RESOLUTION NO. 46-2019
APPENDIX 1

# CECIL COUNTY
# GREEN INFRASTRUCTURE PLAN

June 2019

DRAFT

# Acknowledgements

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# Executive Summary

Cecil County's Green Infrastructure (GI) Plan identifies key natural features that provide wildlife and fish habitat, as well as, a myriad of benefits to residents, like flood reduction, removal of water and air pollutants, erosion control, recreational opportunities, and many more. The GI network is composed of core areas, which provide high-quality natural habitat; hubs, which are large areas of natural and semi-natural (e.g., agriculture) land; and corridors, which are generally linear features that link core areas together and allow animal movement between them.

Within Cecil County's boundaries, including eight Towns, the mapping analyses identified 78,933 acres of core areas (36%) and 23,879 acres of corridors (11%), excluding open water. It's important to note that although 47% of the land throughout the County is mapped within the GI Network, this natural system actually provides over 75% of the ecosystem service benefits for the County. Cecil County's overall ecosystem service values are explained in more detail in a later section. Within the GI Network, 28% of core areas and 34% of corridors are located in parks, conservation easements, or other protected land. 49% of core areas and 57% of corridors are located within the County's current Priority Preservation Area. Areas throughout the County were ranked for conservation importance, for their suitability for managing stormwater runoff, and for their ability to reduce coastal storm hazards. Critical built infrastructure, such as police and fire stations, power plants, and water and wastewater facilities, were also examined for their flood vulnerability and potential mitigation solutions were developed.

The core team also performed vegetation and wildlife surveys at two county parks and verified that green infrastructure core areas and corridors do provide good habitat and wildlife connectivity. Invasive species and deer overbrowsing were problems at both sites, but in general, larger and more remote forest was in better condition, and supported more sensitive species, than small, isolated stands of trees.

The County held two public meetings to raise awareness about the plan and solicit feedback about priorities. In the first meeting, the attendees ranked clean water protection as the #1 goal, followed by natural resource protection and reducing flood risk for critical infrastructure. At the second meeting, the mapping assessments and key findings were shared. The attendees ranked the following as top implementation strategies: protecting high priority wetlands, requiring stream buffers (especially in growth areas), identifying high priority stream restoration sites, targeting preservation of high-value GI network connections with partners, and educating the public about best stormwater management practices.

The plan lists a number of possible actions to protect, restore, and manage County green infrastructure. These items are organized under the five themes of land use policies, planning, education, restoration, and land preservation, beginning on page 43. The main reason for developing the plan is to explore new land use planning techniques that can be implemented in the near term, while focusing preservation and restoration efforts on the GI network. The successful implementation of the plan will involve collaboration with community partners, incorporating action items into local capital improvement programs, and improving the communication about GI benefits.

# Background and Purpose of the Green Infrastructure Plan

Green infrastructure is our natural life support system—an interconnected network of forests, wetlands, waterways, floodplains, and other natural areas; including parks, greenways, farms; and other open spaces that support native species, maintain natural ecological processes, sustain air and water resources that contribute to people's health and quality of life.

Focusing on green infrastructure promotes strategic conservation and restoration that is proactive, holistic, systematic, well integrated and applied at multiple scales (e.g., across landscapes, watersheds, regions, and jurisdictions). Green infrastructure can help coordinate land and water conservation efforts and integrate them into a cohesive strategy for reaching long-range goals. It can also help inform sustainable patterns of development, minimize negative environmental impacts, where restoration could provide tangible benefits, and planning for future water needs.

The land use coverage in Cecil County has been changing over the past four decades and is at risk of losing some of its most valuable resources, including forest and prime agricultural lands. Since 1973, Cecil County has lost over 35,000 acres of resource lands to development. Developed areas increased by 229%. From just 2002 until 2010, almost 3,000 acres of agricultural lands and over 3,000 acres of forest land were converted to development. While growth continues, this plan aims to identify those areas within the GI network that should be preserved in their natural state.

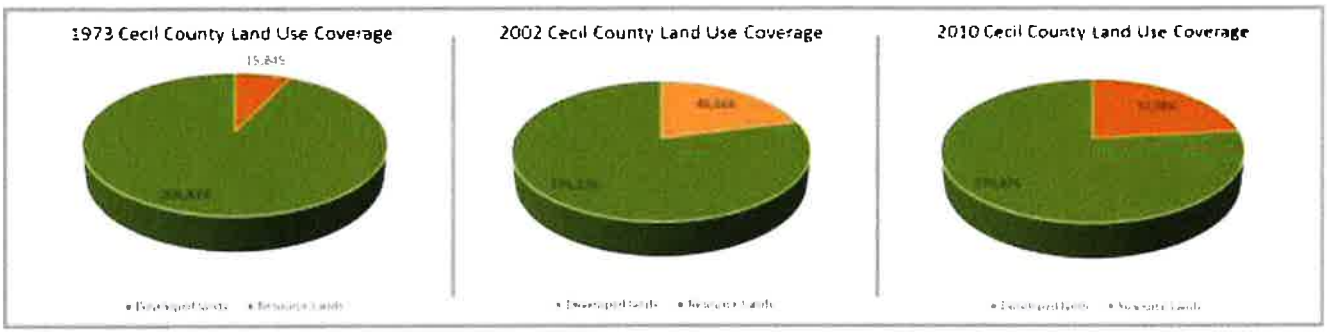



*Figure 1. Land Use Change from 1973 to 2010*

In partnership with the Conservation Fund (TCF), the Susquehannock Wildlife Society (SWS), and planner Jean Akers, Cecil County received a Community Resilience Grant from the Maryland Department of Natural Resources (DNR) to develop and refine a county-wide green infrastructure (GI) network and plan. In addition to this core team, a Steering Committee met bi-monthly during the grant term, to help provide guidance for establishing the GI network and plan. The new GI Plan has a ten-year planning horizon and will help the County accomplish some of its Watershed Implementation Plan (WIP) goals. The Department of Land Use and Development Services will provide assistance integrating GI strategies into future updates of the County's Comprehensive Plan; Hazard Mitigation Plan,; Land Preservation, Parks, and Recreation Plan; Stormwater Management Plan; and Strategic Plan.

## Project Goals

1. Develop a science-based method for prioritizing and incentivizing the selection of green stormwater infrastructure opportunities.
2. Identify, understand, and mitigate nuisance flooding problems, targeting near term adaptation measures.
3. Identify vulnerabilities in coastal and riverine areas and protect with strategic land acquisition and conservation to adapt.
4. Preserve a better GI network and build a management system to address the cumulative effects of development, maintain no net loss of forest, reduce the fragmentation of wildlife habitat, and provide more connectivity.
5. Improve interdepartmental and interjurisdictional coordination.
6. Earn additional Community Rating System (CRS) points and foster partnerships with stakeholders to enhance outreach and education efforts.

## Project Objectives

1. Prioritize where to develop subwatershed master plans, and incorporate hydrologic and hydraulic analyses to mitigate current and future flooding problems.
2. Evaluate capital projects proposed within the GI network, to effectively minimize risk caused by hazard events and loss of ecosystem service benefits.
3. Work with the Towns and the Artesian Water Company to protect drinking water resources and create efficiencies across County Departments.
4. Develop tree planting programs with the DNR Forest Service and other partners to enhance the GI network.
5. Create opportunities to develop complementary public information about GI, including the positive effects that tree planting and stormwater management projects have for improving quality of life.
6. Soften the development footprint in more urbanized areas by incorporating sustainable native plant demonstration gardens and grow heritage tourism around parks to enhance our sense of place.
7. Acquire structures in repetitive loss areas or mitigate their use.
8. Maintain viable fisheries for future generations.
9. Create additional recreational opportunities, incorporate more trails and paths, both to promote healthy lifestyles and alternative modes of travel.

## Project Role for Natural Hazards

Sea level rise and storm surge scenarios developed by the State Highway Administration (SHA) and the Eastern Shore Climate Adaptation Partnership (ESCAP) were incorporated into the assessment for reducing flood risks to critical infrastructure. The increased ability to forecast where nuisance flooding associated with intense precipitation events could exacerbate maintenance issues for the County and Towns will lead to the development of more sustainable maintenance practices, and ultimately better mitigation strategies. Opportunities to ameliorate these effects through green stormwater management solutions were prioritized by identifying co-benefits derived from the other GI strategies developed during the planning process. Understanding and acting on what areas should be preserved to protect natural floodplain functions, will help to save costly restoration funds in the future.

## Project Co-benefits

Identifying the GI network and engaging the community will broaden the base of support for strategic land preservation and restoration projects, including the development of new recreational opportunities. Wildlife conservation areas help to make Cecil County more livable, healthful, and appealing to potential employers,

investors, residents, and tourists. Earning additional CRS points to move up a class helps reduce flood insurance rates for county residents, and also overlaps with other current CRS initiatives, see program details here: https://www.fema.gov/media-library/assets/documents/15846. Connecting these co-benefits will have amplification effects by delivering similar messages from different groups. The County is also aware of the Chesapeake Bay Program's mid-term assessment process and believes mapping the GI network using strategies that anticipate climate effects will better equip the County to adjust its WIP at earlier stages and avoid burdensome changes in the future.

## WIP Commitments

This project is a key component of the county's 2018-2019 Watershed Implementation Plan (WIP) strategies. The specific two-year milestones connected with the project are:

1. County departments seek and apply for grant funding opportunities from various NGO's, federal, and state agencies to assist with WIP milestones implementation.
2. Evaluate county-level ordinances, regulations and procedure guidance documents to align with WIP objectives and Phase II MS4 permit requirements.
3. Consider developing an incentive program for the implementation of SWM practices that are either above environmental site design to the maximum extent practicable or voluntary in nature, to complement state-level policy and nutrient trading efforts.
4. Update the Green Infrastructure Plan to help prioritize funding, programmatic changes, and implementation of riparian buffer planting projects.
5. Identify opportunities for further collaboration between departments regarding issues related to floodplain, stormwater management, critical areas, WIP, and agricultural preservation.
6. Develop and implement a tracking process for changes in land use.

*Figure 2. Flooding in Port Deposit from Tropical Storm Lee. (Photo: Cecil County Department of Emergency Services)*

# Green Infrastructure Concepts

## Overview

Green infrastructure exists at multiple scales (Figure 2). At broad scales, it includes large blocks of forest, wetlands, stream networks, and other natural systems. At local scales, smaller patches may be included. Site-scale green infrastructure may focus on natural or semi-natural solutions to reduce stormwater runoff or heat.

At landscape scales, green infrastructure analysis and design is based on principles of conservation biology and landscape ecology. The goal is to reduce habitat fragmentation, maintain viable populations of native species, preserve interior habitat, improve resiliency from disturbances and climate change, and protect ecosystem services like clean air, clean water, flood reduction, recreation, and many more (Table 1, on page 6).

| Ecosystem Service | Description |
|---|---|
| **REGULATING & SUPPORTING** | |
| **Hazard Amelioration** | |
| Water Flow Regulation / Flood Control | Maintain water flow stability and protect areas against flooding (e.g., from storms). |
| Water Purification | Maintain water quality sufficient for human consumption, recreational uses like swimming and fishing, and aquatic life. |
| Erosion Control and Sediment Retention | Maintain soil and slope stability, and retain soil and sediment on site. |
| Groundwater Recharge | Maintain natural rates of groundwater recharge and aquifer replenishment |
| Air Purification | Remove particulates and other pollutants from the air |
| **Climate** | |
| Microclimate Moderation | Lower ambient and surface air temperature through shading |
| Regulation of Water Temperature | Moderate water temperature in streams |
| Carbon Storage | Sequester carbon in vegetation and soils, thereby reducing atmospheric $CO_2$ and global climate change |
| **Biological** | |
| Support Native Flora and Fauna | Maintain species diversity and biomass |
| Pollination | Provide pollinators for crops and other vegetation important to humans |
| Pest and Disease Control | Provide biota which consume pests and control diseases |
| **Provisioning** | |
| Food Production | Production of plant or fungal-based food for human consumption |
| Game and Fish Production | Production of wild game and fish for human consumption |
| Fiber Production | Production of wood and other natural fibers for human use |
| Soil Formation | Long-term production of soil and peat for support of vegetation and other uses |
| Biochemical Production | Provision of biochemicals, natural medicines, pharmaceuticals, etc. |
| Genetic Information | Genetic resources for medical and other uses, including those not yet realized |
| **Cultural** | |
| Recreation and Ecotourism | Outdoor, nature-based experiences like hiking, birding, hunting, camping, etc. |
| Savings in Community Services | Savings in community services from not converting natural land to houses |
| Increase in Property Values | Provide attractive locations for homes and businesses |
| Science and Education | The existence of natural systems and areas for school excursions, advancement of scientific knowledge, etc. |
| Spiritual and Aesthetic | Aesthetic enjoyment or spiritual or religious fulfillment |
| Bequest value | The value placed on knowing that future generations will have the option to utilize the resource. |
| Existence value | The non-use value of simply knowing that particular resources exist, even if they are not used. |

*Table 1. Some ecosystem services provided by green infrastructure (primary source: Millennium Ecosystem Assessment[1]).*

[1] Millennium Ecosystem Assessment. 2005. Ecosystems and human well-being: synthesis. Island Press, Washington DC.

