



2015 Delaware Wetland Management Plan

A guiding document for prioritizing wetland research, education and conservation



Overview

The Delaware Wetland Management Plan was developed by the Delaware Department of Natural Resources and Environmental Control (DNREC) in cooperation with the Delaware Department of Agriculture's (DOA) Forest Service. This effort was funded through a regional Wetland Program Development Grant awarded by the U.S. Environmental Protection Agency.

This document would not have been completed without the advice, input, time, talents, and insight of wetlands program staff and conservation partners throughout the state.

State Agency Participants

Department of Natural Resources and Environmental Control

Division of Watershed Stewardship
Division of Fish and Wildlife
Division of Parks and Recreation
Division of Waste and Hazardous Substances
Division of Energy and Climate
Delaware Coastal Programs



Department of Agriculture

Forest Service



Cover photo: Non-tidal depression wetland in the Smyrna watershed. (WMAP)

Cover photo insets: Depression wetland (WMAP), Living shoreline restoration installation (WMAP), Mispillion salt marsh (WMAP), Marigold plant (William A. McAvoy), Depression wetland (WMAP), Wilmington Green Jobs outreach program for students aged 14-18 (WMAP)

Back Cover: Salt marsh landscape (WMAP)

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July 15, 2015

Dear Wetland Supporters,

Delaware's wooded and tidal wetlands are a significant part of what defines Delaware's natural heritage. Wetlands comprise a quarter of Delaware's land area and our residents and visitors are never more than a mile from one of these special areas. The wetlands of the Delaware River and Bay are internationally significant for their role as habitat for many species including horseshoe crabs, migratory shorebirds and waterfowl. These beautiful and unique habitats not only provide recreational opportunities, they are also important buffers to absorb stormwater and they remove harmful pollutants and excess nutrients from the water on which we depend for swimming, drinking and supporting fish and wildlife populations. Wetlands are also an integral part of our tourism and conservation economy.

We need to work together to develop new ways to collect meaningful biological and physical data that leads to a better understanding of wetland ecology and more effective management. DNREC is committed to efficient and effective protection and conservation of wetland resources that provide many benefits to the people of Delaware. Today, Delaware's wetlands face threats such as pollution, sea level rise, changing climates and landscapes. It is more important than ever to accurately assess our wetlands and identify changing trends. It is our responsibility to continue to raise awareness among Delaware's citizens about the value of wetlands. A majority of our freshwater wetlands are held in private property and we should reach landowners with important information to improve conservation through stewardship and volunteer actions.

This plan was developed as part of our Wetland Monitoring and Assessment Program and its partners and identifies activities we will be undertaking through 2020 and which will be funded in part through grants from the US Environmental Protection Agency. This document is the result of a collaborative effort to evaluate areas of need and identify a specific course of action to bring about a positive future for wetlands and the species they support. As Secretary, I recognize the need to build the capacity for a stronger wetland program in Delaware. I proudly support and endorse the effort by the contributing programs to prioritize wetland conservation needs in Delaware and work with partners to accomplish the objectives identified here.

I am confident that together we will succeed in protecting the valuable resources that make up our natural landscape and support a healthy economy and way of living. I hope that you will embrace and support our goal to protect the wetland resources that are so important to our great state.

Sincerely,

A handwritten signature in blue ink, appearing to read "David S. Small".

David S. Small
Secretary

Delaware's Good Nature depends on you!

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INTRODUCTION



Figure 1. Tidal and nontidal wetlands in Delaware (SWMP 2007).

Delaware is host to roughly 320,000 acres of wetlands that vary in salinity, soil type and vegetation based on geographic location and water source. With one quarter of the state's land area being wetlands, citizens and visitors to Delaware are surrounded by these hard-working natural features. Situated between water and land wetlands are highly adapted to particular conditions and provide many important services that support the state's economy. Wetlands are home to a myriad of plant and wildlife species, some rare and endemic species, as well as commercially harvested species. Delaware benefits from a strong tourism industry which includes birders, hunters and nature enthusiasts who visit the Delaware Bayshore and support local businesses. Wetlands also have the capacity to filter pollutants from our drinking, fishing and swimming waters and protect our shorelines and property from damaging winds and floods. Our bountiful wetland resources play an understated but vital role for our communities, economy and well-being.

However, Delaware's beautiful and valuable wetland resources are still vulnerable to the same threats they faced in 2008 such as conversion to agriculture or development, a lack of awareness or appreciation, and prioritization differences between management levels. In addition, wetlands face new and growing challenges such as conversion to open water and salt water intrusion due to sea level rise and climate change. Wetlands in the Mid-Atlantic region, in particular, face severe impacts due to a heightened local rate of sea level rise and require the space and priority to migrate landward. The intention of this management plan is to outline how to address some or all of those threats in the next five years (2016-2020) with cooperation from partners through the action items listed.

There is a healthy network of groups around the state dedicated to studying, protecting and improving wetlands for today and future generations of Delaware residents and visitors. This network ranges from state, county, federal, private, non-profit and academic groups, and often their work overlaps. In 2008, DNREC and the Forest Service collaborated to create a guiding document that used stakeholder input to identify and prioritize areas where information or action was needed. The result was the Delaware Wetland Conservation Strategy which listed 42 action items under 6 major goals. Over the past eight years, progress has been made on 88% of the action items, 32 of them were completed and another five are in progress. Moving forward, new goals and action items in this 2015 Delaware Wetland Management Plan address remaining gaps and needs to improve Delaware's capacity to monitor, restore, regulate and conserve its wetland resources.

In preparation of this strategy the following related documents were reviewed to identify overlapping objectives: the 2015 Delaware Wildlife Action Plan, 2010 Delaware Statewide Forest Strategy, 2012 Coastal Training Program Strategy, Environmental Law Institute's 2010 Delaware Wetland Program Review and the 2013 Recommendations for Adapting to Sea Level Rise in Delaware. The contents of this document are meant to give a brief summary of progress that has been made on past action items, and identify remaining or recently developed areas of need and new action items that will help meet those goals.

