more streamlined process for documenting BMP implementation, reducing the administrative burden on local conservation districts and state agencies. By leveraging these capabilities, jurisdictions can better manage their spatial data and contribute to a more comprehensive and accurate regional reporting system.

Implement and Utilize the National Environmental Information Exchange Network (NEIEN) Module

Standardization is critical for achieving interoperability across the multiple jurisdictions and agencies involved in BMP reporting within the Chesapeake Bay watershed. However, the decentralized nature of data reporting has led to variations in data formats and methodologies, creating barriers to effective data integration and reporting. Historically, states have relied on template-based approaches for BMP submission, which often involve manually transposing data into standardized formats required by the NEIEN. While these templates provide a valuable framework for aligning local data with CBP standards, they are also a source of inefficiency and potential error, particularly when used solely for annual reporting.

The NEIEN module in FieldDoc provides a powerful solution by enabling users to automate the alignment of BMP data with NEIEN's standardized practice types, measurement units, and geographic data. This module not only reduces the likelihood of data transposition errors but also facilitates seamless integration into state and federal reporting frameworks. By providing a tabular interface that allows practitioners to crosswalk their BMP records to NEIEN-required fields, the NEIEN module significantly decreases the time and effort required to ensure that data is "NEIEN Ready." Furthermore, the module supports copy-and-paste functions from third-party spreadsheets and generates exportable .CSV files, streamlining the process for state jurisdictions to incorporate BMP data into their reporting cycles. This approach not only improves the efficiency of data submission but also enhances data accuracy and compliance, contributing to a more cohesive and reliable regional reporting system.

Promote Cross-Jurisdictional Data Consistency

The decentralized approach to BMP tracking across the Chesapeake Bay watershed has resulted in a patchwork of data standards and methodologies, leading to inconsistencies that undermine the effectiveness of regional reporting efforts. Each jurisdiction has developed its own system for collecting and managing BMP data, driven by local needs and resources. While this approach allows for flexibility, it also introduces significant challenges when it comes to enforcing consistent data management practices and adapting to evolving reporting requirements. For example, as reporting standards evolve—such as the inclusion of new data elements related to the CWIP—jurisdictions must independently update their systems, often resulting in a lag between the introduction of new standards and their implementation across all regions.

To address these challenges, it is crucial to promote cross-jurisdictional data consistency by harmonizing reporting practices and adopting flexible, yet standardized, data management systems. FieldDoc's NEIEN module serves as a key tool in this effort, enabling jurisdictions to align their data with Chesapeake Bay Program standards more effectively. By providing a common platform for reporting, FieldDoc reduces discrepancies in data formats and methodologies, ensuring that all jurisdictions are working from the same baseline. This harmonization not only improves the quality of data submitted to the CBP but also facilitates more efficient and accurate reporting, ultimately contributing to the success of the region's restoration efforts. By investing in tools and practices that support cross-jurisdictional consistency,

stakeholders can overcome the challenges posed by decentralized data management and work towards a more integrated and effective BMP tracking system.

Facilitate Automated Data Workflows

Manual data management remains a significant challenge for organizations involved in BMP tracking, often consuming valuable time and resources that could be better spent on on-the-ground restoration activities. The current reliance on manual data entry and transposition across multiple platforms creates inefficiencies and increases the risk of errors, ultimately hindering the effectiveness of BMP reporting efforts. For example, organizations that manage BMP data using third-party software as a service (SaaS) platforms like ArcGIS Online or Airtable face the additional burden of manually transferring data to meet the specific requirements of state and federal reporting systems.

To address these challenges, automation through FieldDoc's Workflow module offers a solution by integrating data management tasks with other platforms, streamlining the reporting process, and reducing the administrative burden on practitioners. The Workflow module allows organizations to set up automated triggers and actions that execute when new data is added, edited, or updated across connected platforms. For instance, a trigger can be created to monitor changes in ArcGIS Online, automatically pulling relevant data into FieldDoc and transforming it to fit the required data model for BMP reporting. This automation not only ensures that data is always up-to-date but also significantly reduces the time and effort required for data management, allowing practitioners to focus more on achieving restoration outcomes rather than managing data across multiple systems. By embracing automation, organizations can streamline their operations, improve data accuracy, and enhance the overall efficiency of BMP reporting within the Chesapeake Bay watershed.

Incorporate a Modular Approach to Data Management

The dynamic nature of BMP reporting requirements necessitates a data management approach that is both flexible and adaptable. As reporting standards evolve, systems that rely on rigid, one-size-fits-all frameworks struggle to keep pace with the changes, often leading to disruptions in data collection and reporting processes. The current decentralized approach to BMP tracking across the Chesapeake Bay watershed, where each jurisdiction manages its own reporting system, further exacerbates this issue. When new reporting elements are introduced, such as those required for the CWIP, jurisdictions must independently modify their systems, resulting in a patchwork of solutions that differ in scope, quality, and timeliness.

FieldDoc's modular design offers a flexible solution to these challenges by allowing practitioners to tailor their data management processes to meet both current and future needs. The platform's Pacts and NEIEN modules, for example, enable users to manage and report BMP data in a way that is aligned with evolving standards while maintaining the flexibility to adapt to new requirements as they emerge. This modular approach not only supports the seamless incorporation of new data elements and reporting standards but also ensures that BMP data is consistently managed and reported across jurisdictions. By adopting a modular approach to data management, organizations can better navigate the complexities of BMP reporting, maintain compliance with evolving standards, and contribute to a more cohesive and effective regional reporting system.