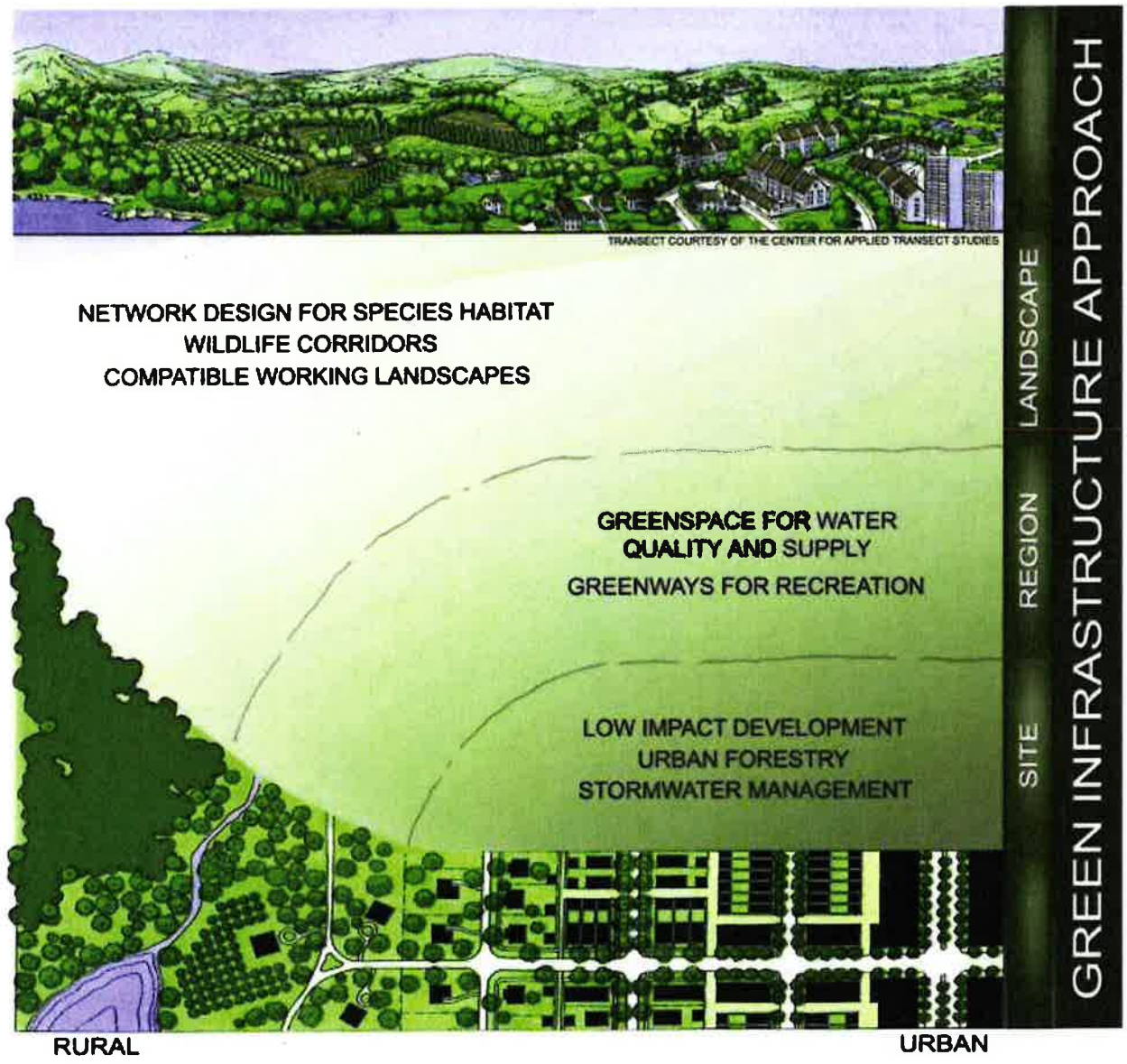



*Figure 2. The Green Infrastructure approach at different scales.*

## Core Areas

The basic building blocks of the green infrastructure network include core areas, hubs and corridors (Figure 3). Core areas contain fully-functioning natural ecosystems and provide high-quality habitat for native plants and animals. These are the nuclei of the ecological network.

## Hubs

Hubs are slightly fragmented aggregations of core areas, plus contiguous natural cover. Hubs are intended to be large enough to support populations of native species, and serve as sources for emigration into the surrounding landscape, as well as providing other ecosystem services like clean water, flood control, carbon sequestration, and

recreation opportunities. Large natural areas are usually more effective than small areas for protecting aquifers and watersheds, sustaining viable populations of most interior species, providing core habitat and escape cover for wide-ranging vertebrates, and allowing natural disturbance regimes.[2]

## Corridors

Corridors are generally linear features, although still wide enough to provide adequate cover, that link core habitats together through an unsuitable matrix like row crops or development and allow animal and plant propagule movement between them. Retaining connectivity can help to mitigate habitat fragmentation by linking otherwise separated populations within discrete habitat patches.[3] The hope is that any localized extinction will be offset by recolonization, and genetic exchange will maintain fitness, ensuring the long-term persistence of the species in the region. Corridors are both context and species dependent: they depend on both the composition and spatial arrangement of the landscape, and the movement abilities and landscape preferences of target organisms.

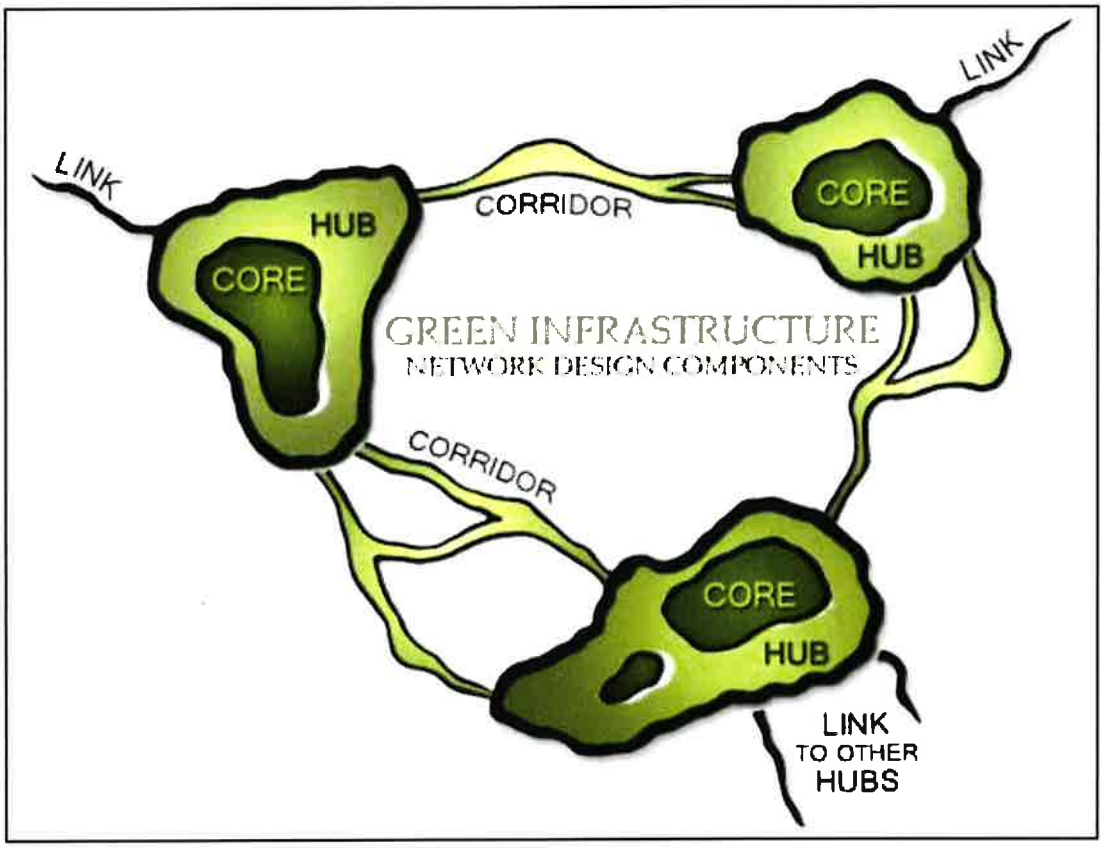



*Figure 3. Conceptual diagram of a green infrastructure network (source: The Conservation Fund).*

[2] Dramstad, W. E., J. D. Olson, and R. T. T. Forman. 1996. Landscape ecology principles in landscape architecture and land-use planning. Island Press, Washington, DC. 80 pp.

[3] Bennett, A. F. 1998. Linkages in the landscape: the role of corridors and sensitivity in wildlife conservation. IUCN, Gland, Switzerland and Cambridge, UK. 254 pp.

## Aquatic systems

Aquatic systems can be examined at both the reach scale (including current and historic floodplains) and the watershed scale. With the loss of forests and increased urban development, Maryland has seen declines in stream stability, water quality, and habitat suitability for fish and invertebrates. Increased fluxes of sediment, nutrients, and other pollutants cause problems downstream as well, impairing large water bodies like the Chesapeake Bay.

# Defining the Green Infrastructure Network

## Focal Species

The types of landscapes and ecosystems incorporated into a green infrastructure network depend on the region's topography, climate, geology, historic and current species composition, present configuration, and other factors. We used focal species to help inform the green infrastructure network configuration. Focal species are species that are used to represent other species or aspects of the environment. They can thereby be used to guide conservation decision making in the absence of complete knowledge of all species present and all their requirements for persistence. Focal species can include umbrella species, indicator species, and keystone species:

- Umbrella species are a species or group of species who are well studied and whose habitat needs overlap those of other animals and plants, such as Forest Interior Dwelling Birds that require large blocks of forest to breed successfully.
- Indicator species, by their presence, indicate healthy ecosystems, like unpolluted streams, and these include salamanders like the Eastern Hellbender or fish like the Rosyface Shiner.
- Keystone species are those with an important role in ecosystem function, such as pollinators, seed dispersers, hydrologic engineers (beavers), and top carnivores (like bobcats).

We received a list of Rare, Threatened, and Endangered species in Cecil County from DNR's Natural Heritage Program (Appendix J). The Cecil Bird Club provided a list of birds found in the county, along with sighting probabilities and whether or not the species bred in the county. The Maryland Biological Stream Survey (MBSS) provided a list of fish found in stream surveys. We also queried the Maryland Biodiversity Project database for vertebrates recorded in the county. The Susquehannock Wildlife Society (SWS) reviewed these lists and provided corrections as needed. Our tally included 30 species of native mammals, 120 birds, 31 reptiles, 25 amphibians, and 60 fish. Appendix B lists these species and associated habitats.

Using NatureServe Explorer, the Maryland Breeding Bird Atlas, and other sources (see Appendix B for complete list), we identified these species' habitat preferences, habitat specificity, home range size, dispersal abilities, suitable landscape features for dispersal, barriers to dispersal (e.g., highways or development), and roles in ecosystem functions. For fish, we also considered the species tolerance for catchment urban and agriculture cover. From this information, we selected focal species native to the area to determine size, connectivity, and other thresholds in the green infrastructure network design. Focal species were not generalists or urban-adapted, and had to breed or overwinter in the county (i.e., not just migrating through).

Habitat preferences of focal species helped identify priority landscape features, associated optimal habitat, size considerations, and general recommendations for how to map core areas (Appendix B). We performed similar crosswalks for hubs. Connectivity requirements of less mobile species (e.g., amphibians and small mammals) were

used to model corridors, considering their dispersal abilities, suitable landscape features for dispersal, and barriers to dispersal.

DNR biologists provided feedback regarding our modeling process, and also identified areas of known biological and ecological importance.

*Figure 4. Mature oak-beech forest in Elk Neck State Park*

## Core forest

Since the eastern U.S. was primarily unbroken forest before European colonization, many plant and wildlife species are adapted to interior forest conditions. Forest edges contain significant gradients of solar radiation, temperature, wind speed, and moisture between the forest patch interior and the adjacent land, especially if the adjacent land is developed. Increased solar radiation at the edge increases temperatures and decreases soil moisture and, with increased wind flow, decreases relative humidity, which can desiccate plants. Increased wind speed at a newly created edge commonly knocks down trees that are no longer buffered by the adjacent canopy and not structurally prepared. Wind can also carry dust or other small particles, which can adhere to vegetation. Noise from developed land disrupts natural activity in adjacent forest or marsh, by drowning wildlife cues for territorial boundary establishment, courtship and mating behavior, detection of separated young, prey location, predator detection, and homing. Sudden loud noises can also cause stress to animals. Changes in insolation and other physical parameters at created edges change plant and animal communities there, and processes like nutrient cycling.

Edge habitat differs from interior forest in tree species composition, primary production, structure, development, animal activity, and propagule dispersal capabilities. The edge communities shift to more shade-intolerant, more xeric tree and shrub species, and early successional species. Edges can favor invasive species, which can then displace native species in adjacent areas. Opportunistic animals like raccoons, opossums, and cowbirds also colonize patch edges, and often invade the interior. These edge species often influence ecosystem dynamics by preying on, outcompeting, or parasitizing interior species. Cats and dogs from developed areas can also prey on or harass wildlife.

We identified tree canopy from high-resolution land cover classified by the Chesapeake Conservancy (Appendix C). We subtracted roads, railroads, utility corridors, parking lots, buildings, driveways, orchards, and Christmas tree farms. From this, we identified forest patches with at least 1 acre of interior conditions (>30 m from the nearest edge). Core forest was a subset of this: either forest patches at least 100 acres in size (only 13% of patches, but 61% of total forest area); or overlapped core aquatic areas, core wetlands, or key biodiversity areas (BioNet Tiers 1-4).

Appendix D contains all core area methodology details.

## Core wetlands

Wetlands, both tidal and non-tidal, provide not only vital habitat and ecosystem services, but are regulated features in Maryland. We defined core wetlands as relatively unimpaired wetlands that met the habitat needs of wetland-dependent species. From the DNR wetland layer, we identified all wetlands that had not been farmed, drained, ditched, or excavated. From these, we identified areas at least 100 feet from cleared or developed land, roads, railroads, ditches, or channelized streams. We then added buffers of natural land and water.

## Core aquatic areas

We identified four classes of natural aquatic habitat and selected the best examples of each, based on indicator fish and other aquatic organisms:

- For non-tidal streams, we selected reaches with a "Good" combined (fish + benthic macroinvertebrate) Index of Biotic Integrity (IBI), which indicate good water quality and stream habitat. We also added stream reaches designated as high quality (Tier II) by the Maryland Department of the Environment (MDE).
- We also selected rivers and streams supporting populations of yellow lampmussels (*Lampsilis cariosa*), a rare freshwater mussel.
- For coldwater streams, we selected streams supporting reproducing populations of brown trout (*Salmo trutta*, an introduced European species) or benthic coldwater macroinvertebrates (*Tallaperla* spp. and *Sweltsa* spp.). *Tallaperla* spp. and *Sweltsa* spp. are sensitive to sedimentation and pollution and need cold water. No brook trout or hellbenders have recently been found in the county.
- Our focal species for tidal waters were Chesapeake logperch *(Percina bimaculata)*, anadromous fish (herring, perch, and striped bass), mummichog (*Fundulus heteroclitus*), and native submerged grasses (SAV). DNR supplied locations where Chesapeake logperch were found. We added 2015 SAV beds, High Priority Blue Infrastructure coastal watersheds, striped bass spawning habitat, and herring and perch spawning and juvenile habitat.

We combined these areas and added the associated riparian zone, using either the 1% (100 year) floodplain or a buffer of 100 feet, whichever was greater.

