Executive Summary

This project, initiated by the Urban Stormwater Workgroup through the Chesapeake Bay Program's Water Quality Goal Implementation Team (GIT) funding from the Chesapeake Bay Trust (CBT), evaluates the effectiveness and efficiency of BMP (Best Management Practice) tracking and reporting processes across the Chesapeake Bay watershed. Objectives include identifying process inefficiencies, improving the integration of multiple restoration goals into performance assessments, and enhancing collaboration with external partners to ensure the Chesapeake Bay Program (CBP) is using the best available information. While current BMP reporting emphasizes nutrient and sediment reductions under the CBP's Total Maximum Daily Load (TMDL) framework, this effort acknowledges a broader set of stormwater BMP benefits—including flood mitigation, habitat enhancement, climate resilience, improved community aesthetics, and reduced infrastructure maintenance costs that work to achieve a holistic approach towards improving the health of the Chesapeake Bay.

To guide this work, a Steering Committee was developed with the assistance from the Urban Stormwater Workgroup (USWG) leadership, to develop project deliverables, identify stakeholders to interview, support interview question development, and garner any other input as necessary to ensure relevance and focus. The first step was to conduct a comprehensive review of each Quality Assurance Project Plan (QAPP) to understand BMP tracking and reporting protocols and to identify discrepancies and inconsistencies within and among jurisdictions and federal reporting partners. The interview phase included meeting with jurisdictional representatives and other partners critical to BMP reporting to gather insights into the practical challenges and gaps they face in BMP data collection, tracking, and reporting, and giving the representatives opportunity to provide insight into their reporting process as well as any recommendations. Final recommendations of this study reflect common themes from the QAPPs and interviews and incorporate input from the Steering Committee.

Our recommendations emphasize the need to address the recurring challenges identified across stakeholders, such as inconsistent data inputs, evolving verification requirements, and capacity constraints, through targeted improvements to current reporting practices. By identifying actionable improvements and promoting alignment across reporting entities, this project will support more efficient data workflows, better integration of diverse BMP benefits like habitat and climate resilience, and stronger partnerships with agencies and organizations contributing to stormwater management and ultimately, the health of the Chesapeake Bay.

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Acronyms

- **AgEP** - Agricultural Enhancement Program
- **BMP** – Best Management Practice
- **CAST** - Chesapeake Assessment Scenario Tool
- **CBP** - Chesapeake Bay Program
- **CBSF** - Chesapeake Bay Stewardship Fund
- **CBT** - Chesapeake Bay Trust
- **DCR** - The Department of Conservation and Recreation
- **DEP** - Pennsylvania Department of Environmental Protection
- **DEQ -** Department of Environmental Quality
- **DNREC** - Department of Natural Resources and Environmental Control
- **DOEE** - Department of Energy and Environment
- **DOF** - Department of Forestry
- **GIT** - Goal Implementation Team
- **LONIE** - Logging Notification and Information Entry system
- **MDE** - Maryland Department of the Environment
- **NFWF** - National Fish and Wildlife Foundation
- **NEIEN** - National Environmental Information Exchange Network
- **NRCS** - Natural Resources Conservation Service
- **QAPP** - Quality Assurance Project Plan
- **TMDL** - Total Maximum Daily Load
- **USWG** - Urban Stormwater Workgroup
- **VA DEQ** - Virginia Department of Environmental Quality
- **VDACS** - Virginia Department of Agriculture and Consumer Services
- **WVCA** - West Virginia Conservation Agency
- **WVDEP** - West Virginia Division of Environmental Protection

Introduction

Robust tracking and reporting of Best Management Practices (BMPs) are essential to restoring and protecting the Chesapeake Bay, the largest estuary in the United States, which continues to face significant challenges from nutrient and sediment pollution. Decades of restoration work have underscored the critical role that BMPs play in managing stormwater runoff and reducing pollutant loads across the watershed.

The Chesapeake Bay Program (CBP), a regional partnership led by the Environmental Protection Agency (EPA) and the Bay jurisdictions, defines stormwater BMPs as structural or non-structural measures installed on development or redevelopment sites to reduce runoff, mitigate flooding and downstream erosion, and improve water quality by lowering nitrogen, phosphorus, and sediment levels. To capture the importance of stormwater BMPs, Figure 1 below shows a heatmap of current urban nitrogen levels throughout the Chesapeake Bay watershed. BMP practices are a central component of the region's strategy for meeting the pollution reduction targets established under the Chesapeake Bay Total Maximum Daily Load (TMDL), a framework developed under the Clean Water Act. Each BMP has specific nutrient and sediment reduction efficiencies laid out in Expert Panel Reports. These reports identify the qualifying conditions and requirements for BMP implementation based on input from experts in the field. Maintenance and verification procedures are also detailed so that BMPs can function properly and ensure the efficiencies being reported are appropriate.

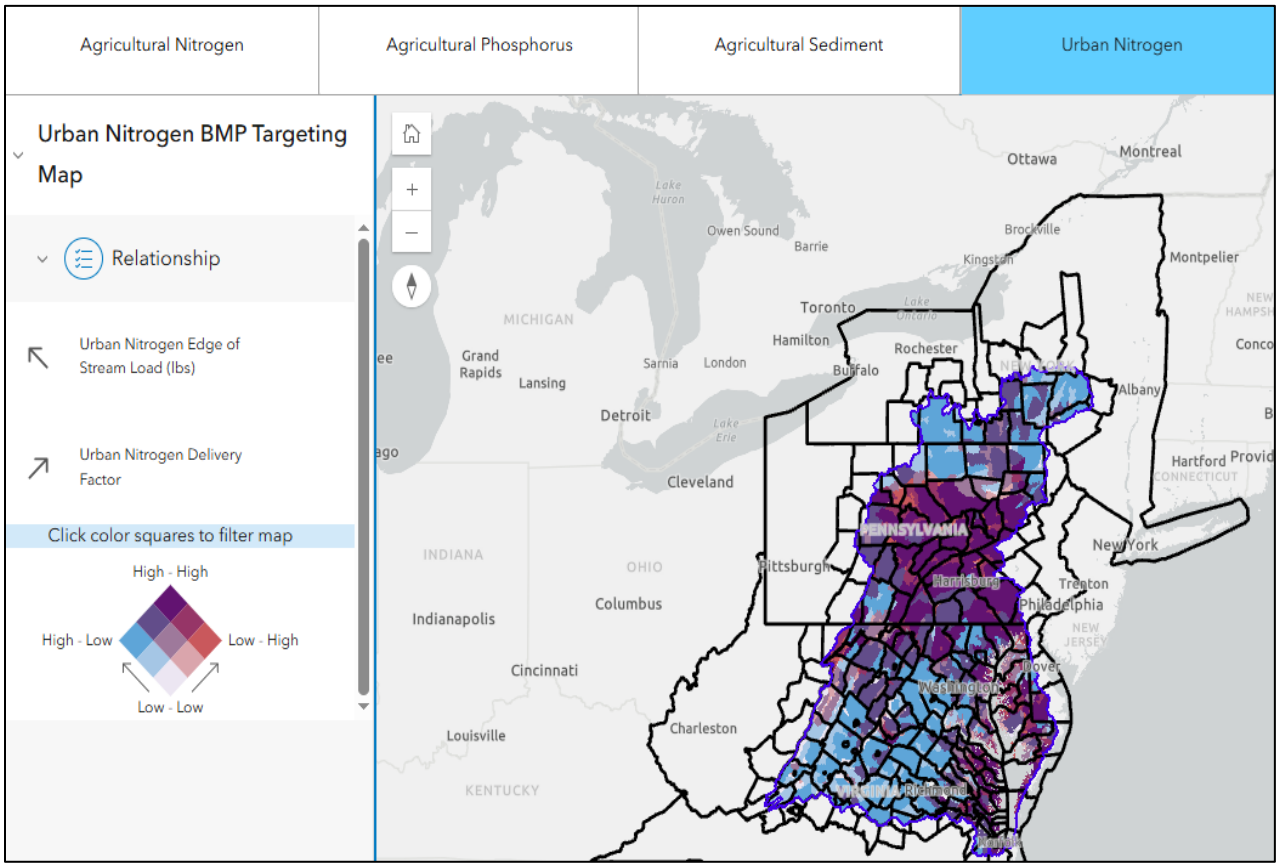

Figure 1 – CAST's Urban Nitrogen Targeting Mapping

Once installed, BMPs must be verified through the collection of specific information such as location, type, and a unique identifier to ensure proper implementation and support long-term maintenance. This data must meet standards established by the CBP in coordination with the EPA. Each participating jurisdiction (Delaware, District of Columbia, Maryland, New York, Pennsylvania, Virginia, West Virginia) compiles this information and submits it through the National Environmental Information Exchange Network (NEIEN), where it is reviewed and incorporated into the CBP Phase 6 suite of watershed models, and the publicly facing Chesapeake Assessment Scenario Tool (CAST). Figure 2 below depicts the data flow from the jurisdictional nodes to their delivery to the watershed model through the NEIEN data process. These models estimate pollutant reductions and track progress toward meeting TMDL milestones. This multi-step process highlights the importance of accurate and efficient BMP data reporting to inform policy, secure funding, and advance the Bay's restoration.