DNREC and the Delaware Forest Service intend that this plan will be embraced and adopted by state partners in a collaborative effort to improve Delaware's capacity to conserve wetlands. The action items found here fulfill some objectives of a comprehensive statewide freshwater wetland strategy.

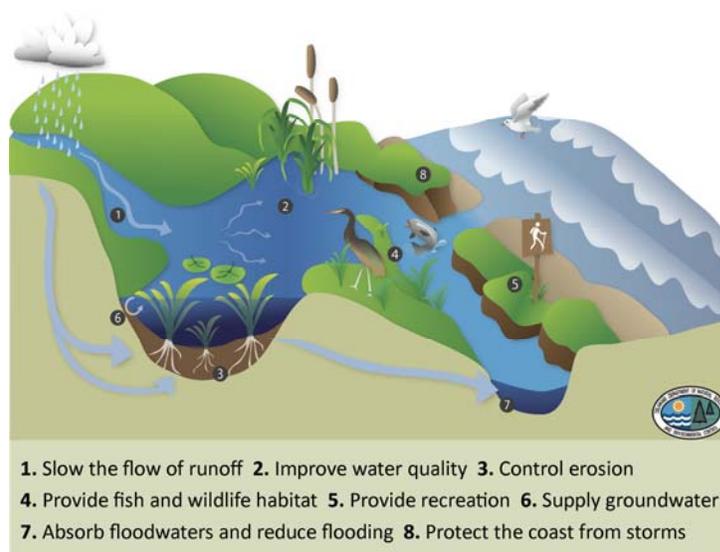


Figure 2. Wetland Functions and Societal Values

EVALUATING PROGRESS 2008 to 2015

The 2008 Delaware Wetland Conservation Strategy included 10 evaluation questions to assess advancement towards completing the action items and goals through 2015. The results are meant to highlight areas of accomplishment and identify where more attention is needed. In addition to these short responses each goal includes a 'progress and current status' segment.

- 1. Which wetlands/wetlands-associated data layers and maps are currently up to date and which data layers are outdated?** Updated layers or data sets include 2012 aerial photography and land use land cover, 2013 NHD, 2014 EcoMap, 2015 LIDAR, 2015 FEMA. Layers in need of updates include state wetland maps, and tidal wetland regulatory maps.
- 2. Which data layers are available to the public and other program staff?** GIS servers have transitioned quite a bit. DataMil was removed from service, Geo Spatial Data Exchange is being removed and FirstMap is currently evolving to house spatial layers with varying levels of access for public and state users.
- 3. How many wetlands in Delaware have been sampled using standardized assessment protocols?** A probabilistic sampling of tidal and nontidal wetlands in the Christina, Appoquinimink, Smyrna, Leipsic, Mispillion, Broadkill watersheds have been assessed for condition (since 2000) and value-added metrics (beginning 2013). Long-term monitoring stations in each county are being sampled annually.
- 4. How much of this information is available to the public and other program staff?** Condition assessment data and findings are reported and are publicly available online. Monitoring data is available upon request.
- 5. What strategic watershed restoration and protection plans have been developed for priority watersheds?** Technical reports for the Christina, St. Jones, Murderkill, Broadkill, Inland Bays were produced and each include a series of watershed specific management recommendations for protection and restoration. A full restoration plan for the Inland Bays watershed is in process.
- 6. How many workshops and public forums have been conducted to update and increase dialogue among wetland scientists, managers, researchers, and the general public?** The Delaware Wetlands Conference was held in 2010, 2012 and 2014. The St. Jones National Estuarine Research Reserve (NERR) held a research symposium in 2014.
- 7. Have wetlands benefitted from the inclusion of wetland assessment data in the PLUS process?** Wetland related comments by DNREC are included in PLUS reviews continuously. However comments are delivered late in the planning process and are dependent upon voluntary compliance.
- 8. Are the tools, resources and other wetlands education materials we have developed for decision makers, landowners, teachers and volunteers being utilized to protect wetlands and receiving positive feedback from their intended users?** We are reaching more individuals in-person and electronically every year. Based on survey feedback, users find our presentations, materials, communications and trainings useful. More effort could focus on targeting teachers and policy makers in the future.
- 9. Who is using these materials to improve wetland awareness and protection in Delaware?** Wetland and coastal programs in DNREC have increased their online presence and continue to educate citizens in-person through organized events, activities and presentations to raise wetland understanding and appreciation, and to use science to drive policy decisions.
- 10. Have extensive reviews of and additional support to existing regulatory programs been completed to clarify where increased regulatory enforcement and regulatory changes/additions are needed for impacts on non-tidal wetlands, most importantly those considered isolated?** An internally-lead review of mapped versus permitting wetland impacts revealed that more tracking and data sharing is needed, especially between state and federal partners. A review of Delaware's wetland program by the Environmental Law Institute highlighted several areas for need-ed growth. Efforts to gain state authority over freshwater wetland activities have been delayed.



GOAL A: MAPPING

Update wetland mapping tools and improve access to wetland related spatial data



Freshwater wetland: Peatland Fen. (William A. McAvoy)



Plotting Shoreline Elevation Points
Via Real-Time Kinematic (RTK) (WMAP)

PROGRESS AND CURRENT STATUS

Since 2008 the ability to draw meaningful conclusions regarding recent changes in and the current status of our wetland resources have been fueled by the 2007 Statewide Wetland Mapping Project (SWMP) layers and accompanying 2011 Status and Changes report.

An assessment of overall wetland function was completed using data that highlighted the relationship between landscape level changes in wetlands and the impact to the services they provide. This information expanded our understanding of cumulative impacts to the wetland services that we all benefit from. Wetland trends for a 15-year period from 1992 to 2007 were drawn using improved digital technology and incorporated a more conservative approach to mapping drier-end wetlands.