## Hubs

Hubs were aggregations of core areas and other undeveloped land, separated by major roads or gaps. Hubs should be large enough to support populations of native species, and serve as sources for emigration into the surrounding landscape. Some core areas and other ecological features fell outside hubs, if they were isolated and below the size threshold. We added a 300 foot buffer of natural land or agriculture around core areas, and subtracted developed land and major roads. We then applied a size threshold of 250 acres.

## Corridors

Corridors allow wildlife to move from one patch of habitat to another. Functional connectivity describes the degree to which landscapes facilitate or impede their movement. It is both context and species dependent, depending on both the composition and spatial arrangement of the landscape, and wildlife movement abilities and landscape preferences. Connectivity suitability depends on the type of organism. But most terrestrial non-aerial species are rarely able to cross busy roads or urban areas successfully. Most aquatic species are restricted to water, and unable to traverse dams and other blockages without fish ladders or similar structures.

We identified landscape permeability or impedance factors for each type of core area (forest, wetland, and aquatic), created impedance layers for each factor (land cover, roads, proximity to water, etc.), then combined them (Appendix D). Permeability reflects how easy it is for a particular organism to move from one area to another based on the intervening landscape features. Impedance is the inverse of permeability. A particular landscape feature (e.g., a pine plantation) might provide marginal habitat for forest-dependent organisms but still be highly permeable.

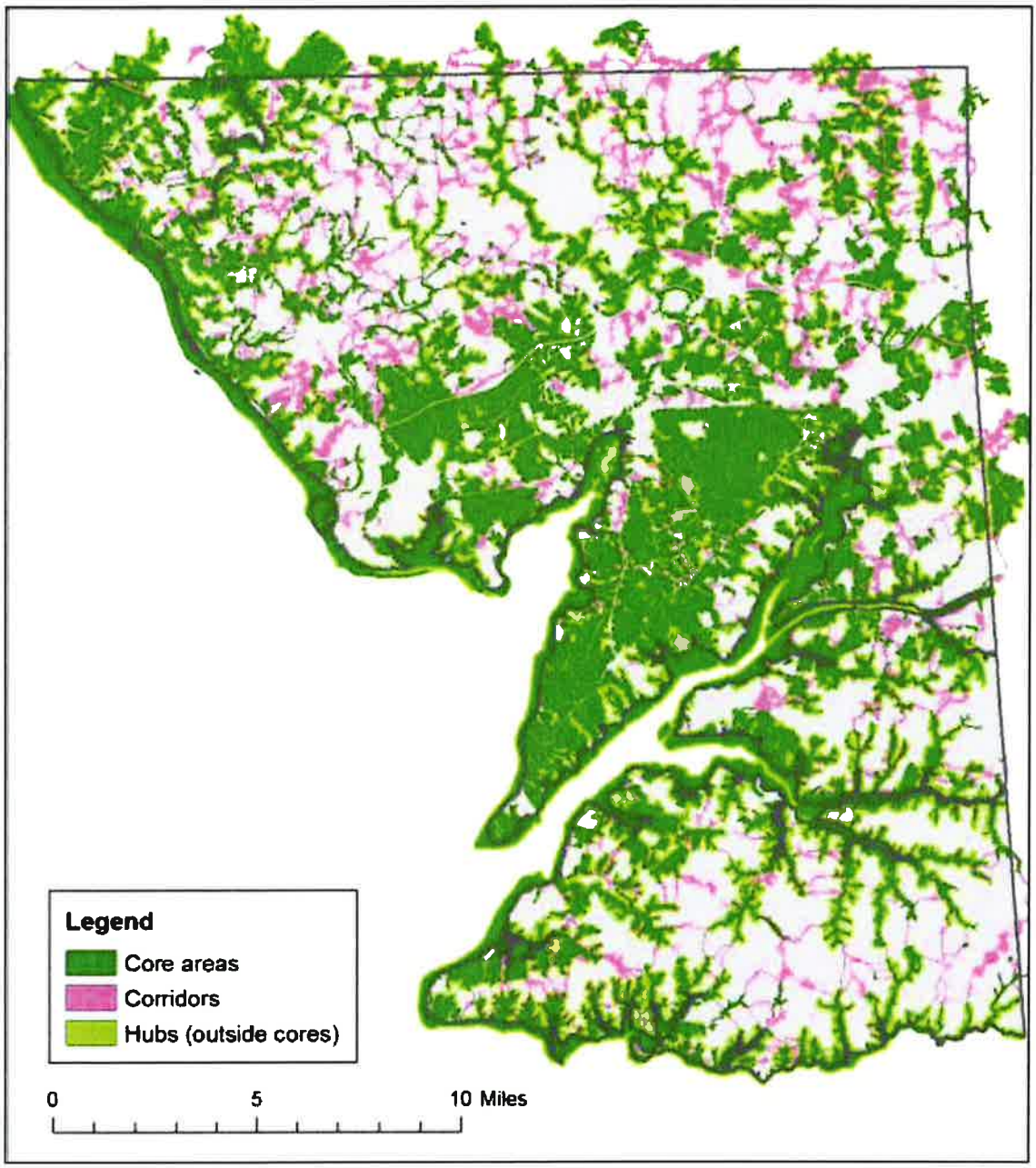
The impedance layers were varied randomly to reflect uncertainties. For example, for forest-dependent wildlife (e.g., gray fox, woodland vole), forest provides better cover than row crops. But *how much* better is less certain.

To model landscape connectivity, we used a program called the Terrestrial Movement Analysis (TMA) tool. It treats the landscape as a circulatory system, identifying those pathways most likely to be followed by wildlife. The tool generates random sets of starting locations (with each location corresponding to an individual organism) and then calculates optimal (or least cost) paths to all other habitat within the landscape. The cell values along the pathway are the summed area (the number of patch cells) that a pathway is connected to at that point. This process is executed iteratively, with each iteration having a different set of random start locations and corresponding least-cost paths. The tool identifies corridors by adding suitable land along this pathway. Finally, it calculates overall movement potential by considering both the amount of habitat connected by a linkage, and how good that linkage is (i.e., is it mostly natural land or are portions degraded or converted?). Note that connectivity potential exists both within and outside core areas.

We defined corridors as connectivity linkages that fell outside core areas (see Appendix D for details).

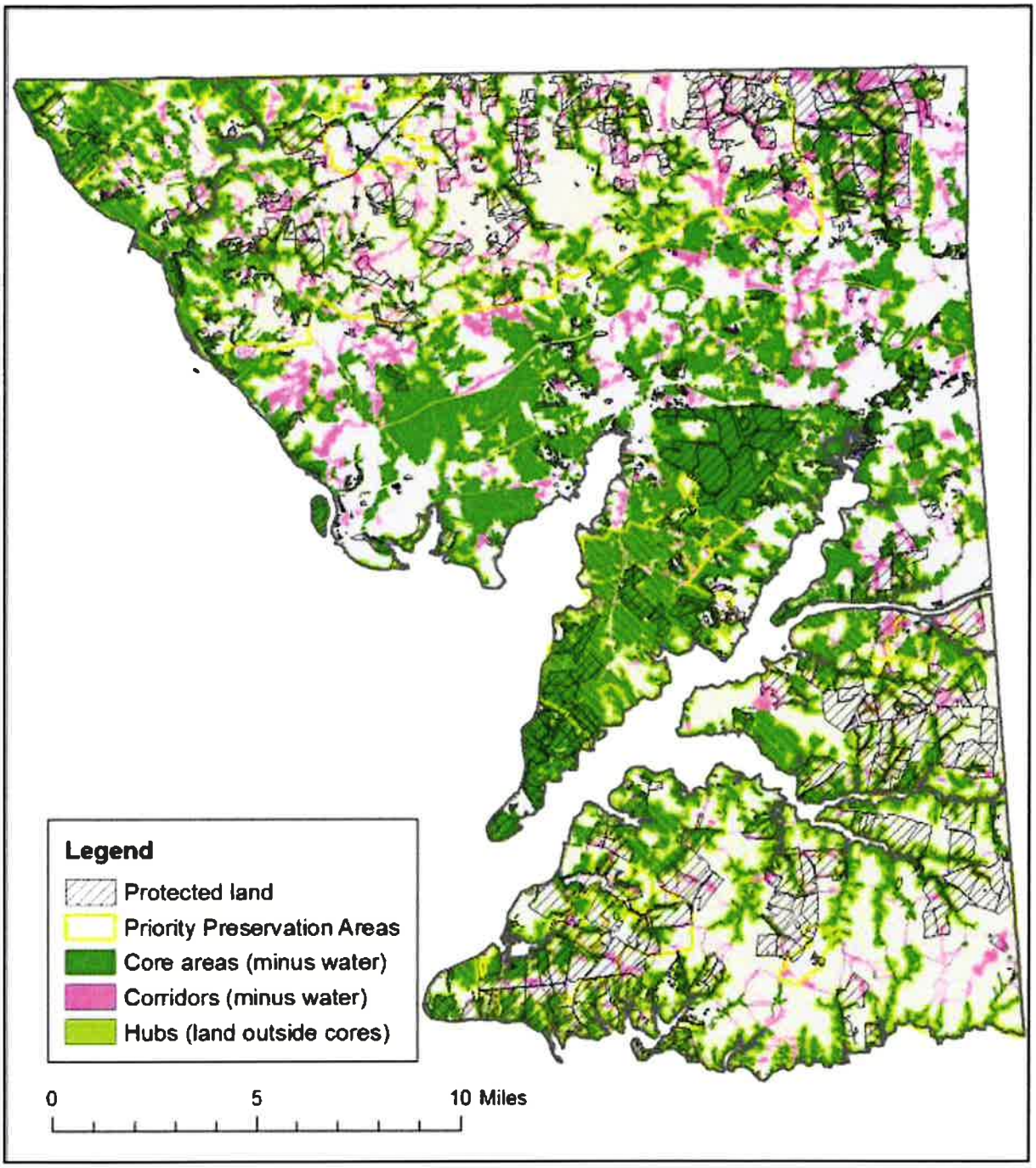
## Green Infrastructure Locations

Map 1 shows core areas, hubs (the portions outside core areas), and corridors. Within Cecil County's boundaries, including municipal areas, the analyses identified 78,933 acres of core areas and 23,879 acres of corridors, excluding open water. 36% of land was in core areas and 11% in corridors.[4] 28% of core area land and 34% of corridor land were in parks, conservation easements, or other protected land (Map 2). 49% of core areas and 57% of corridors were inside the County's current Priority Preservation Area.




*Map 1. Core areas, hubs, and corridors in Cecil County.*

[4] Cecil County land total = 221,289 ac.




*Map 2. Core area, hubs and corridor land (not including open water) compared to current locations of protected land and priority preservation areas.*

# Public Involvement

The Green Infrastructure Plan actively sought to gather public opinion and preferences about the direction of the planning effort and its role in implementing preservation and restoration of the green infrastructure network. A Steering Committee was formed and met regularly to help guide the engagement and focus the mapping and recommendations. A county website was established to announce activities and an on-line file sharing site was established to share planning information and resources. County staff managed an email list of key stakeholders from numerous sources related to natural resource protection, land use planning, non-profit organizations, business community, universities, and public schools throughout the County to aid in the communication and notices for meetings, workshops, special presentations, and related activities. Public workshops were planned for the initiation of the planning process (December, 2018) and the draft plan's findings and recommendations (May, 2019).

The first open house introduced the GI Plan and the concept of a green infrastructure network while also providing information about the planning process, schedule and ways to get involved. The workshop sought to confirm the priorities of key stakeholders and the community about the highest values offered through an effective green infrastructure network. The workshop also solicited ideas and opportunities to conduct restoration and preservation activities.

The second workshop was held in May and shared the findings and preliminary recommendations of the green infrastructure network mapping. Participants were asked to weigh in on their values and priorities by "voting" on relative importance of the different recommendations that the county would be responsible for implementing. Participants were also asked what their role might be in helping to implement parts of the Plan.

## Community Workshops

On December 5, 2018, Cecil County and other members of its Green Infrastructure project team conducted a community workshop to initiate the broader outreach regarding green infrastructure planning. Display boards illustrated several resource maps for the County and solicited feedback on priorities for project goals and benefits. These display boards indicated similar results for priority ranking as the individual ranking exercises that followed the presentation (described below).

Over 40 participants attended to hear the presentation about the GI Plan's scope and timeline, and mapping approaches for four different resilience strategies. The workshop presentation also emphasized the importance of public participation to help guide the planning process and ensure its accurate representation of values and goals for the County and its plan implementation.

Workshop participants were asked to indicate the top three benefits that could be provided by an effective green infrastructure network in Cecil County. Clean Water, Wildlife Habitat, and Clean Air were ranked the top three benefits by participants.

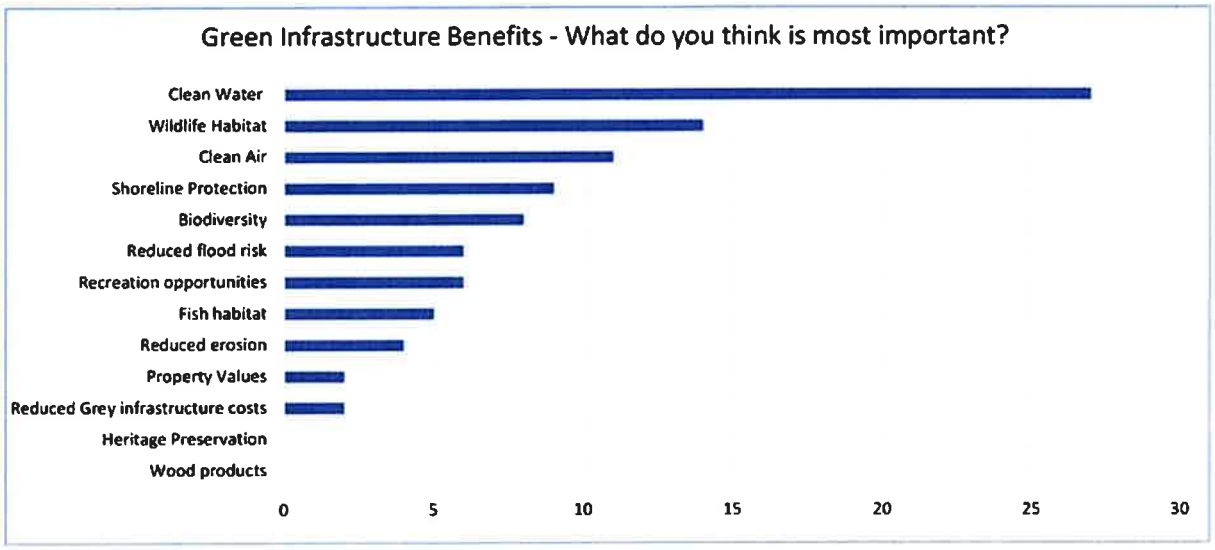



*Table 2. Green Infrastructure Benefits from the First Community Workshop, Dec.5th, 2018.*

A second engagement exercise asked participants to choose their top three goals for the GI network to guide the development of the plan and its future policies and implementation priorities. Clean Water Protection and Natural Resource Protection ranked the highest across the more focused individual ranking cards. Critical Infrastructure Protection and Wildlife Habitat Enhancement tied for third as a top goal of importance.