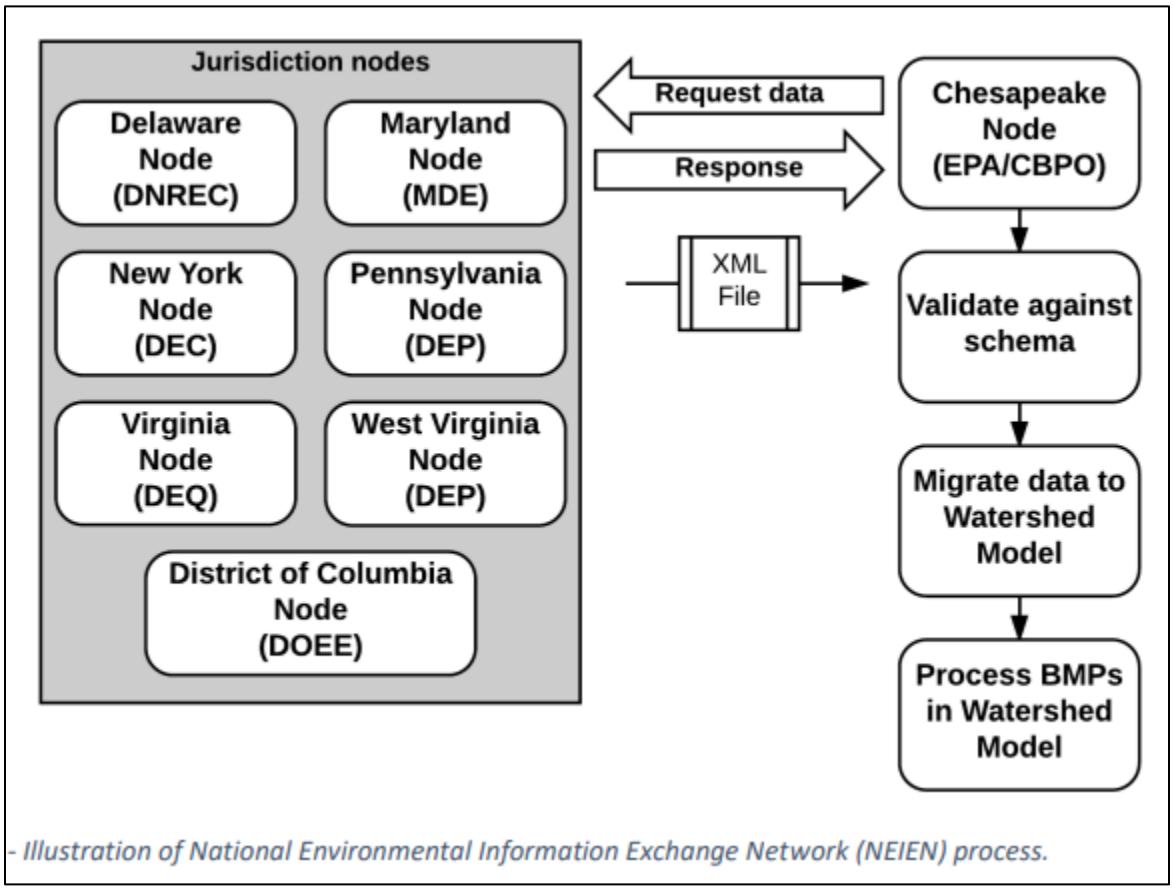

Figure 2 – NEIEN Process

This project was initiated by the CBP's Urban Stormwater Workgroup through the Water Quality Goal Implementation Team (GIT) and funded through the Chesapeake Bay Trust (CBT). It aims to evaluate the effectiveness and efficiency of BMP tracking and reporting across the Bay watershed. While the primary focus is on stormwater BMPs, this project also reviewed other BMP types such as habitat and climate resilience practices to support a more holistic understanding of the data tracking process.

To assess current practices and identify potential gaps or inconsistencies, the project team conducted a review of each Quality Assurance Project Plan (QAPP), which outlines state-level BMP data management and verification procedures. Findings from the QAPP review were compiled into a comparative matrix to

highlight variations across reporting entities. This matrix, along with guidance from a diverse Steering Committee, informed the development of targeted interview questions. Interviews were then conducted with jurisdictional, federal, and technical stakeholders to gather additional context, clarify data gaps, and explore opportunities for process improvement.

Given the number of partners involved in the Chesapeake Bay restoration effort, transparency, clear coordination, and standardized practices are critical to advancing the shared goal of improving the Bay's health. While this report primarily focuses on tracking challenges, it also seeks to highlight areas where innovation and cross-agency collaboration can be improved. Minor limitations encountered during the project included difficulties obtaining the most current QAPPs and accounting for stakeholder bias in qualitative data.

The sections that follow describe the methodology used to conduct this analysis, present findings by interviewee, and conclude with recommendations to enhance BMP data tracking and reporting to support the Chesapeake Bay's long-term restoration goals.

Methodology

To assess the effectiveness and efficiency of BMP tracking and reporting processes across the Chesapeake Bay watershed, this project employed a multi-phase methodology. Figure 3 depicts the step-by-step process ("work plan") followed in the research and development of the report. In the sections that follow, this work plan has been further summarized into Phases I-III to highlight the more notable milestones of the project process. While stormwater BMPs were the primary focus of the research, other practices such as habitat restoration and climate resilience BMPs were included to support a more holistic evaluation of the BMP tracking and reporting process. Both regulated and voluntary BMPs were considered within the project scope as well. The USWG, in collaboration with A. Morton Thomas and Associates (AMT), selected the members of a Steering Committee comprised of representatives from local, state, and federal government and the Chesapeake Stormwater Network (CSN) to help guide the project. The full list of Steering Committee participants can be found in Appendix A.

Figure 3 – Beyond Bean Counting Work Plan

Phase I: QAPP Review and Comparative Matrix Development

The first phase involved a detailed review of each Quality Assurance Project Plan (QAPP), including those from Virginia, West Virginia, the District of Columbia, Maryland, Delaware, New York, and Pennsylvania. Based on this review, a comparative QAPP matrix was developed to visualize similarities and differences in how each reporting entity collects, verifies, and reports on BMP data. This matrix, combined with input

from the project's Steering Committee and USWG, informed the development of interview questions for the second phase.

Phase II: Stakeholder Interviews

The interview phase was designed to further investigate the gaps and inconsistencies identified in the QAPP review and to solicit additional insights not captured in the written documentation. Interview questions were structured into three categories: those specific to state agency representatives, those intended for federal stakeholders, and a common set of questions asked of all participants. Federal stakeholders included representatives from the Department of Defense (DoD), U.S. Fish and Wildlife Service (FWS), National Park Service (NPS), and the National Fish and Wildlife Foundation (NFWF). Interview participants were selected with support from the Steering Committee and USWG. A complete list of interviewees can be found in Appendix B.

Phase III: Synthesis, Gap Analysis, and Recommendations

The third and final phase of the project involved synthesizing findings from both the QAPP review and interviews into a summary assessment. This assessment informed a gap analysis, identified key barriers, and served as the basis for developing a set of recommendations aimed at improving the BMP tracking and reporting process. Draft recommendations were presented to the Steering Committee and the USWG leadership for feedback and consensus.

This phase concluded with the development of a final project report, created in collaboration with the Steering Committee and USWG leadership. The report is intended to translate the research and findings into actionable recommendations that can support improved data quality, alignment across jurisdictions and other federal agencies, and a more comprehensive accounting of BMP benefits, ultimately supporting the shared goal of restoring the Chesapeake Bay. This project not only relied on inter-agency collaboration but also highlighted the critical importance of such partnerships in overcoming shared challenges and advancing restoration efforts for the health of the Chesapeake Bay.

While limitations encountered during this project were minimal, two primary issues were noted. First, it was occasionally challenging to obtain the most current versions of QAPPs, which may have affected the completeness of the initial review. Second, although interviewees were selected carefully, the potential for stakeholder bias remains a consideration when interpreting qualitative responses. Nonetheless, these limitations did not significantly impact the integrity or validity of the project's findings.