The findings of this mapping and reporting effort garnered significant attention due, in part, to a comprehensive webpage (<http://de.gov/dewetlandmapping>) that highlights the work of the Wetland Monitoring and Assessment Program as well as other programs and partners.

The Delaware Wetlands website (<http://de.gov/delawarewetlands>) also contains a library that shares technical reports, protocols, presentations and published articles. This webpage has been made possible through the allocation of a staff member to maintain and update the mapping web page, library and online communications.



GOAL A: MAPPING ACTION ITEMS



Lingo Creek Marsh, Lewes,
Delaware (WMAP)

VISION STATEMENT

DNREC uses wetland maps created from 2007 aerial photographs. The results from the 2011 Status and Changes report emphasized the importance for up-to-date tools and maps that show existing wetlands and highlight changes occurring across the state. State wetland maps and an accompanying Status and Changes report should be updated in 2017 and 2018, respectively, to maintain on a 10-year schedule. In addition, updated LIDAR (Light Detection and Ranging), Land Use Land Cover and EcoMap (formerly Delaware Ecological Network) mapping resources offer rich opportunities to draw new conclusions regarding wetlands, assist with planning for changing conditions and highlight priority areas for protection.

Mapping capabilities have improved greatly in the last eight years and offer more accurate and sophisticated information which should be shared widely. To be more useful, all spatial data layers should be accompanied by complete metadata and should be made accessible to a wide audience. The literature library should be kept current and promoted more to increase visitation and project sharing. Prioritization for conservation and restoration should consider the goals of the Delaware Bayshore Initiative and Chesapeake Bay Program. Lastly, there is a continued need for a streamlined database or webmapper that houses restoration project locations and information from multiple sources. In order to have in-house capabilities to complete projects requiring specialized mapping and analysis skills, staff positions must be supported.

ACTION ITEMS

- A-1 **COMPLETE UPDATE OF DELAWARE STATEWIDE WETLAND MAPPING PROJECT (SWMP) MAPS** and produce an updated wetlands “status and trends” report based on 2017 aerial photography and 2015 LIDAR
- A-2 **DEVELOP RESTORATION PRIORITIZATION LAYERS THAT COMBINE MAPPING RESOURCES** (e.g., SWMP layers, EcoMap, Wildlife Action Plan, SLR, ownership, protection status) to highlight overlapping areas prioritized for protection or restoration
- A-3 **ADOPT, MAINTAIN AND PROMOTE USE OF A RESTORATION TRACKING WEBMAPPER** such as the Watershed Resource Registry to report, map and track wetland projects and share project information with private and public professionals
- A-4 **INCREASE TRAFFIC TO 'LIBRARY' OF DOCUMENTS AND DATA LAYERS** that are up-to-date and provide complete metadata
- A-5 **HELP SUPPORT A GIS STAFF MEMBER TO MAINTAIN WETLAND RELATED DATA SETS AND LAYERS** and assist with spatial analysis needs
- A-6 **MAINTAIN AND PROMOTE A MAP-BASED DATABASE OF VOLUNTEER MONITORING PROJECTS AND INFORMATION**



GOAL B: MONITORING

Increase monitoring efficiency and effort to provide insight into wetland function and health



Barking Treefrog (*Hyla gratiosa*; John D. Willson)



Installation of a Feldspar Plot to Monitor Sediment Accretion (WMAP)



Shorebird Survey (WMAP)

PROGRESS AND CURRENT STATUS

On the ground monitoring of natural, restored or created wetlands have provided valuable insight into wetland health and function while enhancing opportunities to make in-person observations that could not be derived from a landscape census. Currently, wetland condition and local trends are reported on a watershed basis across the state. Since the inception of the previous wetland plan comprehensive reports for the St. Jones, Murderkill, Broadkill and Christina River watersheds have been published to the public. Currently, science-based information is being incorporated into watershed specific management recommendations that drive restoration, protection and mitigation activities.

New sampling protocols are being developed to capture the condition and function of more wetland classifications (for example, tidal freshwater) in addition to refining existing methodologies to reflect a larger reference dataset and address changing concerns. Wetlands are also now being assessed to capture their value apart from condition; their potential to serve both society and the ecological community. Sampling protocols have been shared among DNREC colleagues and outside partners through trainings and presentations with the goal of adopting or utilizing the available data.

Volunteer monitoring has been very active through programs such as the shorebird volunteer program, Delaware Amphibian Monitoring Program (DAMP), marsh bird surveys and DNREC's Volunteer Coordinators Workgroup. Prior to its suspension in 2014 (due to funding challenges), the Adopt-a-Wetland program encompassed 120 wetland sites statewide, including many sites where volunteer adopters engaged in monitoring activities.



GOAL B: MONITORING ACTION ITEMS



Lewes Wetland Monitoring (WMAP)

VISION STATEMENT

Increased sampling of natural, restored, created and mitigated wetlands provides a scientific basis for more effective planning and management. These data sets can be interpreted to track the short-term variability and long-term changes in wetland resources and can support ongoing initiatives such as Watershed Management Plans, the Delaware Wildlife Action Plan, and the National Estuarine Research Reserve Research and Monitoring Plan. In addition to developing specialized sampling protocols, trainings for practitioners are necessary to increase the adoption and use of standardized methods. As operating procedures are developed for restoration techniques and other activities, advanced trainings will be needed to connect the Departments (Natural Resources and Agriculture) with professionals.

To make the most of available sampling methods and existing data, access to information online should be strengthened and clearly linked to other partner groups' work. The use of various levels of wetland information including maps, trends, methods and watershed condition reports should be promoted through online access and active sharing of available tools and information. Developing a web-based portal in lieu of paper submissions will encourage volunteers to contribute their collected data and improve the ease of reporting and tracking important volunteer hours.