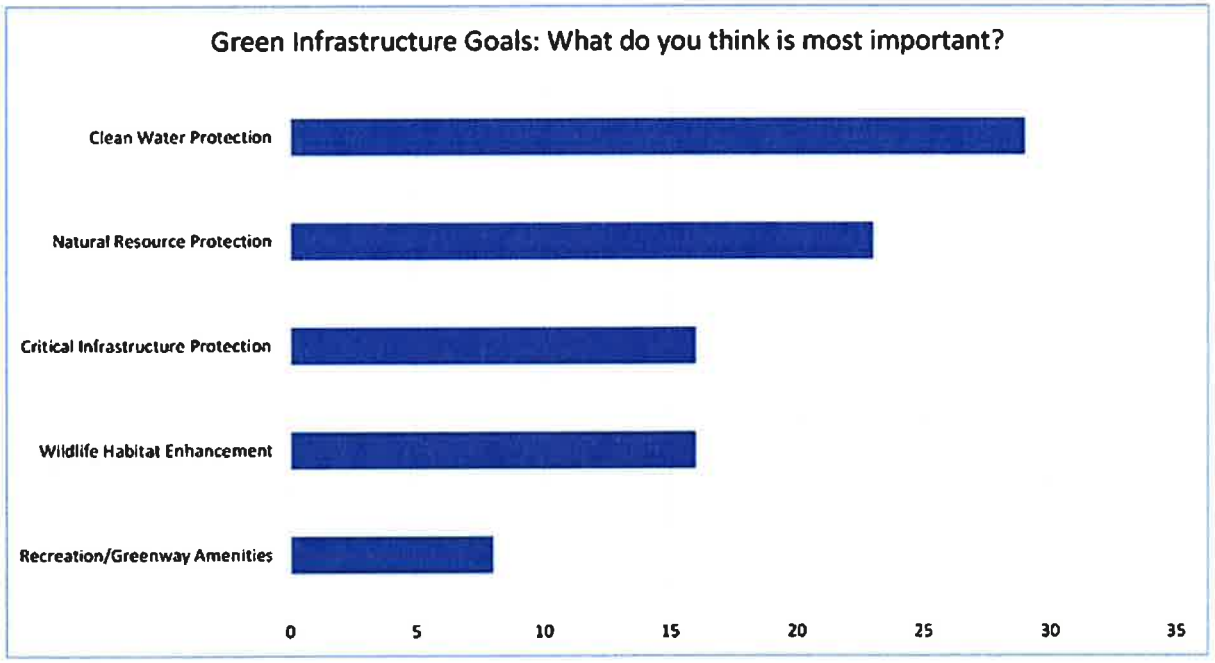



*Table 3. Green Infrastructure Goals from the First Community Workshop, Dec.5th, 2018.*

The second public workshop was conducted on May 15, 2019 and approximately 20 participants were shown the mapping results for the green infrastructure network with a presentation that included the County's new on-line GI mapping tool and a presentation by Maryland's Environmental Management Agency regarding flood hazard mitigation and its relationship to green infrastructure.

Display boards at the workshop included mapping highlights of the four resilience strategies. Some of the boards showed potential strategies for implementation and solicited further ideas and priorities from workshop attendees.

Following the presentation, workshop participants were asked to review a series of draft recommendations for implementing the GI network across the county. Two sets of recommendations focused on tasks to be conducted by the county and asked participants to rank their highest preferences for implementation in the near future. The first set of recommendations focused on the theme of land use policies, and requiring growth areas to protect stream buffers while limiting development in floodplains was the highest priority. The second highest priority was encouraging more voluntary preservation and restoration opportunities, along with more incentives for action, rather than implementing new regulations. The third was to protect adequate habitat areas when land is developed within designated growth areas to enhance the functioning ecosystems within the GI Network.

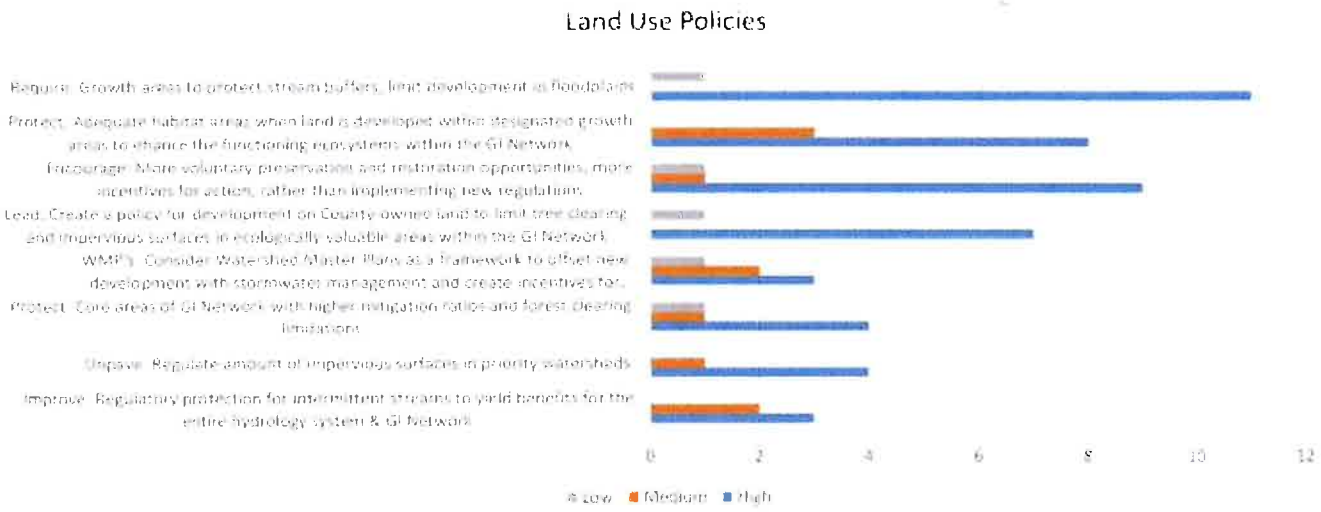



*Table 4. Ranked Land Use Policies from the Second Community Workshop, May 15th, 2019.*

The second set of recommendations revolved around the planning and program development theme. The highest ranking priorities dealt with the protection of wetlands and setting a goal to establish 70% of streams with riparian forest buffers using a combination of incentives and regulations. The third highest priorities included targeting flood mitigation efforts and identifying funding sources for implementing future GI programs and initiatives.

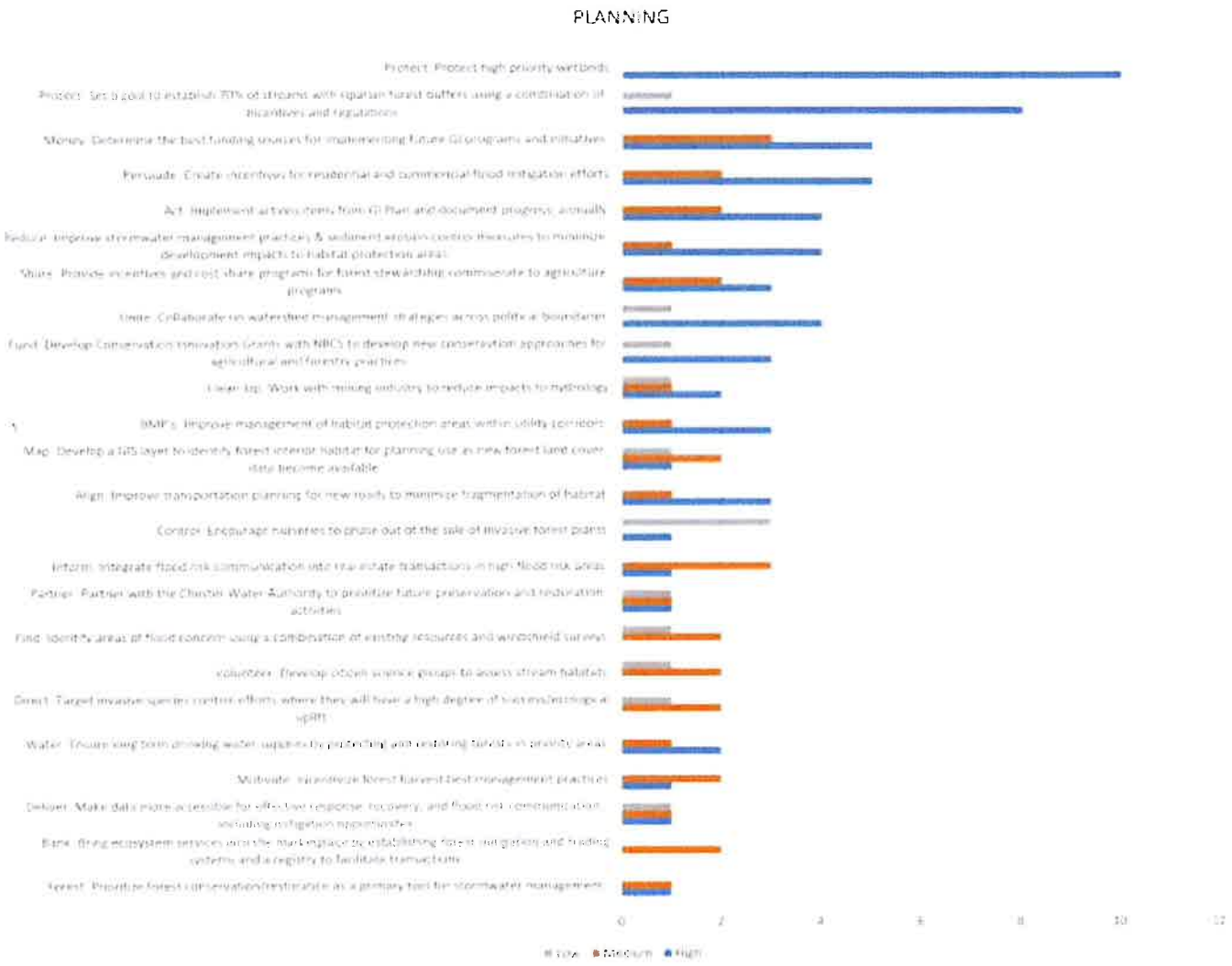



*Table 5. Ranked Planning Programs from the Second Community Workshop, May 15th, 2019.*

Additional sets of recommendations approached the restoration, education, and land preservation theme by asking if and how participants could contribute to implementing the green infrastructure network. From the results, a majority of participants support identifying high priority stream candidates for restoration. A majority also support informing public audiences about stormwater and runoff retention practices, along with targeting preservation of high-value GI connections with partners. The key leader outside local government in land preservation is the Cecil Land Trust and the leader for stormwater education is Shore Rivers. The top partners willing to help develop new implementation strategies are DNR's Critical Area Commission and the Cecil County Watershed Stewards Academy. This information was gathered to help County staff prioritize their focus for the GI plan recommendations and expand their potential network of supporting partners for future GI activities, including grant opportunities.

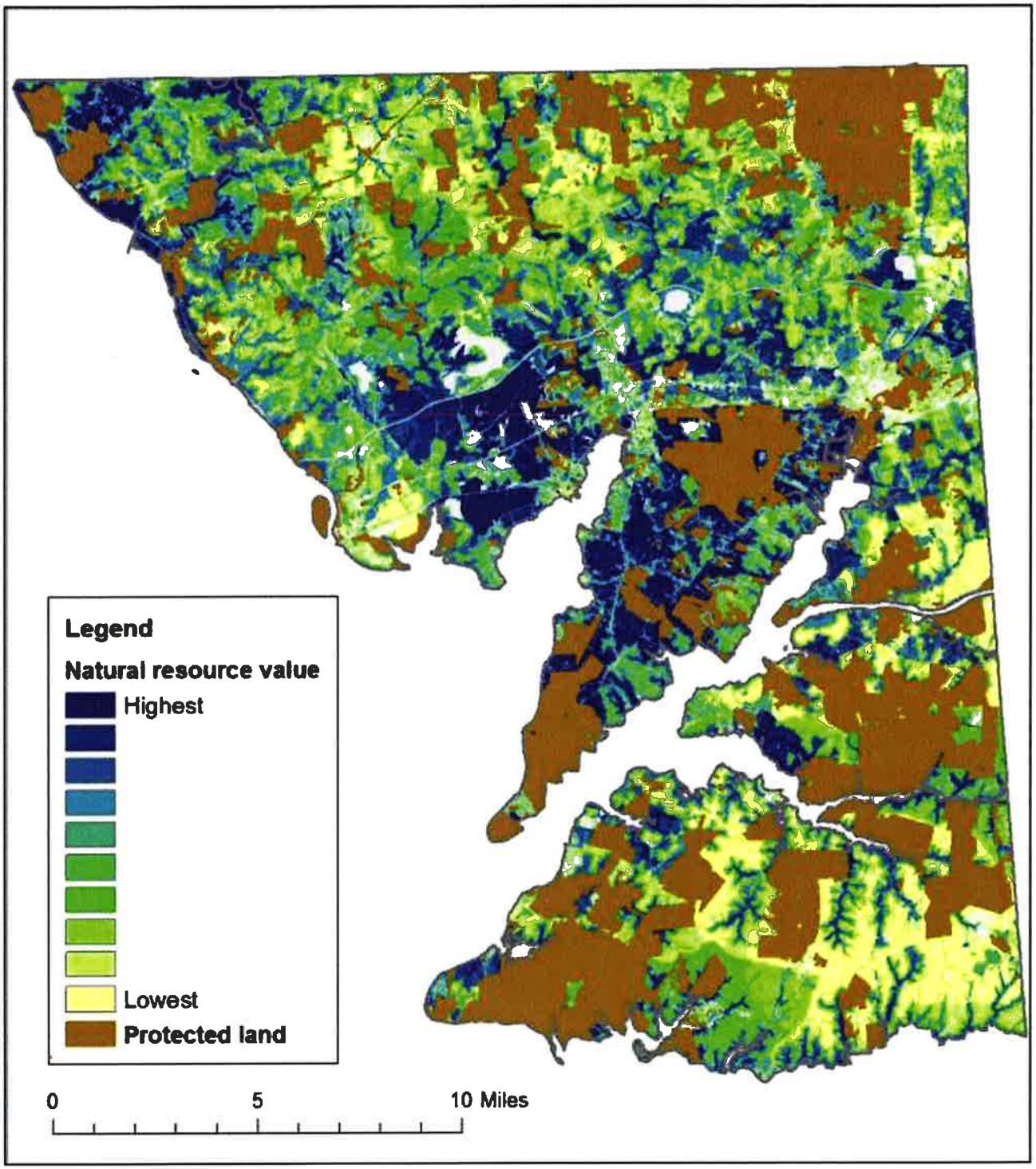
The Steering Committee for the GI plan met approximately every other month over a one year period, to review information, guide decisions, refine the GI network mapping assessments, and comment on the draft plan.