Findings and Gap Analysis

Phase I (State) Interviews

District of Columbia

The Department of Energy and Environment (DOEE) oversees coordinating all BMP data collection and submission for the District of Columbia (District), which fosters internal consistency alongside quality assurance. As a city-state, DC is structured to have more direct control over its data sources without having to rely on as many localities as other larger states. The District coordinates with partners such as federal facilities, landowners, and DC Water. They utilize standardized templates from the CBP, or ones tailored by the DOEE. Upon receipt of data, the DOEE conducts final QA/QC

before reporting. This QA/QC process consists of internal reviews, geospatial verification, and documentation. This collected data and documentation through NEIEN allows the DOEE to ensure that the verification standards are met and accurately credited. The DOEE conducts a documentation-heavy approach as opposed to field visits due to the urban and infrastructure-heavy nature of their implemented BMPs. They conduct verification by using permits, project records, and grant reports. A large portion of these BMPs is stormwater related and are under MS4 permit obligations, such as green roofs, permeable pavement, and bioretention. BMP data collected by DC and federal partners captures a broader range of environmental and infrastructure benefits. Practices such as trash traps, stream restorations, and green infrastructure (e.g., green roofs, permeable pavement) contribute to habitat improvement, climate resilience, and erosion control. Construction-related sediment BMPs, wetland creation, and Illicit Discharge Detection and Elimination (IDDE) efforts are also tracked, emphasizing physical stability, pollutant removal, and ecological uplift. This highlights the District's recognition of multi-benefit BMPs that serve purposes beyond traditional water quality metrics.

Interview Insights

The DOEE leads the reporting but relies on its partners to collect and manage their own data (e.g., DC Water, federal facilities). A current challenge is limited staff bandwidth, which creates difficulty following up on BMP reports submitted externally. The templates used by these partners are not uniform, which is why the DOEE is looking for more standardization of implementation. As a result, the DOEE is building a more centralized database to reduce the reliance upon spreadsheets and individual project files. Regarding QA/QC, the District explained that data quality varies because some reporting partners perform their own checks while others submit information with less intensive review. This inconsistency affects how reliably BMPs can be incorporated into DC's final dataset. Additionally, BMPs implemented on federal lands, including Department of Defense properties, are not always fully captured in the District's reporting because DC does not "own" the underlying data and relies on federal partners to provide complete documentation. Due to this, some federally implemented practices that improve local water quality may not be reflected in DC's submissions to NEIEN or CAST.

Virginia

Virginia's QAPP uses a three-tiered quality assurance system. This system is used to classify its data sources based on the level of documentation and the level of quality assurance. The BMP Warehouse is a tool used to track and report BMPs is, which uses automated QA/QC to prevent double counting from various reporting entities. Data in the BMP Warehouse is formatted and transmitted to the CBP through a standardized XML schema. To verify the accuracy of this data, statistical sampling is used to reflect the broad data sets with reliability. The maintenance and inspection schedules are organized by the type of BMP, sector, and ownership to streamline the verification process. To ensure integration across sectors, coordination is done between Virginia state agencies. Each of these agencies operates under their own standard operating procedure (SOP) but aligns under the same reporting framework. The implemented system actively tracks BMP credit lifespans and generates automated reminders for necessary maintenance/inspection. Virginia's QAPP allows voluntary and unregulated BMP reporting to occur alongside mandatory reporting.

Interview Insights and Context Gaps:

The expectations for verification levels are high. Virginia uses three tiers (1,2,3), that differ by inspection and verification requirements. Despite the use of the automated BMP Warehouse, data entry conducted by agencies and/or districts often still involves manual uploads and reviews. The current QAPP focuses on BMPs specifically reported to the Chesapeake Bay Program, but the DEQ is interested in exploring how they can track practices that aren't required by permits for the Bay TMDL. Some practices on federal lands are reported to DEQ, but the DEQ recognized that these are not always fully integrated with systems like CAST and the BMP Warehouse. Along with this, it is important to the DEQ that consistent communication with the CBP is maintained for keeping up with changes in guidance and expectations. In the interview with DEQ, it was also discussed that there could be improvements in the re-verification of BMPs following their initial crediting. DEQ aids in the coordination of Virginia's BMP reporting but does not have ownership of all data reported. Depending on the agency, the DEQ may take on the role of a reviewer or facilitator of the data rather than be the one who uploads it.

Maryland

The Maryland Department of the Environment (MDE) utilizes a mix of reporting tools and workflows to collect and submit BMP data to the Chesapeake Bay Program. While a stormwater database exists, it has not been recently updated, prompting a phased rollout of a new GIS-based database. Phase I MS4s now submit data via a geodatabase, while Phase II MS4s continues to report using Excel spreadsheets. Once received, QA/QC processes are conducted using ArcGIS Pro and R, with Altova used to generate XML files that comply with the CBP NEIEN schema. While the destination for data is NEIEN, not all entities have the capacity to submit data in this format, leading to non-uniform submissions across localities. Agricultural and wetland/forestry BMP data are handled differently, often arriving already formatted or through separate sources. MDE faces challenges in submitting innovative or non-standard BMP types due to limitations within the NEIEN schema. Unique to Maryland's process is its growing interest in capturing metrics beyond traditional nutrient and sediment reductions, though no formal framework currently supports climate resilience, habitat, or equity benefits. Forest conservation practices, for example, are not yet credited but are recognized as valuable.

Interview Insights and Context Gaps:

Maryland's BMP reporting system faces a range of practical and organizational challenges. Limited staffing and funding make it difficult to consistently carry out key tasks like data quality review, field verification, and inspections. Data issues such as duplication, inconsistent naming, missing inspection records, and delays in MS4 reporting can complicate the overall process. Coordination between state agencies and local governments tends to happen informally, usually through email or Microsoft Teams, and non-MS4 data is not actively gathered by MDE. Some local programs and efforts by the Chesapeake Bay Foundation do contribute additional BMP data, but these submissions can vary in accuracy and completeness. MDE is also concerned that periodic updates to Chesapeake Bay Program protocols may result in older BMPs losing credit, which adds further complexity. While water quality monitoring is not currently a central part of BMP reporting, there is growing interest in including

broader environmental or community benefits in the future. Doing so would likely require updates to both internal tracking systems and the way data is shared through NEIEN.

West Virginia

West Virginia's QAPP outlines a decentralized but functional structure for BMP tracking, with data collection led by the West Virginia Conservation Agency (WVCA) and the Department of Environmental Protection (WVDEP). Verification practices vary across agencies and programs: many BMPs are confirmed at the time of installation, while others such as MS4 practices are reinspected every 10 years. However, there is limited reverification for voluntary practices like tree plantings, and little consistency in protocols for expiring or inactive BMPs. A couple of data systems are in use, such as LONIE (Logging Notification & Information Entry system), a West Virginia Division of Forestry database. ERIS (Environmental Resources Information System) is another data system utilized, specifically one that tracks agricultural BMPs installed through state/federal cost-share programs. Between these data systems and internal spreadsheets, it is challenging to efficiently compile and centralize the data prior to integrating the information with NEIEN. Coordination with federal partners like NRCS or the Cacapon Institute is ongoing, Although WV receives most federal BMP information either through the Chesapeake Bay Program's Federal Workgroup or through permit reporting for construction projects, these submissions are not always updated consistently, which can leave some federal practices underrepresented at the locality level. Additionally, the QAPP currently focuses exclusively on nitrogen, phosphorus, and sediment reductions, with no mechanisms in place to track co-benefits such as climate resilience, habitat, or equity outcomes. Challenges remain around aligning QAPP protocols with evolving CAST definitions and NEIEN reporting requirements.

Interview Insights and Context Gaps:
Staff expressed confidence in the existing system, noting that most BMPs are "routinely tracked through these platforms," and that these systems "handle a large volume of data well." Practices are typically tied to project IDs or location data, and QA/QC protocols are built into the workflow. Reporting consistency appears to benefit from long-standing staff familiarity with the process and systems.

However, interviewees also noted that challenges persist, particularly when it comes to incorporating practices implemented by external partners or non-district entities. These groups may lack direct access to ERIS or LONIE, requiring manual communication or additional coordination to ensure data is captured accurately and on time. While not seen as a critical issue, this reliance on informal processes introduces the potential for reporting delays or gaps, especially when staff capacity is stretched. Improvements in automation and data integration were mentioned as potential opportunities to strengthen the system further.

New York

New York's BMP tracking and reporting relies heavily on coordinated efforts between the Upper Susquehanna Coalition (USC) and the New York State Department of Environmental Conservation (DEC). The USC is responsible for detailed BMP data collection, verification, and initial reporting, particularly for practices like wetland restoration, stream rehabilitation, urban buffers, forestry harvest, and other non-point source BMPs. Data are entered into a standardized online tool, where

each BMP receives a unique identifier to minimize double counting. The USC performs verifications for all new BMPs and conducts follow-up inspections on a statistically representative sample to ensure data quality. The DEC manages broader BMP reporting to the Chesapeake Bay Program through the NEIEN system. DEC handles regulated stormwater BMPs, including construction and post-construction practices, through its Water Information System (WIS), Water Compliance System (WCS), and the Integrated Compliance Information System (ICIS-NPDES). These systems help track compliance and maintain data accuracy. Verification protocols include 100% initial inspections of regulated BMPs and statistically designed subsampling for follow-up verifications, aiming for an 80% confidence level within ±10%. Semi-regulated and non-permitted BMPs are tracked and verified through regional planning boards and voluntary surveys, with data carefully reviewed to avoid duplication. Historical data cleanup and ongoing annual reviews ensure data integrity. New York employs a "Multiple Barrier Approach" to integrate restoration efforts across watersheds effectively. Overall, the QAPP outlines a thorough, multi-layered BMP data management system balancing rigorous verification with collaboration among state agencies, regional coalitions, and local conservation partners.