A great way to engage citizens and supplement field observations is through volunteer and citizen science programs. Adopt-a-Wetland is an example of such a program where volunteers contribute their time and can be effectively trained to collect scientifically viable information. Through these programs, volunteers receive education about wetlands, and leave with a sense of accomplishment and ownership for natural resources, but overhead costs, staff time for training and oversight, as well as supplies must be covered in order for volunteer programs to succeed. A key priority for these programs will be to secure a long-term funding source to support and sustain the contributions that volunteers can make to monitoring efforts.

ACTION ITEMS

- B-1 DEVELOP STANDARDIZED SAMPLING PROTOCOLS FOR WETLAND ASSESSMENT AND MONITORING OF NATURAL, RESTORED AND CREATED WETLANDS.** Protocols should use a tiered approach to account for varying staff expertise, time commitment, and financial resources and should be revised periodically
- B-2 ENCOURAGE ADOPTION OF STANDARDIZED MONITORING PROTOCOLS AND REFERENCE DATA FOR WETLAND RESTORATION, MITIGATION, IMPACTS OR CREATION.** Post the most up-to-date versions on the Delaware Wetlands website for planning and permitting procedures
- B-3 HOLD TRAINING WORKSHOPS ON USE OF MONITORING AND ASSESSMENT PROTOCOLS, DATA COLLECTION METHODS AND QUALITY ASSURANCE TECHNIQUES** for environmental professionals, educators, and volunteer participants
- B-4 USE REFERENCE AND ASSESSMENT DATA TO UPDATE AND ADAPT DERAP, DECAP AND MIDTRAM** to evaluate streams and tidal freshwater wetlands
- B-5 POST MONITORING AND ASSESSMENT INFORMATION ONLINE FOR ACCESS** in data form, as technical reports, as wetland report cards, in geospatial data form, and in public-friendly materials
- B-6 ASSESS THE CONDITION OF WETLANDS BASED ON THE SPECIFIED WATERSHED SCHEDULE** and the National Wetland Condition Assessment in 2016
- B-7 PROVIDE ORGANIZATIONAL AND FINANCIAL SUPPORT FOR CITIZEN SCIENCE AND VOLUNTEER PROGRAMS,** including wetland monitoring, science and stewardship



GOAL C: CLIMATE ADAPTATION

Use available science and research to better understand and plan for the effects of climate change and sea level rise on wetland habitats



Nor'easter of May 2008, Line Represents Marsh Edge (WMAP)



Tidal Wetland Monitoring (WMAP)



Tidal Marsh (WMAP)

PROGRESS AND CURRENT STATUS

Delaware has recognized the vulnerability of its properties, natural resources and infrastructure to inland and coastal flooding, intense precipitation events and droughts. Efforts began in 2000 with the Delaware Climate Change Impact Assessment followed by the Delaware Sea Level Rise Advisory Committee to assess possible impacts (including those affecting wetlands; 2012) and provide prioritized recommendations for adaptation to address those threats (2013). In addition, eleven state agencies are acting under Executive Order 41-Preparing Delaware for Emerging Climate Impacts and Seizing Economic Opportunities to Reducing Emissions (2013) to improve resiliency and develop strategies for adaptation and preparedness. Now the focus is on implementing high priority recommendations.

This new goal was developed in response to wetland-related questions and needs raised in the above mentioned documents. For example, are wetlands keeping pace with sea level rise? How are wetland plant communities adjusting to rising salinity lines? Are tidal freshwater wetlands being squeezed out between salt water intrusion and dams? How can coastal habitats be strengthened against increased storm energy?

Extensive loss of coastal habitat, including wetlands, will result in the loss of revenue from hunting, angling, boating, wildlife viewing and tourism. In addition, there will be impacts to farmland from increased salinity and salt water inundation. Fortunately, with federal support, several state, federal and academic programs, as well as non-profit organizations are already focused on investigating how wetlands are responding to changing conditions. maintaining safety and quality of living in Delaware for years to come.



GOAL C: CLIMATE ADAPTATION ACTION ITEMS



VISION STATEMENT

Coastal wetlands, although resilient to storm energy and environmental stresses, are threatened by an accelerated rate of sea level rise and are limited in their migration inland due to coastal development. Inland wetlands are threatened by erratic precipitation, warmer temperatures, rising tide lines and intruding salt water. Much remains unknown about how wetlands are being impacted by changing conditions, how they will respond and how DNREC can take action to ensure that Delaware's wetlands and their valuable services are sustained into the future.

In collaboration with DNREC's Coastal Programs, Division of Fish and Wildlife and the Partnership for the Delaware Estuary, the Division of Watershed Stewardship will expand research to investigate and model wetland responses to sea level rise in terms of elevation, subsidence rates, shifts in vegetation communities and conversion to open water. In particular, research will include determining how wetlands migrate and how habitat conversion is occurring as water levels rise. Areas that are identified as potential migration paths can be protected or acquired. In addition, the Division of Fish and Wildlife needs to address how flooding and salt water will affect wildlife impoundments and how to accommodate key species and habitats in the future. Another consideration to better understand is the potential loss of carbon storage if expansive tidal emergent wetlands are converted to open water. Research is needed to understand this wetland function, improve the methods to estimate the natural range of carbon storage and determine a value for this service. Additionally, as stronger coastal storms become more common, research will need to determine the impacts of marine debris on tidal wetlands.

In an effort to utilize research and mapping to its fullest, it is important to communicate key findings and implications with landowners, planners and municipalities to raise awareness regarding sea level rise, changing coastal conditions and the protection that wetlands provide. Delaware is a low lying state that relies on its coastal resources as part of its culture and economy. Numerous groups are interested in the effects of sea level rise and climate change in Delaware and every opportunity to collaborate and share information should be taken.