## Ranking Areas for Natural Resource Protection

To prioritize conservation actions, we ranked all currently unprotected and undeveloped land for its natural resource value, giving a score between 0 (lowest value) and 100 (highest). Table 6 lists the factors used for ranking, following feedback from the steering committee and examining output from different weightings. Appendix E shows this in more detail, including how the factors were weighted. Map 3 shows how each 3-meter cell was scored for conservation importance.

| | |
|---|---|
| Mandatory criteria | Not already protected<br>Not a building or paved<br>Not open water |
| State-designated ecological significance | Statewide Green Infrastructure Hub-Corridor Network<br>Targeted Ecological Areas<br>Significant for Biodiversity Conservation (BioNet Tiers 1-5)<br>Wetlands of Special State Concern + 100 ft buffer |
| Watershed characteristics | Percent forest cover (more forest preferred)<br>Percent impervious surface (<5%/5-10%/10-20%/>20%)<br>Watersheds with surface drinking water intakes<br>100-foot buffers of Stronghold Watershed streams, trout bearing streams, streams feeding municipal drinking water reservoirs, and Tier II High Quality Waters (Forests of Recognized Importance) |
| Cecil County green infrastructure network | Core areas<br>Hubs<br>Forest movement importance<br>Wetland movement importance |
| Natural Resource Features | Wetlands + buffers<br>Streams + buffers and 1% (100 year) floodplains<br>Forest patches with at least 1 acre of interior<br>Highly erodible soils |
| Existing priorities | Rural Legacy Areas<br>Priority Preservation Areas |
| Park equity | Distance to nearest existing park |

*Table 6. Factors used to rank unprotected land for natural resource conservation importance.*




*Map 3. Unprotected land in Cecil County ranked for natural resource conservation importance.*

# Stormwater Green Infrastructure

Green infrastructure is a cost-effective, resilient approach to managing stormwater that also provides other benefits (see Table 1 list). Trees and other vegetation intercept rainfall, reduce surface runoff, and allow water to infiltrate into the soil. In contrast, impervious surfaces like roof tops, roads, and parking lots rush water across the land, typically into a storm drain and then to a stream or other body of water. Peak flows from urban runoff can create hazardous floods, scour streams, and release sediment and other pollutants that impair downstream water bodies like the Chesapeake Bay.

At the site scale, best management practices (BMPs) can be implemented to manage stormwater runoff. This includes retaining existing forests and wetlands, using environmental site design (ESD) where areas are developed or redeveloped, and preventing erosion and sediment runoff during construction. Areas already developed without adequate stormwater controls can be retrofitted to mitigate their impacts.

We identified areas that might be suitable for stormwater BMPs like bio-retention areas, constructed wetlands, wet or dry ponds, infiltration basins or trenches, grass swales, porous pavement, sand filters, and vegetated filterstrips to reduce flooding and water pollution. We used EPA's BMP site suitability criteria to identify potential locations for 11 types of BMPs (Table 7). Other BMPs like green roofs, rain barrels, and cisterns could be placed anywhere and did not require site targeting.

| | **Site Suitability Criteria** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **BMP** | **Drainage Area (acre)** | **Slope (%)** | **Hydrological Soil Group** | **Water Table Depth (cm)** | **Road Buffer (ft)** | **Stream Buffer (ft)** | **Wetland Buffer (ft)** | **Land cover** |
| Bioretention | < 2 | < 5 | A–D | > 61 | < 100 | > 100 | > 100 | Grass, bare earth, parking lots |
| Constructed Wetland | > 25 | < 15 | A–D | > 122 | -- | > 100 | > 100 | Grass, bare earth |
| Dry Pond | > 10 | < 15 | A–D | > 122 | -- | > 100 | > 100 | Grass, bare earth |
| Grassed Swale | < 5 | < 4 | A–D | > 61 | < 100 | -- | -- | Grass, bare earth, parking lots |
| Infiltration Basin | < 10 | < 15 | A–B | > 122 | -- | > 100 | > 100 | Grass, bare earth |
| Infiltration Trench | < 5 | < 15 | A–B | > 122 | -- | > 100 | > 100 | Grass, bare earth, parking lots |
| Porous Pavement | < 3 | < 1 | A–B | > 61 | -- | -- | -- | Parking lots |
| Sand Filter (non-surface) | < 2 | < 10 | A–D | > 61 | -- | > 100 | > 100 | Grass, bare earth, parking lots |
| Sand Filter (surface) | < 10 | < 10 | A–D | > 61 | -- | > 100 | > 100 | Grass, bare earth, parking lots |
| Vegetated Filterstrip | -- | < 10 | A–D | > 61 | < 100 | -- | -- | Grass, bare earth, parking lots |
| Wet Pond | > 25 | < 15 | A–D | > 122 | -- | > 100 | > 100 | Grass, bare earth |

*Table 7. Stormwater Management Site Suitability Criteria.*

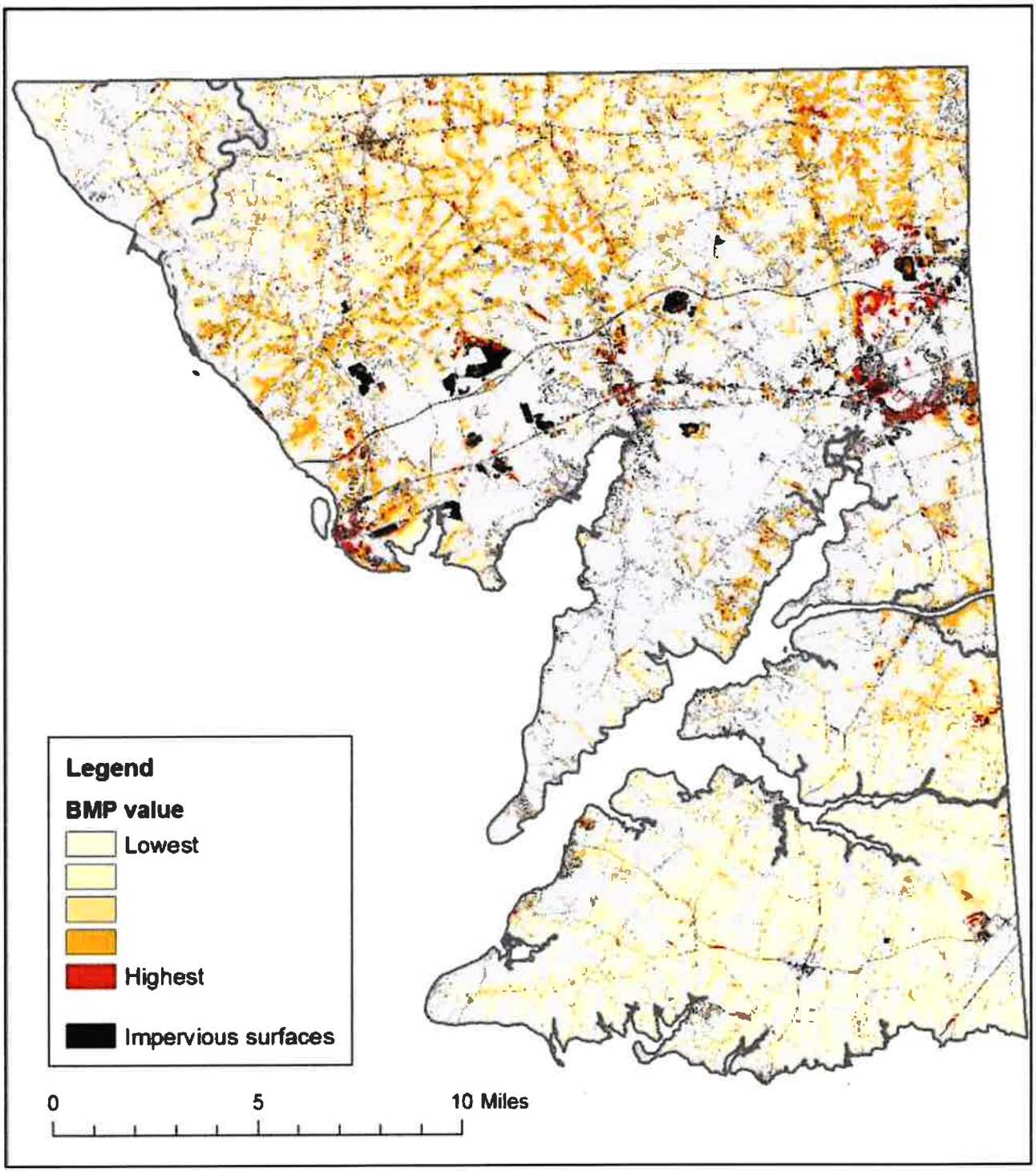
The scan for potential BMPs was a broad initial step; locations have to be examined in the field to confirm their suitability and engineer appropriate designs.

*Figure 5. Rain garden to hold and treat stormwater.*

To help prioritize BMP placement, we then ranked all suitable sites, giving a score between 0 (lowest value) and 100 (highest). Table 8 lists the factors used for ranking, following feedback from Public Works staff and the steering committee, and examining output from different weightings. Appendix E shows this in more detail, including how the factors were weighted. Map 4 shows how each 3-meter cell was scored for BMP importance.

| | |
|---|---|
| Mandatory criteria | Identified using EPA criteria for bioretention, constructed wetland, dry pond, grassed swale, infiltration basin, infiltration trench, porous pavement, sand filter (both surface and non-surface), vegetated filter strip, or wet pond |
| Land ownership | Public ownership preferred<br>Privately owned with easement acceptable but less preferred<br>Privately owned with no easement least preferred |
| Potential for stormwater capture | Area of impervious surface draining to the site<br>Presence/absence of existing BMPs |
| Watershed characteristics (HUC-12 watersheds) | Percent forest cover (less forest preferred)<br>Percent impervious surface (10-20% most preferred, 5-10% and >20% less preferred, <5% not preferred)<br>Within a watershed with surface drinking water intake |
| Small catchment characteristics (NHD catchment) | Amount of older development (less likely to have any stormwater structures)<br>Non-point local nitrogen (TN) urban runoff (SPARROW)<br>Non-point local phosphorus (TP) urban runoff (SPARROW) |
| Constructability and visibility | Distance to nearest road, parking lot, or driveway (closer is better) |

*Table 8. Factors used to rank areas for stormwater BMP construction.*




*Map 4. Site suitability for construction of stormwater control green infrastructure.*

## Coastal Defense

Natural habitats, such as coastal forests, marshes, and submerged aquatic vegetation (SAV), can buffer coastal areas from the impacts of flooding, storm surge, and sea level rise. Coastal vegetation attenuates waves, increases infiltration, and stabilizes sediments.

Maryland DNR, in partnership with the Nature Conservancy, conducted a statewide coastal resiliency assessment in 2015-16 by examining potential hazards, their risk to people, and the role of natural habitats in reducing that risk. Priority areas for restoration and conservation actions were identified based on the presence of existing habitat, its current role in risk reduction along the shoreline, and the presence of nearby coastal neighborhoods.[5]

DNR ranked shoreline segments both statewide and within Cecil County, which has over 200 miles of shoreline. Tier I Shorelines were shorelines with a high habitat role, or would create a high hazard if the habitats were removed. Tier II shorelines had a moderate habitat role, or would create a moderate hazard if the habitats were removed. Calibrated within the county, 29% of shoreline fell in Tier 1 and 39% in Tier 2.

We used a recent study commissioned by the Maryland State Highway Administration (SHA) to identify coastal flood-prone areas.[6] It used the best estimates of sea level change and flood heights available at the time of the study. We used their predicted 1% chance flood extent in 2100 (equivalent to 5.5 feet of sea level rise plus the storm surge from a Category 3 hurricane).