Interview Insights and Context Gaps:

New York's BMP reporting is managed primarily through the Water Information System (WIS), which tracks BMPs for their full lifespan based on Chesapeake Bay CAST lifespans. Verification updates can extend a BMP's life in the system, but expired BMPs are simply allowed to lapse rather than being actively removed. WIS does not directly integrate with the Water Compliance System (WCS) except for NPDES-related permits, and it does not link with ICIS-NPDES outside of wastewater point source QA/QC purposes. BMP reporting to NEIEN is organized by sector, including construction, stormwater, federal, septic, and voluntary urban BMPs, with templates exported for each. Regional planning boards, supported by EPA 604(b) funding, conduct GIS-based surveys and follow-up outreach to collect voluntary BMP data from municipalities. MS4 permittees report as required by their permits, though some BMP types like tree planting may be underreported due to lack of awareness of CBP crediting opportunities. Voluntary BMP reporting relies heavily on regional planning boards, incentives, and outreach programs. The state does not currently conduct analysis on BMP effectiveness beyond nutrient/sediment reduction, and most additional benefits are not quantified within their core reporting systems. Key challenges include the voluntary nature of much urban BMP reporting, staffing and funding constraints, and data quality issues stemming from inconsistent understanding among data providers. Interagency coordination, especially with programs like the 480a Forest Tax Law and Resilient NY, could improve capture of relevant BMP data. Maintenance and verification processes are still maturing, with few BMPs yet reaching the end of their modeled lifespan, but DEC values high-quality, on-the-ground verified data from partners such as USC, Ducks Unlimited, and Trout Unlimited.

The New York interview revealed several gaps in BMP reporting and verification, including inconsistent voluntary urban BMP reporting outside of construction projects, limited incentives for partners to submit data, and staffing constraints that hinder grant pursuit and follow-up on voluntary practices. Interagency communication issues, particularly around forestry and tree planting programs, result in missed data opportunities, while some local data providers lack clarity on reporting requirements. Co-benefits like climate resilience and habitat improvements are not fully integrated into Bay reporting, and the verification program is still too new to assess long-term performance or

over-performance metrics. Additionally, while water quality monitoring occurs, it is not tied into Bay TMDL reporting, and USC faces challenges in updating certain BMP data directly, relying on DEC for database uploads.

Pennsylvania

Pennsylvania's QAPP details a reporting process where BMP data is submitted to the Department of Environmental Protection (DEP) through standardized templates via Excel. Local partners and conservation districts enter a majority of their data into a geospatial database called PracticeKeeper. External partners such as PennDOT and federal agencies provide their data separately, but all data is prepared by DEP for submission to NEIEN. PracticeKeeper is not their main progress database, but a useful tool alongside other BMP tracking programs such as their newer SQL Data Warehouse. DEP has created a new reporting system called "Greenport", an eReporting system that they will soon be requiring partners to use for MS4 data reporting.

Interview Insights and Context Gaps:
PracticeKeeper takes on a central role, particularly for agricultural and forestry related BMPs entered by local conservation districts. PennDOT and federal partners enter theirs through excel templates provided by DEP. This data is all compiled and housed in the Pennsylvania SQL Data Warehouse, which is an improved version of the previous BMP Warehouse that was used by the state. The Greenport platform for MS4 and CAFOs will soon be mandatory, which is seen as a shift forward in standardization of the state's reporting. They are also utilizing a County Wide Action Program or "CAP" program to leverage block grants to engage landowners and anyone who implements voluntary BMPS to supplement the reporting done by DEP. There is a strong focus on locally sourced data, and DEPs aim is to provide guidance and oversight to maintain standardized results within the reporting process. The interview identified several areas where gaps remain in Pennsylvania's BMP reporting and data management processes. Duplicate NRCS data presents a challenge, as the absence of federal QA/QC prevents the state from fully reporting certain practices, resulting in potentially undercounted progress. Agricultural privacy agreements also limit the ability to share mapped BMP locations, which reduces transparency and makes it difficult for local partners to prioritize implementation. Stormwater reporting is incomplete, with only a small portion of MS4 BMPs currently captured and many Post-Construction Stormwater Management (PCSM) practices outside MS4s not included in reporting to the Bay model. Frequent updates to Chesapeake Bay Program protocols and CAST further complicate reporting, as changes are difficult to align with ongoing implementation efforts. Additionally, ecological and resilience benefits from practices such as acid mine drainage remediation and legacy sediment restoration are not fully credited within existing accounting frameworks, leaving significant water quality improvements unrecognized.

Delaware

Delaware's QAPP includes a standardized framework for verifying and reporting both regulated and non-regulated BMPs, particularly within the Chesapeake Bay drainage. The QAPP is coordinated through the Delaware Department of Natural Resources and Environmental Control (DNREC), covering sectors such as stormwater (MS4), agriculture, forestry, and urban BMPs. Delaware's QAPP requires annual verification of BMPs, implementing flexible methods for information sharing such as photos and field inspection reports. DNREC uses eFACTS (Environmental Facility Application and

Compliance Tracking System), which is an internal database utilized by the state of Delaware to track and manage environmental data. This houses implementation data that eventually makes its way to NEIEN and CAST. Delaware incorporates other divisions within the state to meet reporting standards, administering responsibilities to conservation districts and the Delaware Nutrient Management Program. Delaware's QAPP also includes timelines and specific requirements for the verification of different types of BMPs, such as wetlands and urban retrofits.

Interview Insights and Context Gaps:
Delaware's BMP reporting process is focused on correspondence between DNREC and the state's Conservation Districts, with each party playing a specific role in the implementation, verification, and data management of BMPs. Interviewees noted that Delaware's relatively small geographic size allows for more efficient internal coordination and quicker verification turnaround compared to larger jurisdictions. However, they also acknowledged that capacity limitations, particularly staffing, can constrain the depth and frequency of verification, especially for smaller-scale or voluntary practices. Delaware is actively looking to improve tracking and crediting for practices with co-benefits, such as habitat enhancement or climate resilience, but faces challenges due to limited frameworks for quantifying these benefits under current Bay Program protocols. Looking ahead, the state is interested in strategies to increase visibility of voluntary BMPs and ensure long-term maintenance tracking, particularly in urban areas where ownership may change over time. They emphasized the importance of balancing robust QA/QC with realistic resource availability.

CAST

The Chesapeake Assessment Scenario Tool serves as a central modeling platform used by jurisdictions and federal partners to estimate nutrient and sediment reductions from implemented BMPs. Although CAST is widely adopted for Chesapeake Bay TMDL reporting, partners described variability in how the tool is interpreted and applied during the reporting process, particularly when practices do not fit easily into established BMP categories. Several reporting entities noted that CAST is often used differently for planning than for reporting, which can create uncertainty when translating local project information into modeled credit. These challenges highlight the importance of clear guidance, consistent communication, and better alignment between state and federal reporting systems so that CAST can continue to support accurate and comparable progress estimates across the watershed.

Interview Insights and Context Gaps:
During the CAST interview, staff emphasized that CAST functions primarily as a reporting tool, and that many of the questions they receive relate to how partners should interpret eligibility requirements or place projects into the correct BMP categories. They noted that challenges arise when jurisdictions are unsure whether a practice qualifies for credit, how to navigate protocol updates, or how local implementation details should be translated into the modeled structure. CAST staff explained that they routinely help clarify definitions, answer protocol interpretation questions, and support partners in understanding how the model applies to specific scenarios. They also highlighted that misinterpretation typically stems from differences in how jurisdictions document projects rather than from limitations within CAST itself. In several cases, CAST staff observed that partners rely heavily on informal communication when seeking clarification, which can lead to inconsistencies if the same guidance is not shared broadly. These interactions point to a need for

clearer, more consistent communication rather than changes to the CAST system itself.