ACTION ITEMS

- C-1 **RESEARCH THE MECHANISMS AND POTENTIAL MIGRATION PATH OF WETLANDS AND HABITAT CONVERSION** as water levels rise and salt tolerance lines move
- C-2 **IDENTIFY PRESERVATION AREAS FOR POTENTIAL WETLAND MIGRATION** that will improve coastal protection and provide critical habitat
- C-3 Develop an outreach strategy to **EDUCATE CITIZENS AND MUNICIPALITIES ON HOW WETLANDS ON THEIR PROPERTY WILL BE AFFECTED**
- C-4 **INVESTIGATE THE RISK OF FLOODING AND SALT WATER INTRUSION TO STATE WILDLIFE IMPOUNDMENTS AND PONDS** and consider how to support important wetland communities and related species
- C-5 Improve understanding of, and promote possible use of **BLUE CARBON VALUE SYSTEM FOR COASTAL WETLANDS AS IT RELATES TO CLIMATE CHANGE**
- C-6 **STUDY SEDIMENT RATES, WETLAND ELEVATION AND SUSCEPTIBILITY OF WETLANDS TO OPEN WATER CONVERSION** to evaluate if wetlands are keeping pace with sea level rise
- C-7 **FURTHER EVALUATE THE BENEFICIAL USE OF DREDGE MATERIAL TO RESTORE TIDAL WETLANDS**

Blackbird Reserve Living Shoreline Installation (WMAP)



Beneficial Use of Dredge Material at Piney Point (WMAP)



GOAL D: RESTORATION

Advance wetland restoration, creation and enhancement practices to increase wetland acreage, condition and function

PROGRESS AND CURRENT STATUS

Wetland restoration has continued to evolve and advance by the work of multiple DNREC Divisions, the U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration and non-profit organizations such as the Delaware Center for the Inland Bays, Partnership for the Delaware Estuary, The Nature Conservancy, and Delaware Wild Lands.

DNREC has been supportive and actively involved in testing and developing restoration techniques in non-tidal and tidal wetlands. The goal of these projects is to improve restoration performance and increase the utilization of techniques that benefit wetland habitats.

Watershed condition assessments have been completed and reported, but using the assessment data to develop watershed level restoration plans has been limited. Revisions are expected to be made to allow for greater ease in developing watershed restoration plans while still providing polygon-specific restoration and protection priorities for freshwater wetlands.

As the effects of sea level rise and stronger coastal storms make noticeable changes to our coastlines and tidal wetlands, restoration techniques in estuarine systems have become more important. Demonstrations and training workshops for traditional restoration techniques, as well as for emerging practices, such as living shorelines, have been organized and held to educate wetland scientists and private sector practitioners.



GOAL D: RESTORATION ACTION ITEMS

VISION STATEMENT

The development and use of sound restoration techniques followed by thorough monitoring serves to increase wetland functions across Delaware. Connecting the development of new and refined practices to consultants, engineers and contractors is an important goal. As connections with more private practitioners are developed, targeted trainings should be continued and offered at more advanced levels.



Living Shoreline Contractor Workshop (WMAF)

Restoration efforts should dedicate more time and resources in planning for after-construction monitoring and the identification of possible adjustments to sites for improved performance and success. Above all it is imperative that wetland scientists, professionals and landowners communicate openly to share the best available techniques, work through adjustments and put research results to use when designing and implementing successful projects.

Creating clear Best Management Practices (BMPs) and mitigation requirements for restoration efforts will make reaching out to eligible landowners with restoration opportunities easier, more understandable and increase the likelihood of participation and compliance.

Plans to guide wetland restoration projects should be developed through collaboration, based on a refined process for prioritizing wetland polygons of greater ecological value and interest. Incorporation of existing information such as the EcoMap, wetland maps and Watershed Resource Registry will facilitate the creation of targeted areas and projects. During project design, the impacts of rising sea levels, changing precipitation patterns and salt tolerance should be incorporated.

ACTION ITEMS

- D-1 **HOST WORKSHOPS TO SHARE WETLAND RESTORATION TECHNIQUES AND PRACTICES** with consultants, engineers, planners, wetland professionals and interested stakeholders
- D-2 **EDUCATE ELIGIBLE LANDOWNERS ABOUT RESTORATION AND CONSERVATION OPTIONS** and promote enrollment or participation through workshops, online materials and targeted communications
- D-3 **SUPPORT COLLABORATION AND INFORMATION SHARING BETWEEN PRIVATE AND PUBLIC SECTORS** to more effectively advance and improve wetland restoration practices and rates of success
- D-4 **DEVELOP WATERSHED LEVEL RESTORATION PLANS** in watersheds with completed wetland assessments using GIS analysis and stakeholder input
- D-5 **SUPPORT THE WETLAND RESTORATION GOALS OUTLINED IN THE CHESAPEAKE BAY AGREEMENT**
- D-6 **EVALUATE THE PERFORMANCE OF WETLAND RESTORATION AND MITIGATION** in replacing wetland acreage and function
- D-7 **DEVELOP WETLAND RESTORATION BEST MANAGEMENT PRACTICES** for construction techniques, monitoring and reporting for a variety of wetland types and projects



2014 Delaware Wetlands Conference (Gene Shaner)



GOAL E: COLLABORATION

Facilitate collaboration and project sharing among wetland science programs, educators and regulators

PROGRESS AND CURRENT STATUS

DNREC and the Department of Agriculture have improved the level of collaboration and project sharing between related departments. This has in turn increased efficiency and strengthened relationships between some programs with similar goals to protect and conserve wetlands. There is still a need for more opportunities to stay connected to other groups.

In terms of reaching a large audience, the most successful effort to share wetland science and projects has been the biennial Delaware Wetlands Conference. In both 2012 and 2014 this event attracted over 250 attendees bringing together professionals and stakeholders from all sectors. These events informed participants about emerging topics, new technologies, current research endeavors, future needs for improving wetland protection and conservation and encouraged networking among colleagues.