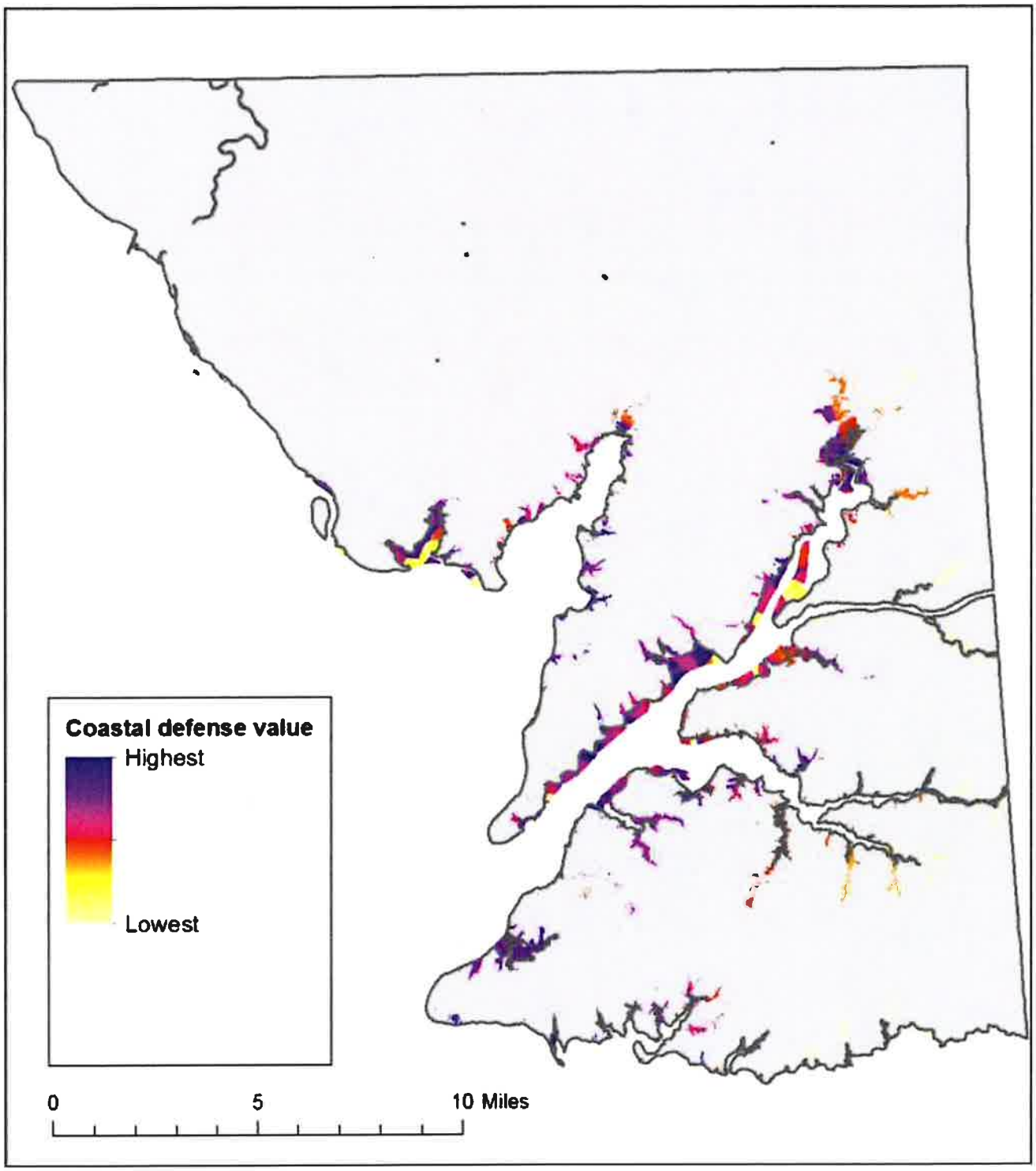
To prioritize conservation for coastal defense, we scored all currently unprotected forests, wetlands, and SAV beds within the flood-prone zone for their ability to reduce flood risk to people, as well as their provision of coastal habitat (Table 9). Appendix E shows the ranking criteria in more detail, including how the factors were weighted. As an illustration, Map 5 shows how areas scored.

| | |
|---|---|
| Mandatory criteria | Not developed<br>Not already protected<br>Within predicted coastal flood extent<br>Existing natural features within storm surge zone (forest, wetlands, or underwater grass) |
| State-designated Blue Infrastructure shoreline segments | Blue Infrastructure total rank, allocated to nearest natural features in storm surge zone |
| Maryland Coastal Resiliency Assessment | Habitat role in hazard risk reduction (High/Moderate/Low or None) |

*Table 9. Factors used to rank preservation of natural features for coastal defense importance.*

[5] Canick, M. R., N. Carlozo and D. Foster. 2016. Maryland Coastal Resiliency Assessment. The Nature Conservancy, Bethesda, MD. http://dnr.maryland.gov/ccs/Documents/MARCH-2016_MDCoastalResiliencyAssessment.pdf

[6] Eastern Shore Regional GIS Cooperative. 2016. GIS data products to support climate change adaption planning. Maryland State Highway Administration, Baltimore, MD.




*Map 5. Natural features ranked for their coastal defense importance in Cecil County.*

## Critical Infrastructure Protection

Green infrastructure can buffer critical infrastructure from extreme weather impacts like flooding and high winds. Critical infrastructure includes power production and transmission facilities, hospitals, police stations, fire stations, emergency management centers, water supplies, waste water treatment facilities, evacuation routes, and more.

We compared locations of critical infrastructure in Cecil County to SHA's predicted 1% flood extent in the year 2100 in coastal areas (described in previous section), as well as, the current 0.2% flood extent in riverine areas. Scientists typically use statistical probability to put a context to floods and their occurrence. For example, 0.2% has a 1 in 500 chance of occurring any given year, 1% has a 1 in 100 chance, and 10% has a 1 in 10 chance. We found 49 potentially vulnerable facilities, each with varying degrees of threat level, current protection, and recommended flood reduction measures (Table 10).

| ***Facility Name*** | **Hazard** | **Threat Level** | **Current Protection** | **Potential GI Measures to Reduce Flood Risk** |
|---|---|---|---|---|
| ***Port Herman Condominiums Treatment Plant*** | • Not in 100yr or 500yr floodplain<br>• 1% chance storm with sea level rise by 2100 | **Low** | permeable surfaces surrounding, little wooded area | • Retention or detention pond nearby<br>• Constructed wetland and/or submerged gravel wetlands |
| ***Harbour View WWTP*** | • Within 100yr floodplain<br>• 0.2% chance storm with sea level rise by 2050<br>• 1% chance storm with sea level rise by 2100 | **High** | existing forest provides some protection, most plant components have been relocated outside of 100 yr floodplain | • Constructed wetland with infiltration berms and retentive grading<br>• Restoration of floodplain once relocation is complete |
| ***Elkton WTP11001*** | • Within 100yr floodplain<br>• 1% chance storm with sea level rise by 2100<br>• 0.2% chance storm with sea level rise by 2050, level 3 Hazard Vulnerability on Delaware Ave | **Medium** | wooded areas surrounding facility and lining adjacent creek | • Bio-swale into adjacent forested area<br>• conservation landscaping<br>• Constructed wetland with infiltration berms and retentive grading |
| ***Cecil County Detention Center*** | • Within 500yr floodplain<br>• 1% chance storm with sea level rise by 2100 | **Medium** | Minimal pervious surfaces surrounding facility | • Retention or detention pond on the grounds<br>• Upgrade to porous pavement and addition of filter strips<br>• Constructed wetland |

| | | | | |
|---|---|---|---|---|
| ***North East Town Hall*** | • Within 100 Yr floodplain<br>• 0.2% storm with sea level rise by 2050, level 3 Hazard Vulnerability on Main St; level 2 on West St.<br>• 0.2% chance storm with sea level rise by 2050 | **High** | little natural protection, microbioretention project installed in parking lot in May of 2016 | • Green roof or wall<br>• Rain gardens and cisterns<br>• Upgrade to porous pavement |
| ***North East Police Department*** | • Within 100yr floodplain<br>• 0.2% storm with sea level rise by 2050, level 3 Hazard Vulnerability on Cecil Ave; level 2 on Race St.<br>• 1% chance storm with sea level rise by 2100 | **High** | forested area behind facility | • Detention area on grounds or in parking lot and/or filter strips<br>• Upgrade to porous pavement<br>• Conservation landscaping and bio-swale into forested area<br>• Managed retreat if other options are unsuccessful |
| ***Perryville Vol. Fire Department*** | Within 500yr floodplain | **Low** | wooded areas surrounding 2/3 of facility | • Conservation landscaping<br>• Rain garden and cisterns<br>• Upgrade to porous pavement<br>• Bio-swale and/or detention ponds on ground<br>• Green roof and/or wall |
| ***Port Deposit WWTP*** | • Within 100 year floodplain<br>• 10% chance storm with sea level rise by 2050 | **High** | large forested area behind facility | • Possible relocation out of 100yr floodplain<br>• Higher floodproofing |
| ***Port Deposit Town Hall and Police Station*** | • Withn 500yr floodplain<br>• 1% chance storm with sea level rise by 2100; level 3 Hazard Vulnerability on S Main St | **Medium** | large forested area behind facility | • Bio-swale to forested area<br>• Upgrade to porous pavement in parking lot<br>• Backfill foundation crawlspaces<br>• Improve flood openings and Elevate utilities |
| ***Water Witch Vol. Fire Department*** | • Within 100yr floodplain<br>• 1% chance storm with sea level rise by 2100; level 3 Hazard Vulnerability on S Main St | **High** | wooded area behind adjacent structures | • Upgrade to porous pavement in parking lot and addition of filter strips or bio-swale<br>• Rain garden and cisterns |
| ***Port Deposit WTP*** | • Within 100yr floodplain<br>• 1% chance storm with sea level rise by 2100 ; level 2 Hazard Vulnerability on Rock Run Landing | **Medium** | Adjacent wooded strip between facility and shoreline | • Constructed wetland with infiltration berms and retentive grading<br>• Conservation landscaping and bio-swale into forested area |

| | | | | |
|---|---|---|---|---|
| ***Meadowview WWTP influent pump station*** | • Within 100yr floodplain | **High** | wooded area behind adjacent structures | • Constructed wetland with infiltration berms and retentive grading<br>• Rain garden and cisterns |
| ***Persimmon Creek Pump Station*** | • Within 500yr floodplain | **Medium** | wooded area behind adjacent structures, detention pond on the grounds | • Bio-swale to forested area<br>• Floodproofing |
| ***W.L.Gore Elk Mills Campus Pump Station*** | • Within 500yr floodplain | **Medium** | wooded area behind adjacent structures, detention pond on the grounds | • Bio-swale to forested area<br>• Floodproofing |
| ***Carpenter's Point Grinder Station #11*** | • Within 100yr floodplain, 1% chance storm with sea level rise by 2100 | **High** | little natural protection | • Constructed wetland with infiltration berms and retentive grading<br>• Rain garden and cisterns<br>• Floodproofing<br>• Backup generator |
| ***143 Greenbank Grinder Station*** | • Within 100yr floodplain, 1% chance storm with sea level rise by 2100 | **High** | little natural protection | • Constructed wetland with infiltration berms and retentive grading<br>• Rain garden and cisterns<br>• Floodproofing<br>• Backup generator |
| ***121 Kirk Road Grinder Station*** | • Within 100yr floodplain, 1% chance storm with sea level rise by 2100 | **High** | little natural protection | • Constructed wetland with infiltration berms and retentive grading<br>• Rain garden and cisterns<br>• Floodproofing<br>• Backup generator |
| ***72 Little River Road Grinder Station*** | • Within 100yr floodplain, 1% chance storm with sea level rise by 2100 | **High** | little natural protection | • Constructed wetland with infiltration berms and retentive grading<br>• Rain garden and cisterns<br>• Floodproofing<br>• Backup generator |
| ***Newport Landing Grinder Station*** | • Within 100yr floodplain, 1% chance storm with sea level rise by 2100 | **High** | little natural protection | • Constructed wetland with infiltration berms and retentive grading<br>• Rain garden and cisterns<br>• Floodproofing<br>• Backup generator |
| ***Charlestown Manor Pump Station*** | • Within 100yr floodplain, 1% chance storm with sea level rise by 2100 | **High** | little natural protection | • Conservation landscaping<br>• Rain garden and cisterns<br>• Floodproofing |
| ***Church Point Pump Station*** | • Within 100yr floodplain, 1% chance storm with sea level rise by 2100 | **High** | little natural protection | • Conservation landscaping<br>• Rain garden and cisterns<br>• Higher floodproofing<br>• Managed retreat if other options are unsuccessful |
| ***Greenbank Pump Station*** | • 1% chance storm with sea level rise by 2100 | **Low** | wooded area behind adjacent structures | • Conservation landscaping<br>• Rain garden and cisterns<br>• Floodproofing |
| ***Mechanic's Valley Pump Station*** | • Within 100yr floodplain | **High** | adjacent bridge culvert has been enlarged | • Higher floodproofing<br>• Managed retreat if other options are unsuccessful |

| | | | | |
|---|---|---|---|---|
| ***North East Isles Pump Station*** | • 1% chance storm with sea level rise by 2100 | **Low** | little natural protection | • Conservation landscaping<br>• Rain garden and cisterns<br>• Higher floodproofing |
| ***Rt. 40 Pump Station*** | • Within 500yr floodplain | **Low** | large forested area surrounds facility | • Higher floodproofing |
| ***Price Marina Pump Station*** | • Within 100yr floodplain, 1% chance storm with sea level rise by 2100 | **High** | little natural protection | • Conservation landscaping<br>• Rain garden and cisterns<br>• Higher floodproofing<br>• Managed retreat if other options are unsuccessful |
| ***Port Deposit Town Hall Pump Station*** | • Within 100yr floodplain, 1% chance storm with sea level rise by 2100 | **High** | little natural protection | • Constructed wetland with infiltration berms and retentive grading<br>• Rain garden and cisterns<br>• Floodproofing<br>• Backup generator |
| ***Port Deposit Vannort Pump Station*** | • Within 100yr floodplain, 1% chance storm with sea level rise by 2100 | **High** | little natural protection | • Constructed wetland with infiltration berms and retentive grading<br>• Rain garden and cisterns<br>• Floodproofing<br>• Backup generator |
| ***Chesapeake Estates Pump Tank #9*** | • 1% chance storm with sea level rise by 2100 | **Low** | wooded area behind adjacent structures | • Bio-swale to forested area<br>• Floodproofing |
| ***Chesapeake Estates Pump Tank #11*** | • 1% chance storm with sea level rise by 2100 | **Low** | wooded area behind adjacent structures | • Bio-swale to forested area<br>• Floodproofing |
| ***Elkton Pump Station 13002*** | • Within 500yr floodplain, 1% chance storm with sea level rise by 2100 | **Medium** | little natural protection | • Constructed wetland with infiltration berms and retentive grading<br>• Rain garden and cisterns<br>• Floodproofing<br>• Backup generator |
| ***Elkton Pump Station 17001*** | • 1% chance storm with sea level rise by 2100 | **Low** | wooded area behind adjacent structures | • Bio-swale to forested area<br>• Floodproofing |
| ***Frenchtown Road Pump Station #49*** | • Within 500yr floodplain | **Medium** | large forested area surrounds facility | • Constructed wetland with infiltration berms and retentive grading<br>• Rain garden and cisterns<br>• Floodproofing, Backup generator |
| ***South Chesapeake City Pump Station*** | • Within 100yr floodplain, 1% chance storm with sea level rise by 2100 | **High** | little natural protection | • Constructed wetland with infiltration berms and retentive grading<br>• Rain garden and cisterns<br>• Floodproofing<br>• Backup generator |

*Table 10. Potentially vulnerable critical facilities in Cecil County.*


*Map 6. The Town of North East with projected sea level rise by year 2100, coupled with a 1 percent chance storm event.*

# Nuisance Flooding

Flooding is one of the most common natural hazards experienced in Cecil County. Given the varied topography, flooding occurs in both coastal and riverine areas, as both storm surge and flash floods. The National Oceanic and Atmospheric Administration (NOAA) defines nuisance flooding, as "flooding that leads to public inconveniences such as road closures." In Cecil County, nuisance flooding occurs along major waterbodies and in particular riverine and coastal floodplains and typically includes problems associated with flooded homes, blocked roads, critical facility threats, and drainage system maintenance. In fact, water damage is the main driver of growing insurance costs throughout the region. There are a number of properties at risk around the County that have repeatedly flooded and can be found in neighborhoods including Port Deposit, Carpenter's Point, Charlestown, Locust Point, and Hollywood Beach.