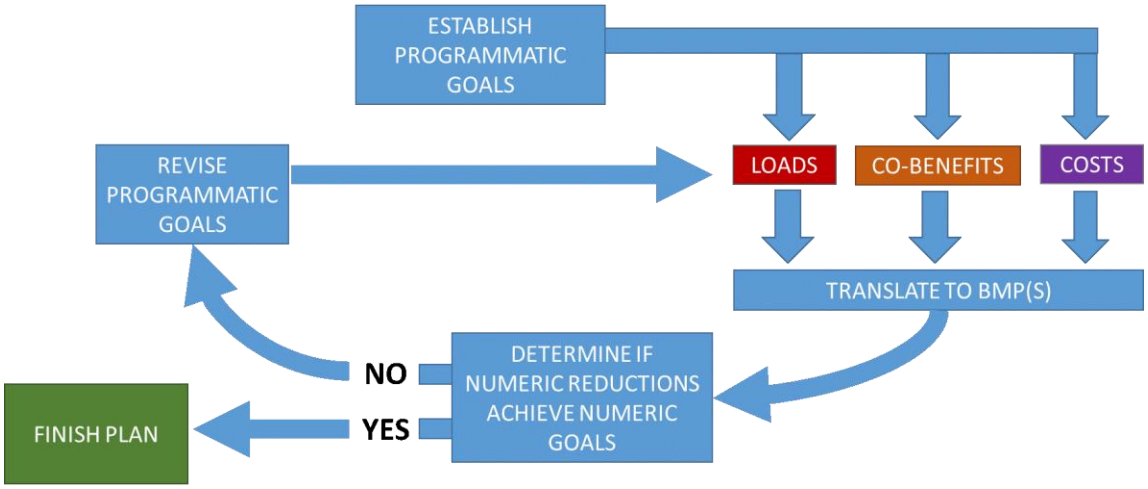

Figure 4 – Steps for Developing a Water Quality Improvement Plan

Phase II (Federal) Interviews

NFWF

The National Fish and Wildlife Foundation (NFWF) uses a platform called "FieldDoc" to spatially track and standardize BMP data for restoration projects funded by NFWF. The use of this program is made to be compatible with NEIEN and CAST reporting standards. FieldDoc's use is required for most Chesapeake Bay Stewardship Fund (CBSF) grantees to report and configure their BMP data. It is used alongside EasyGrants (NFWF financial system) and integrates with CAST isolation tables and NEIEN-compatible exports which aid QA/QC procedures. These NEIEN exports specifically are reviewed by each jurisdiction before inclusion in TMDL reporting for the EPA. There are several specific highlights to FieldDoc, it embeds real-time dashboards for NFWF staff to consistently keep track of progress and operates as a highly collaborative model, incorporating training, jurisdiction feedback loops, and grantee support. This model also operates on a comprehensive QA/QC system. A Lifecycle Workflow Checklist is used to review each project in FieldDoc at three key stages, award, interim reporting, and project close-out. This ensures the data is uniform across the board prior to reporting.

Field Liaisons are a supporting role that gathers feedback from grantees, NFWF staff, and the FieldDoc developers. They ensure BMP data is tracked and effectively communicated between all parties involved.

Interview Insights and Context Gaps:
NFWF relies on FieldDoc as a geospatial platform to track their BMP activity and connect it with spatial data. This reporting follows NEIEN schema with some slight variations depending on the jurisdiction. When data moves from NFWF to jurisdictions, double counting is experienced which NFWF as well as all other entities involved in this process are aiming to reduce. NFWF is anticipating increasing implementation of innovative BMPs which can pose challenges in reporting using the current system, so they are interested in expanding the functionality of their data collection. Currently, their reporting primarily addresses nutrient and sediment reductions, but they recognize the need to move beyond

this “bean counting” approach by incorporating co-benefits such as habitat enhancement, carbon capture, flood resilience, and improved community outcomes. Looking ahead, NFWF plans to support innovative BMPs and expand data collection to include structural and functional attributes like tree species, growth rates, and shade coverage to better capture ecosystem services and inform more precise modeling and evaluation of BMP effectiveness.

DoD

DoD installations report BMP implementation, planned practices, and historical installations via a standardized datacall template covering specific timeframes (e.g. BMPs from July 1, 2020–June 30, 2021; planned BMPs through December 2025). Submitted BMP records are consolidated by the DoD Chesapeake Bay Program (CBP) and sent to participating jurisdictions (e.g., MD, VA, DC, PA) by early October. States then assign unique IDs and submit data to NEIEN and CAST modeling systems. Since 2018, installations must include inspection and maintenance information (e.g., date of last inspection, maintenance status) or risk losing credit for BMPs. If required data is missing, the BMP is excluded from the jurisdiction submission and credit model. DoD CBP prepares crediting reports that identify BMPs fully credited, partially credited, or lost credit. Causes of credit loss (e.g., missing maintenance data) are documented and communicated so installations can take corrective action. For the annual DoD Chesapeake Bay BMP datacall, installations typically receive data requests at the end of July and have about one month (through the end of August) to submit their BMP records. The DoD Chesapeake Bay Program and its contractor then use September to review, quality-check, and follow up on those records before submitting a consolidated DoD BMP progress dataset to the Bay jurisdictions by October 1 each year. The consultant consolidates installation data by jurisdiction and submits unmodified formats to EPA and jurisdictions by October 1.

Interview Insights and Context Gaps:
Each spring, consultants go over their BMP credits within CAST, highlight uncredited BMPs, and share their findings to installations for correction. When CAST models or BMP pollutant removal rates change (e.g., new stream protocols or oyster BMPs), DoD adjusts data collection and reporting templates accordingly. They track proprietary BMPs, even when they are not receiving credit (e.g. manufactured treatment devices such as Filterras), they are still monitored internally, and information is shared through fact sheets, journals, and internal guidance to help installations consider adoption and track performance over time. The DoD is involved with the Urban Stormwater Workgroup to help pave new pathways for these proprietary BMPs, with interest in finding ways to administer credit for them specifically when dealing with model inaccuracies. A supplementary datacall is conducted as a progress indicator that is separate from TMDL – focused BMP reporting. It focuses on natural infrastructure/habitat, biodiversity, and community benefits. Some specific examples of these benefits are wetland restoration, forest buffer plantings, fish passage projects, oyster restoration, public access sites, and carbon sequestration. These benefits are tracked in aims to meet the goals of Executive Order 13508, which mandates tracking efforts regarding ecosystems and communities. Installations are asked to report not only traditional BMPs, but also any projects or activities that support these non-TMDL goals. The data is then compiled by the DoD CBP support team into a report format that satisfies internal planning goals and federal accountability mandates (e.g., EO 13508 and the Watershed Implementation Plans). These tracked co-benefits are reported under four executive order buckets, Abundant Life, Conserved Land, Engaged Communities, and Clean Water.

The DoD makes a strong effort to coordinate with jurisdictions and help them obtain their preferred NEIEN templates. Along with this, the DoD prepares MS4 data for VA installations and provides it for reporting to the BMP Warehouse. The DoD faces challenges with staffing capacity, where many employees are responsible for multiple environmental programs (e.g., NEPA, stormwater compliance, etc.), which limit time and resources available for BMP tracking and maintenance. Considering turnover struggles, the DoD began conducting datacall preparation training earlier in the year to give new staff more time to get familiar with their responsibilities and prepare accurate data for BMP reporting. Another challenge faced by the DoD involves data/template inconsistencies with other agencies, and jurisdictions as well. The Army Corps of Engineers have their pollutant load data lumped in with the DoD, which creates confusion when it comes to the DoD's tracked performance. As a result of little federal guidance with BMP effectiveness beyond water quality, the DoD relies on internal assessments, contractor support, and peer evaluation to adapt implementation strategies.

Army Corps of Engineers

BMP data is collected and managed internally via Excel spreadsheets, which capture basic information such as BMP type, installation date, funding year, and cost. Reporting occurs to multiple recipients - individual states, the DoD, and, in the case of the Washington Aqueduct, the District of Columbia. Each has slightly different data needs, resulting in redundancy. Eligibility and verification are determined by meeting both state and DoD criteria for TMDL credit. Coordination is primarily through Natural Resource Managers in the Operations Division, who liaise with field staff at dam and reservoir projects. Because the Corps operates under a project-based funding model, BMPs are typically incidental to larger maintenance or construction projects, not driven by a dedicated watershed program. Large-scale BMPs, such as reservoirs functioning as regional sediment basins, often do not fit neatly into the CAST modeling framework and may go uncredited despite their ecological value. Additional parameters beyond nitrogen, phosphorus, and sediment are not formally tracked, and co-benefits are rarely quantified unless part of broader planning efforts like the Chesapeake Bay Comprehensive Plan. There is currently no formalized SOP for incorporating Chesapeake Bay Program protocol updates into USACE reporting, though the agency acknowledges this as a need. No mention was made of QAPPs, and the Corps appears to not employ a formalized quality assurance plan for BMP data collection. Reporting is further complicated by high staff turnover, shifting responsibilities, and the lack of dedicated reporting personnel.

Interview Insights and Context Gaps:
The interview revealed several key gaps in USACE's BMP tracking and reporting process, including the lack of a standardized SOP or QAPP for data quality, limited recognition of large-scale or non-traditional BMPs in CAST, and minimal tracking of co-benefits beyond nutrient reduction. Reporting is fragmented and redundant across multiple entities, compounded by high staff turnover, inconsistent coordination with states, and the absence of centralized data systems. The Corps' project-based funding model further limits alignment with programmatic TMDL milestones, while staffing shortages and the loss of institutional knowledge hinder timely and accurate reporting.

Recommendations

Based on the review of each QAPP and the interviews conducted with jurisdictional and federal partners, the consultants and Steering Committee identified recurring challenges that affect the accuracy, consistency, and completeness of BMP reporting across the Chesapeake Bay watershed. Each reporting entity maintains its own reporting systems, though many of the issues raised were shared by all. Some examples include inconsistent data formats, variable verification approaches, limited capacity, and difficulties capturing voluntary or innovative practices.