DNREC has been successful in facilitating the completion of wetland-related projects with non-government organizations through technical advising or financial support. The formation of “work groups” such as the Delaware Living Shoreline Committee, Inland Bays Fringe Wetland Restoration Work Group, Delaware Sediment Elevation Table (SET) User Group, Chesapeake Bay Wetland Work Group, Mid-Atlantic Wetland Work Group ([MAWWG](#)), the Mid-Atlantic Coastal Wetland Assessment Working Group (MACWA) and the National Wetland Monitoring and Assessment Work Group (NWMWAG) have been critical for informing other states and organizations about Delaware’s projects and advances in wetland science. In addition, the Departments have benefited from the expertise and advice gained through shared insights, personal connections, and transferred technologies. Through these relationships Delaware’s wetland programs have become recognized and respected in the Mid-Atlantic region.

In an effort to connect wetland science with decision makers, biologists met with Kent County planners in a series of meetings regarding available wetland information and how to incorporate more wetland health findings into the review of proposed land use projects. There was limited success in changing the current process. Also, Preliminary Land Use Service (PLUS) comments remain advisory only and do not require action. A need still exists to establish a process that engages end users and connects wetland data to decisions regarding wetland impacts and mitigation.



Collaborative Living Shoreline Project Among Wetland Monitoring and Assessment Program, Partnership for the Delaware Estuary and Delaware Center for the Inland Bays (WMAP)



Wetland Assessment Method Workshop (2014; WMAP)



GOAL E: COLLABORATION ACTION ITEMS



*Inland Bays Fringe Wetland Restoration Group
Planning the Piney Point Restoration (WMAP)*

VISION STATEMENT

Collaboration has grown stronger between governmental and outside partners, but the Departments would like to find a consistent and convenient way for wetland groups to stay informed of developments and new projects. There is a need to open and maintain communication lines with outside experts and colleagues to maximize limited state funding and work efficiently. Local universities and colleges can strengthen wetland science research programs by offering wetland internships, networking and sharing wetland research experiences with other institutions via an academic work group, and incorporating wetland material into courses.

Continuing with the Delaware Wetlands Conference will engage and inform a wide audience in a short time, while also encouraging networking. Organizers will make an effort to have relevant topics represented, encourage networking and interactive discussions and place more focus on how to communicate wetland information with a wider audience. There should be a continued commitment to support and participate on the work groups previously mentioned that serve to bring state, federal, private and academic professionals together to share data and transfer knowledge. These wetland programs will expand opportunities for private sector entities to support projects through sponsorship and volunteering.

DNREC staff will pursue an avenue to insert more wetland-specific comments into land use planning reviews that impact wetlands. County and municipal planners need to be educated to understand and value wetland-related remarks in order for them to generate project modifications.

ACTION ITEMS

- E-1 **HOST A BIENNIAL WETLANDS CONFERENCE** to share information relating to current wetland activities (e.g., monitoring, restoration, planning, education) among wetland professionals and interested public
- E-2 **PARTICIPATE IN AND LEAD PROFESSIONAL WORK GROUPS** to encourage data sharing and transfer of knowledge regarding wetland related issues in the state, region and nation
- E-3 **ENCOURAGE PROJECT SHARING WITHIN DNREC AND AMONG CONSERVATION PARTNERS AND ACADEMIA** through online and written communications or organized gatherings to maximize impact and reduce redundancy
- E-4 **EXPAND PRIVATE SECTOR SUPPORT OF WETLAND CONSERVATION PROJECTS** to increase funding leverage and promote community stewardship
- E-5 **PRODUCE MORE DATA-DRIVEN WETLAND COMMENTS IN PLUS** review by coordinating among DNREC programs



GOAL F: EDUCATION

Enhance education and outreach efforts to broaden understanding and strengthen wetland stewardship among all wetland stakeholders



Filming for Outreach Video (WMAP)



Students Engaged in Hands-On Learning (WMAP)



Wetland Education and Outreach Display (WMAP)

PROGRESS AND CURRENT STATUS

DNREC and the Forest Service have improved capabilities to reach a wider audience beyond one-on-one interactions through email marketing, interactive websites, printed materials and social media. A significant amount of materials and presentations were shared regarding changes in Delaware's wetland resources in the last few decades. Both the Adopt-a-Wetland program and the Delaware National Estuarine Research Reserve published a newsletter series to inform citizens about their work, educate readers and advertise upcoming events. Sophisticated guidebooks for wetland restoration and for public participation were printed, distributed widely and made available online. Wetland report cards by watershed share details about the health of wetlands by type, where the most severe impacts to function have occurred, and offered recommendations for improvements. Recent reports conveying the message of wetland impacts and continued losses have reinvigorated the drive for strengthened freshwater wetland protection.

Despite increased use of electronic communication channels, the demand remains high for in-person events. Contact has been made with thousands of people of various ages and backgrounds to broaden their understanding of the wetland resources all around them. Citizen interest in wetland issues was reflected in growth of the Adopt-a-Wetland program to over 120 sites adopted across Delaware. This program has provided an outlet for school groups and interested citizens to voluntarily collect meaningful scientific information and become stewards for their adopted wetland. Their volunteer hours helped to support the Division of Fish and Wildlife and the Governor's No Child Left Inside Initiative but unfortunately this program was suspended due to funding challenges.

Not long after the state wetland maps were updated, DNREC met with county officials to improve the protection of freshwater wetlands. Planners were provided with more accurate updated maps to aid in the identification of areas in which development should be avoided. Information was also provided to planners about wetland health reports, wetland ecology and the value of wetlands to our state. Over the past few years DNREC has developed and executed a series of workshops for the public and local officials about the threats of sea level rise and how residents and municipalities can plan for changing conditions. Lastly, the Delaware National Estuarine Research Reserve's Coastal Training Program has coordinated dozens of learning opportunities across sectors and disciplines for the management of coastal resources in Delaware.