Multiple Departments within Cecil County Government have identified locations that are prone to nuisance flooding, including Emergency Services, Land Use and Development Services, and Public Works. Our Towns have also contributed information on some of these locations. Geographic Information Systems (GIS) has been used to create the first ever comprehensive inventory of roads, bridges, and sewer infrastructure that are vulnerable to nuisance flooding problems, (please see Appendix H for more details).

Cecil County is a Storm Ready community. When warranted, severe weather alerts are repeated by the Department of Emergency Services, however, flood warnings are initiated by the National Weather Service. When local nuisance flooding is anticipated, it may be necessary for the County to initiate a message to flood hazard areas via the County's mass notification system, and/or social media outlets, with details about flood severity, duration, or impacts such as road closures. Thresholds should be developed for Cecil County which direct a set of actions based on a particular inundation level or frequency of flooding. These thresholds are intended to supplement actions directed by the County's Emergency Operations Plan.

Documenting the extent and impacts of nuisance flooding is critical to public safety and the long-term resilience of Cecil County. A review of flood documentation should provide the County with a comprehensive view of trends in flooding over time. The following factors should be recorded by the County and Towns for tracking and subsequent mapping in GIS. These should also include instances of nuisance flooding addressed by the State Highway Administration (SHA) and communicated over the radio.

- Date, time, and location of nuisance flooding
- Impacts (e.g. water depths and extent)
- Agency notified and action taken

The Green Infrastructure Plan can be used as a tool to help identify natural flood mitigation solutions in appropriate areas, serving to highlight priorities for land preservation and restoration opportunities that can be used in concert with each other, to increase resilience to extreme precipitation events and coastal storm surge. Green Infrastructure deserves to be a part of every discussion about flood mitigation. In addition, there will be overlap with key strategies found within both the Comprehensive and Hazard Mitigation Plans to help confirm the top priorities for mitigation. As planners, we shall have special concern for the long-range consequences of present actions.

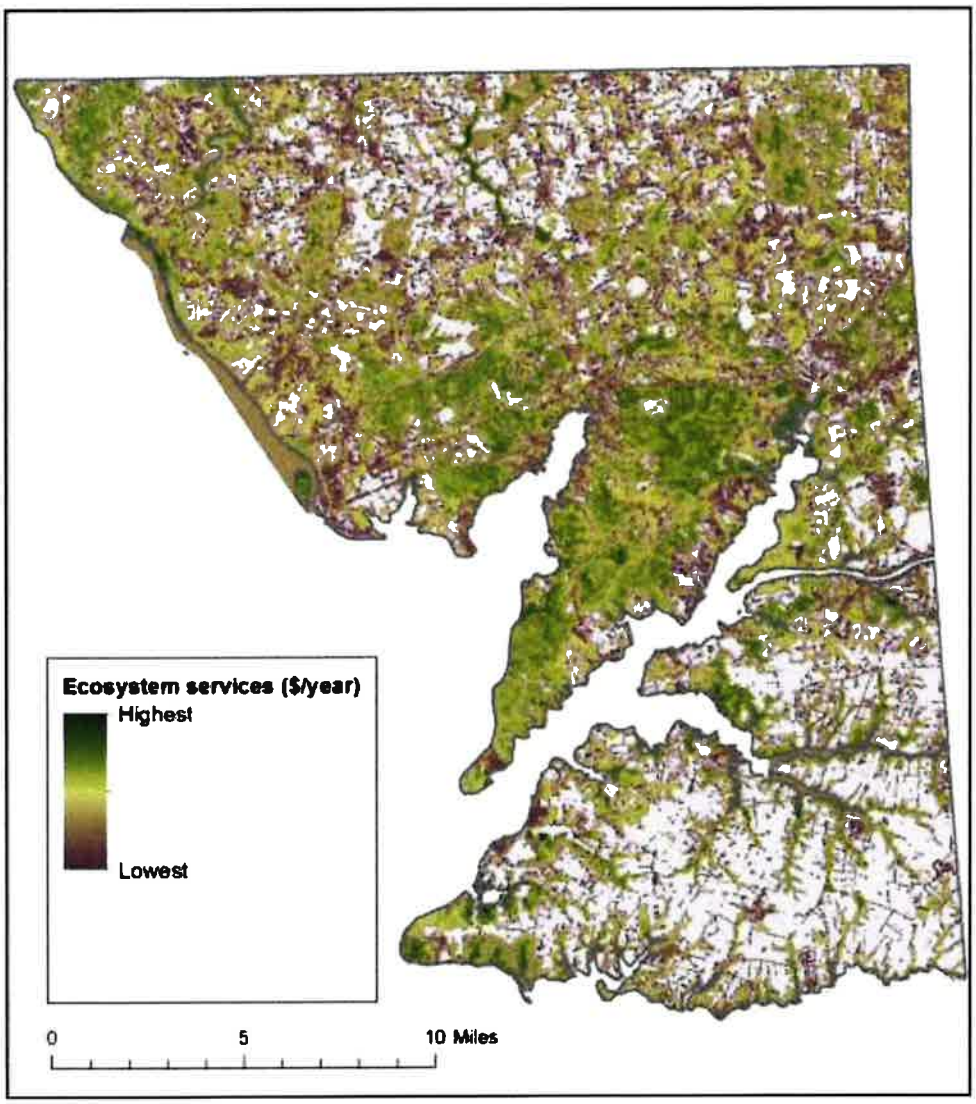
Below are a few action items from the Hazard Mitigation Plan that will help Cecil County plan for a safer future and also address nuisance flooding problems:

- Arrange training sessions with County and Town staff; and local insurance companies, on the National Flood Insurance Program.
- Provide letters and hold public meetings with the owners of structures in repetitive loss areas with high flood risk to discuss potential participation in flood mitigation projects, including acquisition and relocation.
- Work with SHA and local Public Works Departments to identify areas of frequent roadway flooding and develop appropriate mitigation strategies.

An inventory of roads, bridges, and sewer infrastructure that are vulnerable to flooding are provided in Appendix H.

## Ecosystem Service Value

As shown in Table 1, natural areas provide benefits to people in many ways. The Maryland Department of Natural Resources quantified seven of these "ecosystem services" provided by forests and wetlands: carbon sequestration, nitrogen removal, stormwater mitigation and flood prevention, wildlife habitat and biodiversity, air pollutant removal, groundwater recharge, and surface water protection.[7] DNR mapped these values throughout the state (see Map 7). Within Cecil County, forests and wetlands provided an estimated $237 million/year. This was only a subset of services, and did not include the value of timber, recreation, or aesthetics, for example. It's important to note that although 47% of the land throughout the County is mapped within the GI Network, this natural system actually provides over 75% of the ecosystem service benefits for the County.




*Map 7. Relative provision of ecosystem services in Cecil County.*

[7] Campbell, E., R. Marks, and C. Conn. 2018. Accounting for Maryland's ecosystem services: integrating the value of nature into decision making. Maryland Dept. Nat. Res., Annapolis, MD. DNR 14-081518-92.

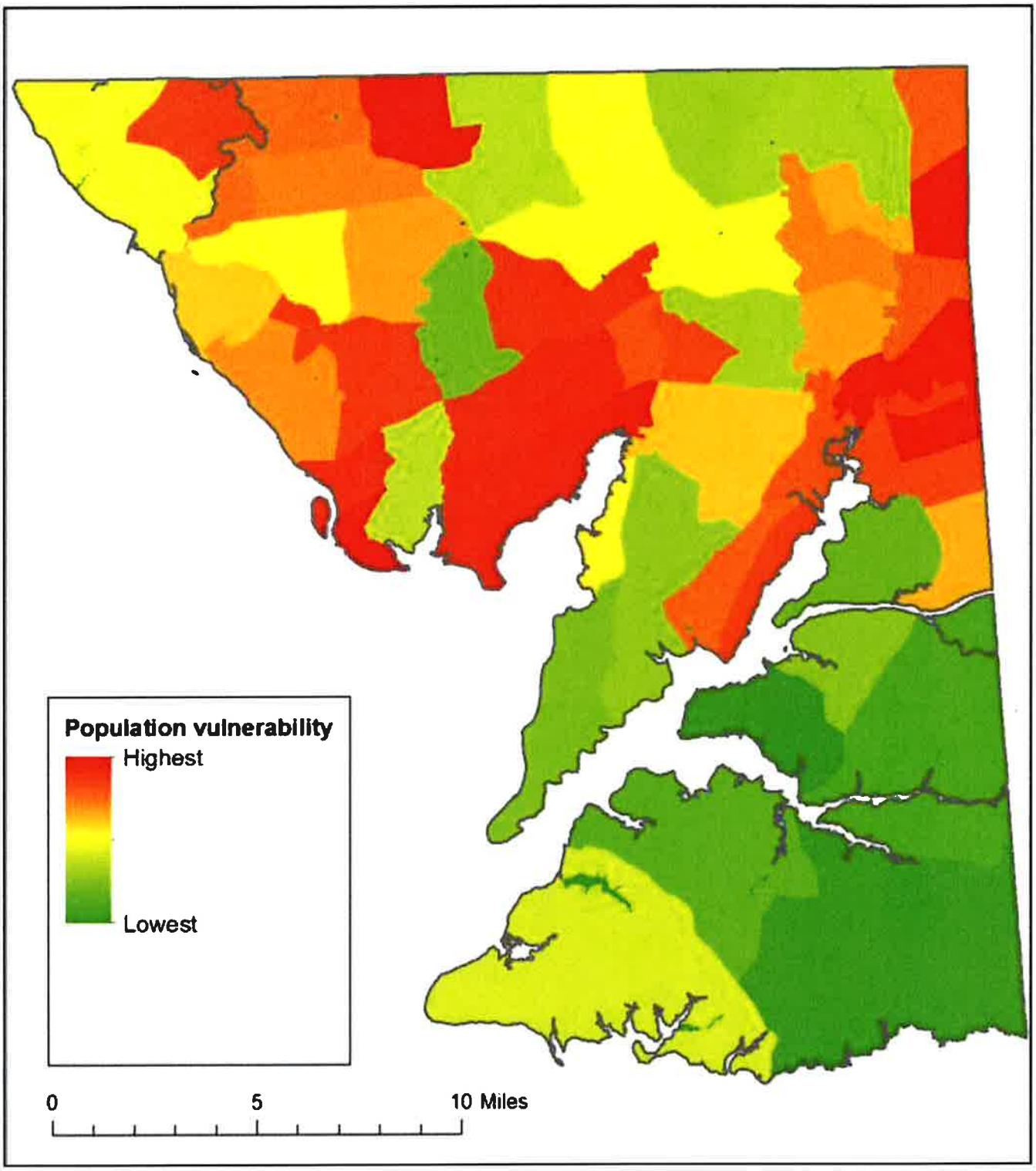
# Population vulnerability

Population density and three metrics of social vulnerability (income, English proficiency, and age) were used to identify communities that might be more impacted by flooding and other natural hazards, and less equipped to prepare for, respond to, and/or recover from them. Equity concerns tend to be more common in urbanized coastal areas, but they also exist in rural riverine areas. The population vulnerability factors selected for this analysis were consistent with Maryland's Coastal Resiliency Assessment, and were derived from census block data (Table 11). The census block data includes overlap with the eight Towns, which account for approximately 30% of the County's population. The factors below were equally weighted before combining into an overall metric of population vulnerability (Map 8).

Per discussion at the Feb. 6, 2019 Steering Committee meeting, we removed population vulnerability as a factor in weighting natural resources protection and stormwater BMP placement, and set it aside as an independent variable to be considered in the planning process.

| Factor | Metric | Weight |
|---|---|---|
| Population Density | # of people/mi$^2$ | 0.25 |
| Household Income | % Population with income below poverty (12 mo.) | 0.25 |
| Ethnicity/Minority | % Population of non-proficient English speakers | 0.25 |
| Age | % Population <18 or >= 65 years of age | 0.25 |