The following recommendations are intended to support jurisdictions in strengthening existing reporting structures, improving coordination among partners, and aligning local and state-level reporting pathways with Bay Program expectations. These recommendations focus on strengthening processes that already exist, enhancing communication and consistency, and identifying feasible approaches that jurisdictions may consider implementing over time.

Standardize Reporting Templates Across Reporting Entities

Across all interviews, reporting entities emphasized that one of their most persistent challenges is receiving BMP data in inconsistent formats from local governments, conservation districts, federal partners, and NGOs. These inconsistencies increase QA/QC burdens, contribute to duplicate or incomplete entries, and slow down NEIEN or CAST preparation.

Interview findings highlighted several recurring problems:

- District of Columbia reported non-uniform templates from partners such as DC Water and federal facilities, which requires additional follow-up and slows QA/QC.
- Maryland receives a mix of geodatabases (Phase I MS4s), spreadsheets (Phase II MS4s), and differently formatted agricultural reports, all of which must be manually converted before submission.
- Delaware and West Virginia noted that external partners without access to their state systems often submit ad-hoc spreadsheets, requiring manual interpretation and increasing risk of errors.
- Federal partners (DoD, USACE, NFWF grantees) frequently submit data structured differently than state databases, requiring states to reformat for NEIEN compatibility.

To address these shared issues, each jurisdiction could develop one state-specific standardized reporting template that all its reporting partners use, tailored to the fields and structure of its existing systems (eFACTS, BMP Warehouse, WIS, ARIS/LONIE, SQL Data Warehouse, etc.).

Purpose and Benefits

The aim is not to create a Bay-wide universal template. Instead, the goal is to improve consistency for each state, giving data providers a clear and familiar structure. This approach may help:

- Clarify expectations for counties, districts, and other local partners who often struggle with reporting requirements.

- Reduce formatting differences that lead to missing metadata, geometry errors, or incomplete records.
- Lessen the amount of manual reformatting state staff must perform before preparing NEIEN or CAST submissions.
- Improve alignment with existing state QAPPs and database structures.
- Reduce repetitive outreach and clarification when templates vary from partner to partner.
- Increase voluntary reporting of non-regulated BMPs.

Feasibility Considerations
This recommendation could be implemented within jurisdictions' existing reporting frameworks, since most already provide some form of template or guidance. Updating or refining these templates may be a more manageable approach than developing new reporting systems, and templates can be adapted over time as NEIEN and CAST requirements evolve.

Track Co-Benefits Beyond Nitrogen, Phosphorus, and Sediment

During interviews, several reporting entities expressed interest in tracking additional outcomes such as habitat uplift, shade, tree canopy, and flood resilience. However, they noted that these benefits are not currently integrated into Bay reporting. For example, Maryland highlighted that non-standard practices often cannot be credited through NEIEN, and Pennsylvania and New York noted that ecological functions of practices like legacy sediment restoration or buffer plantings are not fully captured. Federal partners, including NFWF and DoD, also emphasized a desire to quantify co-benefits without creating additional reporting burdens.

Purpose and Expected Benefits
This recommendation supports jurisdictions that already collect limited co-benefit information but lack a consistent way to incorporate it into BMP reporting. Aligning co-benefit tracking with ongoing Bay Program modeling work would:

- Improve visibility of multi-benefit BMPs already implemented
- Strengthen consistency in how jurisdictions document ancillary outcomes
- Avoid duplicative or standalone tracking systems
- Build toward a more holistic understanding of watershed restoration progress

How This Could Build on Existing Processes
Instead of creating new reporting pathways, this approach would use the co-benefit categories currently being explored in Bay Program efforts (e.g., shallow waters, living resources modeling). Jurisdictions could:

- Identify 1–2 co-benefit metrics already collected during project design or permitting (e.g., acres of tree canopy added, habitat restored)
- Integrate those metrics into existing BMP documentation templates
- Share this information during current reporting cycles or workgroup discussions

This method strengthens what jurisdictions are already doing without expanding reporting requirements.

Feasibility Considerations

Because it relies on data many partners already collect and ties into Bay Program modeling work already underway, this recommendation could become moderate in scope and evolve gradually as modeling updates become available. The DoD and the District of Columbia already capture some of this information, however other jurisdictions and partners may find this burdensome. It will be necessary to find methods to incentivize implementation and data capture which could be accomplished through the sharing of techniques and tools to make ease of reporting feasible for all partners.

Strengthen Targeted BMP Reporting Training and Helpdesk Support for the NEIEN Process

Interviews showed that many reporting inconsistencies begin early in the data submission chain, particularly among local governments, conservation districts, and other partners who are less familiar with NEIEN expectations. States noted frequent questions about required fields, documentation standards, spatial accuracy, and verification timelines. While each jurisdiction has one or two individuals responsible for the final NEIEN submission, most errors originate upstream, highlighting the need for clearer communication and more accessible support for those entering BMP data.

Jurisdictions also acknowledged that support resources already exist, including CAST tutorials, existing CBP Quick Reference Guides, sector verification guidance, state-led training, and program-specific tools or warehouse documentation. However, these resources are unevenly accessed, and local implementers are not always aware of them. Furthermore, these resources may provide conflicting information or may not be tailored to those at the local level implementing BMPs.

Purpose and Benefits

This recommendation focuses on strengthening existing support pathway**s** rather than creating new helpdesk systems. Opportunities include:

- Consolidating existing guidance into short, state-tailored training materials for local implementers.
- Offering periodic virtual office hours or Q&A sessions through existing workgroups.
- Developing brief, targeted modules addressing common issues (e.g., verification documentation, spatial data, duplicate reporting).
- Improving communication between GITs, Outcome Coordination Teams, and jurisdiction BMP coordinators to relay updates more consistently.

These efforts may reduce common reporting errors and lessen the burden on state staff who currently correct inconsistencies during QA/QC.

Feasibility Considerations

This approach aligns with existing workflows and does not require new staff or infrastructure. Enhancing and coordinating resources already in use could support more consistent reporting across data providers, and tools can be adapted as NEIEN and CAST evolve.

Implement Interoperable Data Systems Pilots

Across jurisdictions, interviewees described having multiple internal and external data systems that are not currently connected, requiring staff to manually translate or re-enter BMP information before it can be submitted to NEIEN or CAST. Maryland's mix of geodatabases and spreadsheet-based submissions, and the separate systems used for stormwater, agriculture, and forestry in West Virginia and Delaware are a few examples. These parallel systems contribute to duplication, inconsistent data fields, and added QA/QC time, especially when data must be reformatted to match state reporting structures.

Some jurisdictions expressed interest in better connections between these systems. For example, some recommended future integration between MS4 reporting databases and state warehouses, or improved translation between county-level BMP inventories and state-level NEIEN submissions. While full system integration would require significant investment and coordination, several interviewees noted that even small-scale pilots or one-directional data transfers could reduce manual processing.

Purpose and Benefits

This recommendation focuses on small, targeted pilots that test limited interoperability between existing systems rather than proposing full-scale integration. These pilots could explore:

- Exporting or syncing data from commonly used local systems into state databases (e.g., GIS-based BMP inventories into warehouse structures).
- Creating simple import templates that allow state systems to ingest consistent CSV or geodatabase files.
- Testing whether standardized, state-specific reporting templates (recommended above) reduces formatting conflicts between systems and eases the transition from local to state databases.
- Aligning metadata fields across systems so that jurisdiction staff spend less time reconciling naming conventions, units, or missing attributes.

These pilots may help jurisdictions identify low-effort opportunities to streamline data flow, reduce manual re-entry, and support local partners who rely on different tracking tools.

Feasibility Considerations

Limited-scope pilots can be carried out within existing systems without large-scale redevelopment. Because jurisdictions already maintain their own databases and reporting structures, these efforts would likely focus on adjusting export formats, aligning fields, or testing. Improvements may also become more effective when paired with the recommendation to standardize state reporting templates, which can reduce inconsistencies that currently complicate system-to-system exchange.

Enhance and Incentivize Voluntary BMP Reporting

Interviews highlighted that voluntary BMPs represent one of the largest reporting gaps across the watershed. Jurisdictions consistently noted that many unregulated or privately installed practices never reach state databases due to limited staff capacity, lack of awareness among landowners, privacy constraints, or uncertainty about what documentation is required. This results in BMP implementation that occurs on the ground but is not reflected in NEIEN or CAST submissions.

Pennsylvania explained that agricultural landowners often implement practices independently but have been hesitant to work with the state government. This leads to significant underreported agricultural BMPs unless CAP coordinators or conservation districts document them. DC reported difficulty capturing homeowner-scale BMPs unless tied to a grant or permit program, meaning many small urban practices are missed. West Virginia noted that voluntary tree plantings are not consistently updated, leading to uncertainty about credit retention. Several jurisdictions acknowledged that voluntary practices outside formal programs including small buffers, stormwater retrofits on private property, or unregulated agricultural practices are rarely documented in a way that aligns with state reporting templates.