GOAL F: EDUCATION ACTION ITEMS



VISION STATEMENT

Communication and education are crucial in reaching audiences and turning wetland science into better management and action. A goal for both Departments is the development of a common message for wetland conservation that sends a clear directive to audiences about what is needed and how they can help wetland conservation in Delaware. Priorities for wetland educators should include attending public events to attract new wetland enthusiasts, as well as outreach to schools to enlighten students on Delaware wetland issues. Where possible, tracking of numbers of individuals interacted with at events and programs should be maintained, with an eye to increasing the quality and quantity of such contacts on an annual basis. Also, there should be an effort to create or provide information and activities to educators that are aligned with public school science standards. This information should be easily accessible and organized clearly.

As the state moves forward with recommendations from the Delaware Wetland Advisory Committee, it is clear that more effort should be made to communicate with other county and municipal officials to improve planning decisions, especially after state wetland maps are updated. Targeting audiences on a watershed scale and reaching those decision-makers and landowners in their backyards with messages that are tailored to their priorities (e.g. business owner, landowner, forester, farmer) will move people to take action and make a difference in areas that are not protected or regulated.

Communicating the results of wetland studies, including wetland health report cards, is important and should focus on promoting how management can be improved and how citizens can become involved. Previously created guidebooks are in need of revisions and can be reprinted to include new landowner stories and emerging techniques, such as living shorelines. Increasing public participation in wetland programs through online and social media venues can expand the number of followers reached, leading to stronger connections with modern audiences. In addition, cross-posting of other wetland program updates (ex. Partnership for the Delaware Estuary, Center for the Inland Bays, DNERR, Delaware Sea Grant, USFWS) on social media will boost exposure and awareness. Through online campaigns such as Wetlands Month, World Wetlands Day, National Estuaries Day, and Sea Level Rise Awareness Week, Delaware programs can bring local issues to the national level.

ACTION ITEMS

- F-1 **CREATE ELECTRONIC AND PRINTED EDUCATION MATERIALS FOR DISTRIBUTION** that represent a unified Department of Agriculture and DNREC message for wetland conservation, resonate with targeted audiences, reflect wetland condition findings, convey the monetary and biophysical value of wetlands and address misconceptions regarding wetland conservation and protection
- F-2 **IDENTIFY AND ADDRESS GAPS IN WETLAND EDUCATION PROGRAMS**, topics and audiences to improve wetland awareness, appreciation and prioritization
- F-3 **DEVELOP AND IMPLEMENT A SERIES OF WORKSHOPS AND COMMUNICATIONS TO EDUCATE COUNTY AND MUNICIPAL LEADERS** regarding the importance of wetland benefits, how wetland services support the economy, the threats posed to our state resources and the tools available to address those threats
- F-4 **CREATE A SOCIAL MEDIA FOLLOWING FOR WETLAND PROGRAMS** to update constituents and conservation partners regarding wetland projects, facts and current events
- F-5 **REFINE AND MAINTAIN A WETLAND WEBPAGE** that shares scientific results, describes wetland types, services and values, informs audiences, and encourages wetland conservation
- F-6 **COMPILE, DEVELOP AS NEEDED AND PROMOTE WETLAND EDUCATION CURRICULUM AND MATERIALS** that align with science standards in public schools



Fowler's Toad (Bufo fowleri; WMAP)



Coastal Plain Pond (William A. McAvoy)



*Pink Orchid (Calopogon tuberosus)
(William A. McAvoy)*



GOAL G: CONSERVATION

Work with partners to support and enhance wetland conservation programs that are not covered by state and federal regulations

PROGRESS AND CURRENT STATUS

DNREC has numerous programs related to wetlands, and a review of all of these programs was conducted by the Environmental Law Institute (ELI). The resulting report identified gaps and areas of need including consistent messaging, a freshwater wetland conservation program, and improved tracking of cumulative impacts due to permitted activities.

Forested headwater wetlands make up two-thirds of Delaware's freshwater wetlands and may appear dry during parts of the year, leaving them open to questionable delineations and susceptible to development. During a comparative review of mapped wetland losses versus permit records, it was discovered that cumulative impacts due to activities in wetlands and the investigation of possible illegal activities occurring in wetlands were not being tracked thoroughly. The review also highlighted a need for stronger state wetland conservation programs and greater attention on the enforcement of permits in Delaware's wetlands.

Delaware is an agriculturally rich state. In light of low land values and high crop prices, some Delaware farmers have, unfortunately, moved away from wetland preservation programs and returned wet fields to productive agricultural fields. Offering a higher wetland value per acre would incentivize participation in preservation programs. On the impacts side, Delaware does not have a mitigation bank for replacing wetlands impacted or an in-lieu fee program. Introducing such programs would provide incentives for landowners to commit to conserving their wetlands and thereby prevent further losses.

The ELI review in combination with the state's documented loss of wetlands prompted the creation of Senate Bill 78. This legislation established the Delaware Wetland Advisory Committee to contribute towards a statewide freshwater wetland strategic plan. The Committee met with the goal of delivering recommendations to improve freshwater wetland conservation and restoration to the DNREC Cabinet Secretary. The Committee recommended the promotion of tax incentive programs, such as the Forestland Preservation Act which would protect forested wetlands, and using outreach and education to encourage private landowner wetland stewardship.