Build a Robust Chain of Custody for BMP Data

Transparent and accountable BMP tracking is essential for ensuring that the efforts to restore the Chesapeake Bay are both effective and sustainable. However, the complexity of funding mechanisms that support BMP implementation—often involving multiple public and private sources—presents a significant

challenge to maintaining a clear chain of custody for BMP data. Many current reporting systems lack the relational capabilities required to document the full range of funding sources and programs associated with BMPs, leading to incomplete data representation and challenges in demonstrating the collective impact of restoration efforts. For instance, when a BMP is funded by multiple sources, such as a combination of federal, state, and private grants, it is critical to accurately document all contributions to ensure transparency and accountability. Failure to do so can result in misrepresentation of financial contributions, compliance issues, and an inability to fairly evaluate program effectiveness.

The Pacts module in FieldDoc addresses these challenges by enabling users to document and relate practice data to multiple funding sources, establishing a clear chain of custody for BMP implementation. This capability allows organizations to accurately capture the diverse funding streams that support BMPs, providing a comprehensive view of the financial pathways that lead to successful implementation. By documenting the full range of funding sources, organizations can ensure that all contributions are recognized, enhancing transparency and accountability. Additionally, this approach facilitates the evaluation of funding strategies, allowing stakeholders to assess the effectiveness of different programs and refine their approaches to future projects. By building a robust chain of custody for BMP data, organizations can better demonstrate the collective impact of their restoration efforts and contribute to a more transparent and accountable BMP tracking system.

Expand Integration Capabilities

The effectiveness of any BMP tracking platform is significantly enhanced by its ability to integrate with other widely-used tools and systems. Given the diversity of data management needs across the Chesapeake Bay watershed, it is essential that BMP tracking platforms like FieldDoc offer robust integration capabilities to support a wide range of workflows and data management practices. Many organizations rely on third-party software platforms, such as Practice Keeper, Google Sheets, and Felt Maps, to manage their BMP data, and the ability to seamlessly integrate these tools with FieldDoc can greatly enhance the efficiency and effectiveness of BMP reporting.

To maximize the utility of FieldDoc, it is recommended to expand its integration capabilities to include additional platforms. For example, integration with Practice Keeper could facilitate more detailed agricultural BMP tracking, while Google Sheets integration could support flexible data entry and analysis. Expanding these capabilities will allow practitioners to manage their BMP data more efficiently, leveraging the strengths of multiple systems while maintaining a centralized reporting framework. Moreover, by supporting integration with third-party visualization tools like Felt Maps, FieldDoc can provide users with more options for presenting and analyzing their data, further enhancing the platform's value as a comprehensive BMP tracking solution. By investing in expanded integration capabilities, FieldDoc can better meet the diverse needs of organizations across the Chesapeake Bay watershed, ensuring that they have the tools they need to manage and report BMP data effectively.

Develop Clear Data Reporting Guidelines

The lack of standardized reporting guidelines across jurisdictions has led to confusion and inconsistencies in BMP data submission, undermining the reliability and accuracy of the information used to assess progress toward Chesapeake Bay restoration goals. This challenge is particularly acute in the context of decentralized data management, where each jurisdiction follows its own reporting practices, often resulting in discrepancies in data formats, methodologies, and geographic scales. For example, the variation in how BMPs are reported—whether by coordinate pairs, county, or watershed—creates significant challenges in verifying practices and ensuring that they are accurately credited. These inconsistencies not only degrade data quality but also hinder the ability of stakeholders to evaluate the effectiveness of their restoration efforts.

To address these issues, it is essential to develop and disseminate comprehensive data reporting guidelines that clearly define the scales and practices required for BMP reporting. These guidelines should be designed to align with both jurisdictional and programmatic needs, providing a clear framework for data submission that reduces ambiguity and ensures consistency. By offering clear and detailed guidance, organizations can better navigate the complexities of BMP reporting, leading to more accurate and reliable data that can be used to assess progress toward Chesapeake Bay water quality goals. Additionally, standardized guidelines will help to harmonize reporting practices across jurisdictions, ensuring that all stakeholders are working from a common understanding of the requirements and expectations for BMP data submission. By establishing clear and consistent reporting guidelines, the CBP can improve the overall quality of BMP data and enhance the effectiveness of its restoration efforts.

Incentivize Adoption of Unified Reporting Platforms

The adoption of unified reporting platforms is critical for achieving consistency and efficiency in BMP tracking across the Chesapeake Bay watershed. However, many organizations are hesitant to adopt new platforms due to concerns about additional administrative burden and the need to transition from established data management practices. For example, organizations that already rely on third-party SaaS platforms for data management may view a new reporting platform as an additional hurdle, requiring significant time and effort to integrate into their existing workflows. This reluctance is further compounded by the fact that many reporting platforms have traditionally been focused on fulfilling basic data submission requirements rather than providing features that address the broader needs of data providers and program administrators.

To overcome these barriers, it is important to incentivize the adoption of unified reporting platforms by offering features that directly address the needs of both data providers and program administrators. FieldDoc's ability to manage organizational metrics, track key performance indicators (KPIs), and integrate third-party visualizations makes it an attractive option for comprehensive BMP data management. By highlighting these advantages and providing training and support to potential users, organizations can be encouraged to adopt FieldDoc as their primary reporting platform. Additionally, the platform's modular design, which allows users to tailor their data management processes to meet specific needs, offers a clear incentive for adoption by reducing the time and effort required for data entry and management. By promoting the benefits of unified reporting platforms like FieldDoc and addressing the concerns of potential users, the CBP can facilitate the widespread adoption of these systems, ultimately leading to more consistent and efficient BMP tracking across the watershed.