Purpose and Benefits

This recommendation focuses on improving the reporting of voluntary practices not expanding regulatory requirements by clarifying expectations and strengthening communication pathways already in place. Opportunities include:

- Working through established partners such as conservation districts, CAP coordinators (PA), local stormwater programs, and watershed groups to communicate consistent reporting expectations.
- Identifying the voluntary BMPs that each jurisdiction most frequently struggles to capture (e.g., voluntary agricultural practices, tree plantings, small urban homeowner BMPs).
- Providing clear, simplified documentation guidance aligned with each state's reporting template explaining what information is required for these practices to be credited.
- Updating one-pagers or fact sheets to reflect reporting needs for voluntary practices, including basic location information, lifespan, and verification documentation.
- Ensuring voluntary practices are explicitly included in state-specific reporting templates to reduce uncertainty about required fields.

These actions support bottom-up reporting by ensuring that voluntary practices can be captured in a consistent, reportable format.

Feasibility Considerations

This approach works within existing structures, relying on partners and jurisdictions that are already used to working with landowners and local implementers. Strengthening communication and clarifying documentation expectations may help states better capture voluntary practices without creating new programs or systems. Over time, improved guidance may reduce reporting gaps identified across interviews. Resources and incentives through existing grant programs may spur additional voluntary reporting, particularly if reporting templates are more standardized and easier to use.

Update Quick-Guide Templates for BMPs

Interviewees noted that local implementers often rely on outdated or inconsistent BMP fact sheets when determining what information to submit for reporting. Several jurisdictions shared that localities, conservation districts, and project partners sometimes reference older materials that do not reflect current NEIEN fields, reporting requirements, or verification expectations. This contributes to inconsistent or incomplete submissions that require follow-up from state staff.

Purpose and Benefits

This recommendation focuses on updating existing materials, not creating new programs to clearly communicate what information is needed for BMP reporting. Opportunities include:

- Refreshing existing BMP one-pagers and fact sheets to align with current state reporting templates and verification requirements.
- Clarifying basic documentation needs that frequently lead to errors (e.g., location data, installation dates, inspection requirements).
- Ensuring fact sheets reflect the BMP types that reporting entities identified as difficult to report or credit during interviews.
- Helping local implementers, grantees, and conservation districts submit consistent information that can be easily incorporated into state databases.

These updates can help reduce common reporting mistakes and support more complete and consistent submissions from partners.

Feasibility Considerations
Because most states already maintain fact sheets or BMP guidance documents, updating these materials can be integrated into ongoing communication and outreach efforts without major system changes. Modernized materials may support the other recommendations by reinforcing consistent expectations across all reporting partners.

Improve QAPP Accessibility and Consistency

Across interviews, several jurisdictions noted difficulty locating the most current versions of QAPPs, identifying which QAPPs apply to which reporting pathways, or navigating multiple websites where outdated links remain active. Committee feedback confirmed that some links to QAPP documents on public-facing Bay Program pages are outdated, and jurisdictions expressed uncertainty about where to find consolidated, up-to-date resources. This lack of clarity can complicate reporting, especially when staff turnover occurs or when partners need to confirm sector-specific verification requirements.

Purpose and Benefits
The purpose of this recommendation is to improve accessibility, clarity, and consistency of QAPP documentation. A centralized library or clearly maintained index could:

- Provide jurisdictions and partners with an easily navigable location listing current QAPPs across sectors.
- Reduce confusion associated with outdated or broken links that jurisdictions identified during interviews and committee discussions.
- Improve consistency in reporting by ensuring all partners reference the same, current verification and documentation requirements.
- Support new staff, local implementers, and federal partners who rely on clear QA/QC expectations when submitting BMP information.

This approach could draw on existing Bay Program infrastructure, such as Verification Guidance webpages or CAST documentation pages, without creating new platforms.

Feasibility Considerations

A centralized resource could be managed through existing Bay Program communication channels or workgroups, with potential collaboration from participating jurisdictions and federal partners. The effort would largely involve organizing links, confirming document versions, and ensuring routine updates. These activities can be incorporated into existing workflows. Improving access to QAPPs may support more accurate reporting by reducing misunderstandings about verification requirements.

Adopt a "Living QAPP" Approach

Across multiple interviews, several noted difficulties keeping track of the most current QAPP guidance, especially when links were outdated or verification expectations changed during CAST or NEIEN updates. Several partners including Maryland, Pennsylvania counties, and federal agencies described challenges determining which procedures were still valid, particularly with staff turnover and non-uniform verification requirements.

Purpose and Benefits

A simplified "living QAPP" approach would allow jurisdictions to keep verification requirements current. Instead, each jurisdiction would prepare a short annual addendum summarizing updates tied to their existing reporting systems (e.g., BMP Warehouse, WIS, eFACTS, PracticeKeeper, ARIS/LONIE). Benefits include:

- Clearer, more accessible verification expectations
- Reduced confusion around outdated QAPP versions
- More consistent reporting across data providers
- Less administrative burden for both jurisdictions and partners

Feasibility Considerations

This recommendation relies on existing workgroups and data systems. Posting short annual QAPP addendums in the same locations where documents are already maintained offers a low-burden way to reflect ongoing jurisdictional updates. This approach improves current workflows by improving transparency and accessibility without requiring new systems, staff, or reporting structures. Updates are included on the Chesapeake Bay website under *Sector Verification Guidance* but appear to be minimal and not QAPP specific. The goal of this recommendation is to provide a practical way to improve clarity and give easy access to changes made in in each QAPP.

Regional Staff Capacity Building

Across several interviews, many highlighted challenges maintaining consistent QA/QC and managing BMP reporting due to limited staffing and competing responsibilities. Maryland and Delaware cited constraints that limit the depth and frequency of verification and data review. West Virginia noted that external partners often cannot enter data directly into ARIS or LONIE, requiring additional manual coordination from state staff. The District of Columbia reported limited staff bandwidth, making it difficult to follow up on BMP submissions from external partners and maintain consistent QA/QC across all data sources.

Purpose and Benefits

Enhancing regional QA/data capacity would strengthen the accuracy and completeness of BMP data submissions by supporting the staff who manage reporting processes. Benefits include:

- More consistent QA/QC across reporting partners
- Reduced delays caused by staff availability or turnover
- Improved accuracy of BMP submissions to NEIEN and CAST
- Increased support for local and voluntary projects that lack dedicated reporting staff

Feasibility Considerations

Supporting regional capacity for BMP reporting can be achieved by expanding the models that already operate effectively in parts of the watershed. West Virginia's regional environmental coordinators demonstrate how locally based staff can provide ongoing project and data support across multiple jurisdictions. Conservation district structures, which already assist with data entry and verification in states such as Delaware and the District of Columbia, offer another example of how localized staffing can strengthen reporting without adding new administrative layers. Regional planning councils and stormwater groups also show how existing networks help facilitate communication and implementation across counties and municipalities. Adapting or scaling these familiar models where needed would allow jurisdictions to improve the consistency and completeness of BMP reporting while still working within current organizational frameworks. Because this approach relies on structures that partners already use and can be tailored to available resources, it offers a practical and achievable path for strengthening reporting support without creating new requirements or administrative burdens.

Enhance Cross-Jurisdiction Communication

Interviews with jurisdictions and federal partners highlighted that coordination often occurs informally and inconsistently. Maryland described largely email-based communication among state and local partners. West Virginia shared that external entities submit data in varying formats, and that informal coordination is needed to resolve gaps. New York noted challenges aligning regional partners such as planning boards, USC, and DEC reporting systems. DC expressed limited staff bandwidth to follow up with external reporters, leading to inconsistent data quality. Federal partners including DoD and USACE described mismatched templates, unclear expectations, and frequent turnover as barriers to consistent BMP reporting.

Purpose and Benefits

Strengthening existing coordination pathways would improve the clarity, consistency, and completeness of BMP reporting across all reporting partners. Benefits include:

- More consistent interpretation of BMP crediting and verification requirements
- Improved communication between state agencies, federal partners, and local implementers
- Better alignment of templates, data expectations, and reporting timelines
- Reduced reporting errors and fewer follow-up requests from state data managers

Feasibility Considerations

This recommendation is feasible because it builds directly on structures that jurisdictions already use for BMP reporting and verification. Existing Bay Program workgroups, outcome coordination teams, regional

planning councils, conservation districts, and state–federal coordination channels already facilitate regular communication on reporting issues. Semi-annual virtual check-ins among BMP coordinators would formalize and streamline conversations that are already happening informally, reducing confusion caused by staff turnover, inconsistent templates, and shifting reporting expectations. Since no new staffing or organizational structures are required, this approach strengthens current networks while providing a clearer and more consistent venue for sharing updates on templates, QAPP adjustments, and CAST or NEIEN changes.