GOAL G: CONSERVATION ACTION ITEMS



Coastal Plain Seasonal Pond (William A. McAvoy)

CON STATEMENT

DNREC has the authority to regulate tidal wetlands as part of the Wetlands and Subaqueous Lands Section. This program has been successful in controlling and limiting tidal wetland impacts. The regulation of wetlands at the state level is limited, in part, by the hesitation of some stakeholder groups to additional regulations and general concern with state government. Using other states as an example will help to reach a compromise that benefits Delaware's resources and economy. Initiatives by both Departments will incorporate some of the recommendations by the Delaware Wetland Advisory Committee, such as pursuing a state conservation program for ecologically rare wetland habitat types. DNREC, DelDOT and the Department of Agriculture intend to set a strong example of resource conservation and the value of partnerships by forming a Memorandum of Understanding (MOU) to protect and conserve those rare and unique wetland communities occurring on their properties. DNREC will contribute wetland condition data towards the development of TMDLs and will seek the chance to establish wetland specific-water quality standards.

With the lack of a comprehensive state freshwater wetland program, DNREC, the Forest Service and related non-governmental organization's would like to increase voluntary preservation and conservation of privately owned wetlands by encouraging participation in incentive programs. In particular both groups would like to protect forested headwater wetlands and isolated wetlands. Forested headwater wetlands make up two-thirds of Delaware's freshwater wetlands and may appear dry during parts of the year, leaving them open to questionable delineations and susceptible to development. Isolated wetlands are home to dozens of endemic and endangered plant and animal species but lack regulation under the federal permitting system. Lastly, a review of local ordinances could identify areas that are not being used as intended or to their fullest capacity.

ACTION ITEMS

- G-1 **ESTABLISH A STATE WETLAND CONSERVATION PROGRAM** (maps included) that includes protecting rare and unique wetland communities and species, compliance monitoring and tracking impacts cumulatively
- G-2 **UPDATE STATE TIDAL WETLAND MAPS** to reflect changing coastal conditions, improve efficiency for permitting activities, and minimize wetland impacts in tidal wetlands
- G-3 **DEVELOP AN MOU BETWEEN STATE AGENCIES TO PROTECT AND CONSERVE RARE AND UNIQUE WETLANDS** on DelDOT, DNREC and Department of Agriculture property
- G-4 **ENCOURAGE COUNTY AND MUNICIPAL-LEVEL SUPPORT TO ESTABLISH VEGETATED BUFFERS** around isolated and headwater forested wetlands and ecologically rare and unique wetland communities
- G-5 **PRIORITIZE FORESTLAND PROTECTION AND CONSERVATION** including forest buffers around streams and forested wetlands, isolated forested wetlands, headwater forests and large contiguous forest blocks
- G-6 **REVIEW EXISTING COUNTY MUNICIPAL CODES AND ORDINANCES** to consider their full intent, whether they are being used to their full extent, and to identify gaps in wetland protection including constructed wetland best management practices
- G-7 **REPORT ON THE CONDITION OF WETLANDS IN COMPLIANCE WITH THE CLEAN WATER ACT** (305b report) and explore opportunities to develop Water Quality Standards for Wetlands.

EVALUATING PROGRESS

Achievement of the goals presented in the preceding pages will lead to better protection and restoration of wetland resources in Delaware. We will evaluate progress toward meeting these goals and improving wetland protection in Delaware in five years (2020). The answers to the following questions will be used to evaluate areas where we've met our goals, areas that require more work, and to determine if there is a need to develop new goals or action items.



GOAL A: MAPPING - Update wetland mapping tools and improve access to wetland related spatial data

- ◇ Have we improved the quality and availability of spatial layers?
- ◇ What spatial tools or layers have been created or made available?



GOAL B: MONITORING - Increase monitoring efficiency and effort to provide insight into wetland function and health

- ◇ Which standardized assessment protocols been developed for natural and restored wetlands?
- ◇ Have monitoring techniques been shared via workshops and trainings?



GOAL C: CLIMATE CHANGE - Use available science and research to better understand and plan for the effects of climate change and sea level rise on wetlands habitats

- ◇ Do we have an improved understanding of how and where wetlands are migrating?
- ◇ How are we using monitoring information to prevent loss of coastal wetlands?



GOAL D: RESTORATION - Advance wetland restoration, creation, and enhancement practices to increase wetland acreage, condition and function

- ◇ What watersheds have strategic restoration and protection plans developed?
- ◇ Has there been an increase in enrollment in restoration and conservation programs?



GOAL E: COLLABORATION - Facilitate collaboration and project sharing between wetland science programs, educators, and regulators

- ◇ Has information sharing and transfer of knowledge been encouraged amongst wetland professionals?
- ◇ How has DNREC facilitated communication and collaboration of wetland projects, data, or findings?



GOAL F: EDUCATION - Enhance education and outreach efforts to broaden understanding and strengthen wetland stewardship among all wetland stakeholders

- ◇ Have we increased the number of people reached with in person, online and written information sharing?
- ◇ Are educational materials aligned with public school programs and readily accessible?



GOAL G: CONSERVATION - Work with partners to support and enhance wetland conservation programs that are not covered by state and federal regulations

- ◇ Are wetlands in Delaware better protected by new or updated conservation programs?
- ◇ Has wetland protection been strengthened beyond the federal level?

Appendix A: Acronym glossary

DECAP	Delaware Comprehensive Assessment Procedure
DeIDOT	Delaware Department of Transportation
DOA	Department of Agriculture
DERAP	Delaware Rapid Assessment Procedure
DNREC	Department of Natural Resources and Environmental Control
EPA	Environmental Protection Agency
HGM	Hydrogeomorphic
LLWW	Landscape Position, Landform, Water Flow Path and Waterbody Type
MidTRAM	Mid-Atlantic Tidal Rapid Assessment Method
NERR	National Estuarine Research Reserve
NWI	National Wetland Inventory
PLUS	Preliminary Land Use Service
SWMP	Statewide Wetland Mapping Project
TMDL	Total Maximum Daily Load
USFWS	U.S. Fish and Wildlife Service
WPP	Wetland Program Plan
WMAP	Wetland Monitoring and Assessment Program



“A true conservationist is a man who knows that the world is not given by his fathers, but borrowed from his children.”

— John James Audubon

2015 Delaware Wetland Management Plan