Provide Clarity for Tree Canopy and Forest Conservation Reporting

Interviewees from multiple jurisdictions and federal partners noted inconsistencies in how forest conservation, tree plantings, and canopy expansion efforts are reported across the watershed. Several states (e.g., Maryland, Pennsylvania, and New York) described challenges reporting urban tree plantings or forest preservation practices that do not fit cleanly into NEIEN or CAST structures. Due to model limitations regarding land use and acreage, these BMPs can be underrecognized by the model. New York highlighted that tree planting BMPs are sometimes underreported because local implementers are not fully aware of crediting pathways. Federal partners (DoD, USACE) shared that large-scale land conservation or tree-based BMPs often lack clear crediting guidance, resulting in lost opportunities for reporting.

Purpose and Benefits

Improving the clarity and consistency of forest and tree canopy crediting would support jurisdictions that already track these practices but struggle to incorporate them into NEIEN/CAST reporting. Benefits include:

- More consistent and accurate reporting of tree canopy gains and forest protection
- Reduced confusion around eligibility and verification requirements for forestry BMPs
- Increased recognition of BMPs that provide both nutrient reduction and co-benefits such as shade, habitat, and temperature mitigation
- Stronger alignment between watershed forestry efforts and existing BMP verification processes

Feasibility Considerations

This recommendation can be supported through coordination channels that already exist across jurisdictions and Bay partners, without requiring new programs or staffing. Many jurisdictions already engage with the Forestry Workgroup, outcome coordination teams, and sector-specific reporting groups, which provides a natural platform for sharing forestry-related guidance and clarifying how practices such as urban tree plantings, forest buffers, and conservation actions align with current CAST and NEIEN schema. Drawing on examples from states that already demonstrate effective forestry BMP integration for example, New York's USC field verification approach or Maryland's efforts to better account for forest conservation benefits offers practical reference points without adding new reporting requirements. Strengthening these communication pathways provides a realistic way for jurisdictions to improve the accuracy of forestry related reporting within the frameworks they already use.

Clarify CAST Limitations

Across jurisdictions and federal partners, interviewees described challenges navigating CAST's current structure, particularly when BMPs do not fit neatly into existing categories or when model updates occur mid-cycle. Maryland noted difficulty reporting innovative or nonstandard BMPs because they cannot be easily entered into CAST or NEIEN. Pennsylvania shared that frequent protocol and CAST updates make it difficult for data providers to understand changing reporting requirements. Federal partners such as USACE explained that large-scale BMPs like reservoirs acting as sediment basins "do not fit intuitively into CAST," resulting in lost credit. DoD reported that changes in CAST pollutant removal rates or protocols require frequent template adjustments and create inconsistencies across jurisdictions. Provision of consistent CAST guidance would aid in clarification.

Purpose and Benefits

Improving clarity around CAST's limitations and providing consistent planning guidance would support jurisdictions in understanding how best to report BMPs within the current modeling framework. Benefits include:

- Reduced confusion around what can and cannot be credited
- More predictable reporting expectations during CAST update cycles
- Clearer pathways for documenting BMPs that provide water quality benefits but do not align perfectly with CAST categories
- Increased consistency in how states and federal partners interpret CAST guidance

Feasibility Considerations

Strengthening how CAST is interpreted and used for both reporting and planning can help jurisdictions and federal partners navigate common challenges more consistently. Clearer and more consolidated guidance, supported by existing resources such as the CAST How To Guide for Local Governments, would help reduce confusion around expectations and data needs. Improved coordination between jurisdictions, modelers, and technical teams through the communication pathways that are already in place can also ensure that reporting templates and instructions remain aligned when protocols change. Incorporating real examples of recurring difficulties, such as federal reservoir projects that do not align well with CAST categories, Maryland's experience with urban retrofits, and Pennsylvania's work with legacy sediment restorations, would give implementers a better understanding of where limitations may occur before reporting deadlines. These refinements rely on workgroups and outcome coordination teams that already support cross jurisdictional communication and therefore do not require new structures. This makes the recommendation a practical way to improve clarity and consistency in reporting while still operating fully within existing systems and responsibilities.

Improve Wetland Restoration Reporting

Jurisdictions and partners consistently noted challenges reporting wetland restoration BMPs due to monitoring requirements, inconsistent documentation, and limitations within NEIEN and CAST. Maryland noted that wetland and innovative restoration practices often cannot be easily submitted because "the NEIEN schema does not support" certain data types. Pennsylvania described difficulty tracking ecological functions tied to legacy sediment and floodplain restoration because existing crediting frameworks do not fully capture these outcomes. Federal partners, including NFWF and USACE, expressed that wetland and

habitat-focused projects often provide measurable water quality benefits but lack clear pathways for crediting within the Bay reporting system.

Purpose and Benefits

Improving wetland crediting guidance would help jurisdictions more consistently report these practices in line with existing verification and reporting expectations. Benefits include:

- Clearer documentation requirements for wetland and floodplain restoration
- More consistent reporting of nutrient-reducing wetland practices
- Improved ability to capture projects that jurisdictions and federal partners already implement
- Reduced confusion for implementers who are unsure how to document monitoring or biological assessment needs

Feasibility Considerations

Improving wetland restoration reporting can be achieved by building on the processes and tools that jurisdictions already use. Clarifying how wetland practices should be entered into existing reporting templates, using the NEIEN schema already in place, would help reduce confusion for both state and local submitters. Strengthening coordination through Bay Program technical teams, which have previously discussed wetland protocols, can consolidate guidance in one accessible location and reduce the need for partners to search across multiple sources. Incorporating examples raised during interviews, including Maryland's difficulty submitting nonstandard wetland types and Pennsylvania's experience with legacy sediment floodplain restorations, can help refine expectations for documentation and monitoring. Identifying how wetland projects align with existing CAST BMP categories also supports implementers by reducing uncertainty about how these practices are credited. Because this recommendation focuses on clarifying and organizing guidance that already exists rather than creating new BMP categories or modeling structures, it offers a practical and achievable way to support more accurate and consistent wetland reporting while remaining within current workflows and reporting systems.

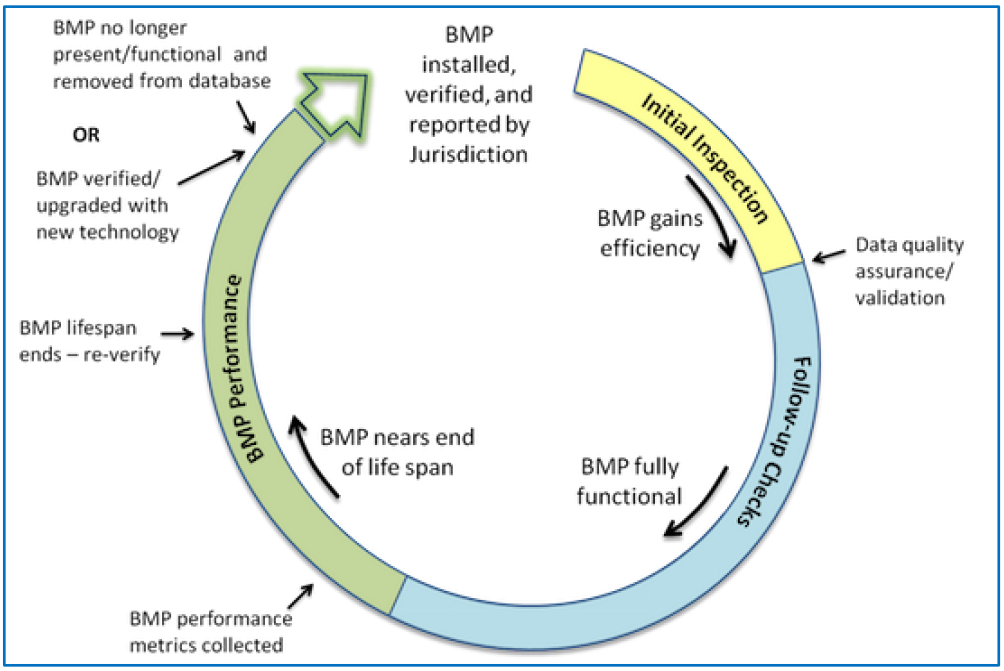

Figure 5 – BMP Lifecycle

Conclusion

This assessment integrates the QAPP review, jurisdiction interviews, CBP consultants, and federal partner insights to clarify how BMP reporting functions across the Chesapeake Bay watershed and to identify the barriers partners face in documenting BMP implementation. Despite differences in data systems and regulatory structures, many jurisdictions described similar challenges. These changes were described as inconsistent data inputs, evolving verification requirements, staff capacity limitations, and uncertainty around how certain practices should be credited. The recommendations in this report respond directly to those issues by refining existing workflows, improving coordination, and clarifying reporting expectations in ways that fit within current practices. These actions aim to strengthen the accuracy and consistency of BMP data submitted to NEIEN and CAST, ensuring that ongoing restoration work is more fully and reliably documented. Looking ahead, continued collaboration across states, local partners, and federal programs will be essential for adapting reporting processes as tools for maintaining a reliable foundation for tracking Chesapeake Bay restoration progress.

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Appendix A

Steering Committee participants:

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Appendix B

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