*Table 11. Population vulnerability factors.*



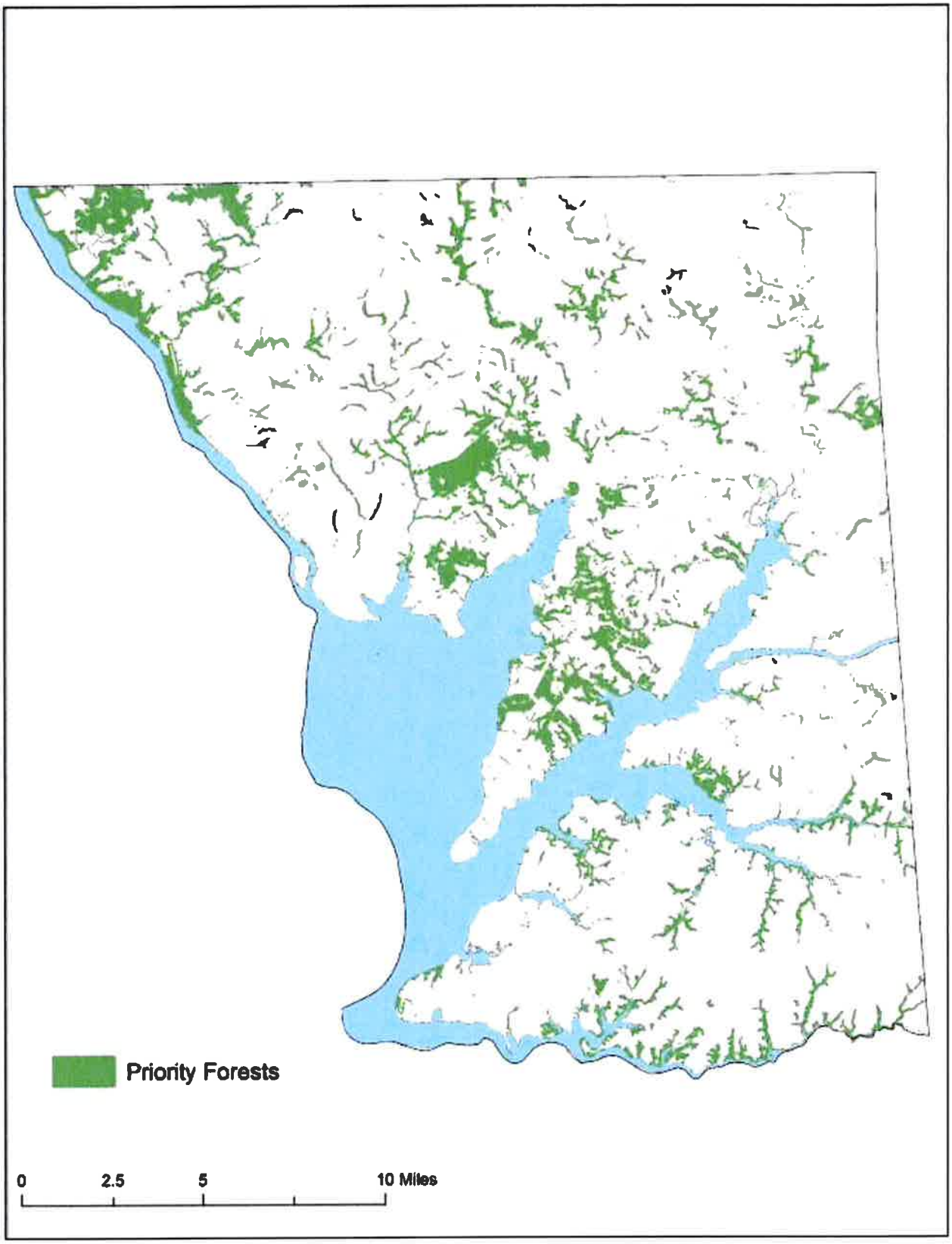

*Map 8. Relative population vulnerability in Cecil County.*

# Priority Forests

Priority Forests are an essential component of Cecil County's GI network. Land use types which are designated as Priority Forests include floodplains, intermittent and perennial streams and their buffers, steep slopes over 25%, critical habitats for endangered species, and non-tidal wetlands. Forests which exhibit these land use types have been identified on Map 9 and will be prioritized for preservation using the natural resource protection and other mapping assessments provided as part of this plan. Priority Forests can be further identified through conducting a Forest Stand Delineation in which an inventory of forest characteristics are assessed and evaluated. Additional guidance found in the State and County forest conservation manuals include identifying forest patches at least 100 acres in size and forest corridors at least 300 feet wide, which is similar to the methodology used to delineate the GI network. High structural diversity in forest is also valued, although this is more difficult to map, and the concept is explored in further detail within the Mature Forest Estimation section found in Appendix F.

Appendix F also includes some of the findings of the recent forest assessments conducted throughout the region. Later successional forests tended to have fewer invasive plants than younger earlier successional, especially when over 150 feet from the edge. Core forest also had significantly fewer invasive plants than non-core forest. Forest bird richness was higher in undisturbed, mature broadleaf forest with streams and wetlands nearby. Areas with oaks dominant or co-dominant in the canopy were less likely to have more than 5% invasive plant coverage. Many sites had little native groundcover plants and it would be wise to implement deer control measures such as controlled hunting and fencing to benefit the forest understory. Since it was determined that tree canopy heights were not a strong indication of mature forest, it's recommended to digitize the forested areas shown on the 1930's aerial photos, to compare to current forests, and to conduct similar forest assessments in the future.

Providing financial incentives to land owners to implement Best Management Practices for Timber Harvests and other operations which may cause disturbance, is a potential implementation strategy Cecil County could implement to protect Priority Forests. This could be accomplished through Deed Restrictions held with Cecil County on sites designated as Priority Forests. Deed Restrictions would outline specific criteria, such as where to limit disturbance and employ Best Management Practices based on the Priority Area(s) within the site.




*Map 9. Priority Forests in Cecil County*

## Natural Floodplain Functions

Floodplains are an important community asset. The rise and fall of flowing water, combined with the connections to upland and aquatic resources, is what makes riparian ecosystems so special. Moisture in the soil leads to a greater diversity of plant species. But floodplains don't only provide for wildlife conservation areas, they are also commonly found in parks and other open spaces, where passive trails tend to make our neighborhoods more appealing to citizens, potential employers, and visitors. Some of the best outdoor community amenities are those preserved and developed according to their original functions and because of their scenic value, can become sources of neighborhood pride.

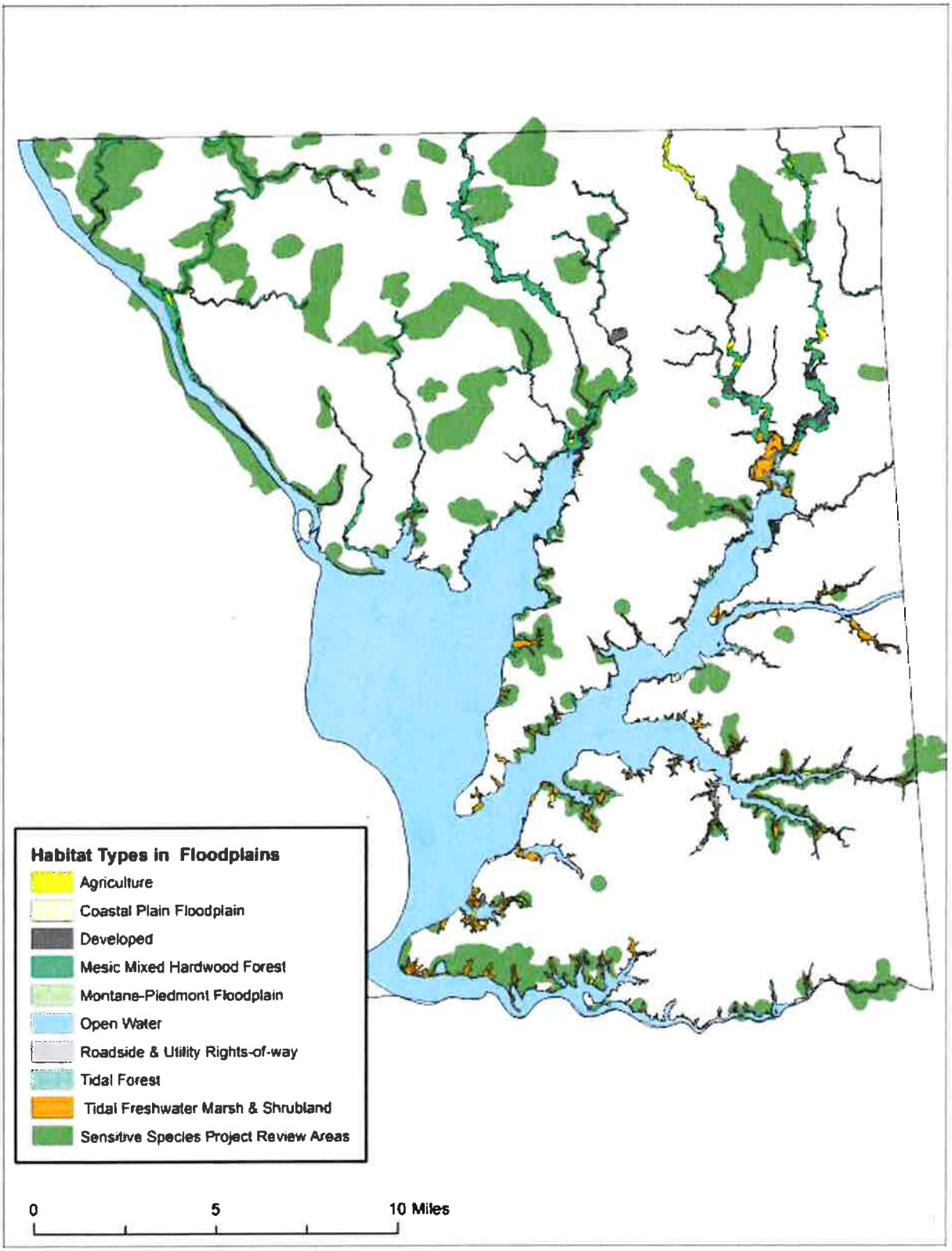
Some of our more important natural areas, including coastal wetlands, non-tidal wetlands, intermittent, and perennial streams are worth adapting to, rather than trying to control, since lower cost investments made by preserving Green Infrastructure can help to offset expensive capital improvements for pollution control in the future. For example, groundwater supply quality is greatly improved when healthy vegetation is found within intact, connected stream and wetland systems. Floodplains provide many benefits, including storage and conveyance of flood waters, recharging of groundwater, maintenance of surface water quality, limiting erosion, and providing for fish and wildlife habitat. Many different government agencies and community partners with different goals can find common ground in floodplains, and it's important to tap this energy to plan and collaborate together.

There are a number of plant and animal species that are only found within floodplains and throughout various part of their life cycles. For example, coastal wetlands and marshes are ecologically significant as habitat for aquatic organisms, including fish, shellfish, waterfowl, and other wildlife. The Susquehanna River flats includes the largest stand of submerged aquatic vegetation in the State of Maryland. This area is an integral component of the tidal bass fishery in the upper Chesapeake Bay, including the North East, Elk, and Sassafras Rivers, and is a major regional economic engine that draws in roughly $10 million in annual expenditures by anglers. Table 12 below gives an indication of the different habitats found within floodplains countywide.

| % Floodplain | Acres | Habitat Types |
|---|---|---|
| 7.3 | 875.9 | Agriculture |
| 0.7 | 79.8 | Coastal Plain Floodplain |
| 12.4 | 1482.5 | Developed |
| 50.5 | 6017.6 | Mesic Mixed Hardwood Forest |
| 0.9 | 103.8 | Montane-Piedmont Floodplain |
| 0.3 | 34.5 | Roadside & Utility Rights-of-Way |
| 3.5 | 415.6 | Tidal Forest |
| 24.4 | 2913.5 | Tidal Freshwater Marsh & Shrubland |
| | **2438.2** | |

*Table 12. Percentage of floodplain by different habitat types, excluding open water & including Town floodplains.*

These habitat types correspond with the wildlife species identified as those with the Greatest Conservation Need in the 2015 Maryland State Wildlife Action Plan. The lists of species that could be found within Cecil County floodplain habitats are provided in Appendix I. A list of rare, threatened, and endangered species found within Cecil County and prepared by Maryland's Department of Natural Resources, Wildlife and Heritage Service, is provided in Appendix J.




*Map 10. Habitat Types in Floodplains and Sensitive Species Project Review Areas in Cecil County.*

# Wildlife Surveys and Management Recommendations

The research team from Susquehannock Wildlife Society (SWS) visited each of the two hub / corridor sites multiple times during the project period to document wildlife diversity and assess the quality of the habitat. The two sites were chosen both geographically, to cover different regions of the county, and based on their connectivity through green corridors.

The SWS team of biologists, naturalists, researchers and volunteers chose trails through each site that crossed through as many habitat types as possible while taking into account which would have the highest yield of wildlife sightings. They recorded the general status of the forest, plant diversity, presence of invasives and quality of the understory. They mapped out what types of habitats were available for wildlife at each site with a focus on those that would support species like amphibians that are more sensitive to poor quality habitat.

Seasonal wetlands (vernal pools) were sought out during the spring surveys to capture the brief breeding season of frogs, toads and salamanders which included listening for calls, lifting debris, searching for egg masses and visual encounters around wetlands. Other wildlife species recorded during surveys were mammals (including tracks and scat), birds, reptiles, and larger / significant insects. Fish, mollusks, and crustaceans were not specifically targeted due to existing extensive stream surveys previously performed by others. High resolution trail cameras with nighttime infrared illumination were placed at each site for a period of at least two weeks to record the diversity and density of species that might be nocturnal, weary of humans, or just not encountered during the on-site visits. Camera locations were selected based on animal signs, trails, or just significant natural features of the site such as habitat transition zones. Upon the conclusion of the site surveys SWS consolidated its findings to focus on the status of each site's wildlife diversity, habitat quality, and recommendations for how to improve each site to better benefit wildlife.

Site Descriptions and Findings:

Elk River Park - This actively used county park in the coastal plain has a wide variety of habitat types that transition from an open waterfront park, mixed hardwood forest, natural and man-made wetlands, and the freshwater tidal coastline of the Elk River. This site is part of a network of protected lands within the Elk Neck peninsula.

While there is a higher amount of human activity, significant deer graze along some of the understory and invasive plant species at this site, the habitat diversity that includes tidal marsh, several man made wetlands and transition areas is able to support a wide variety of species including some sensitive species. This site is also an important stop over for migrating birds and can support more diversity than most locations due to its location in the flight path and the different habitat types all found within close proximity. The site would benefit from a portion of the mowed grass areas being converted into a native meadow or native forest so that part of the unused open space can benefit wildlife and stormwater while not disrupting the use as a park. Early results from the avian surveys found three forest interior dwelling bird species (FIDS).

Elk Mills Road Site - This infrequently accessed green space has a small parcel of mixed forest, spring seep wetlands and a creek surrounded by and bisected by agricultural lands. While some of the species diversity is reduced due to the sedimentation of the stream and agricultural influence, there are some valuable spring seeps and forest habitat that may benefit a variety of species. The forest is alternates from pine to deciduous with

enough to provide some habitat but some invasive species are present throughout and deer graze is evident. Most importantly this site may be able to act as a corridor for species that may utilize the larger habitat to the north at Fair Hill Natural Resource Management Area.

Although this site is a narrow protected area between agriculture and residential areas, it is clear that wildlife moves through it as a corridor and the habitat diversity is beneficial. The forest to the north has some beech tree monoculture where there should be more native tree diversity. There are some spring seep wetlands that support sensitive amphibian breeding. Early results from the avian surveys found three forest interior dwelling bird species (FIDS) the south tract and 2 in the north tract. Early results from the plant surveys found some old beech and oak tree species in the north tract, as well as, some very old tupelo tree species.

Summary of Results and Recommendations:

The overall observation of the effectiveness of these two county-owned parks as hub and corridor sites was positive. Wildlife is certainly concentrated in these places to varying degrees depending on type and quality of habitat but each did allow for species that require connectivity between sites to exist in some capacity. The biggest consistent threat to the future health of all sites were invasive plants outcompeting native plants, overgrazing by white-tailed deer, and sedimentation of wetlands or waterways.

At Elk River Park, wildlife can be enhanced by adding and monitoring more nest boxes, installing fishing line disposal stations, planting native plants with wildlife value, removing or controlling invasive plants, and creating additional habitat areas such as meadow strips to replace unused grass areas.
At Elk Mills, wildlife can be enhanced by adding and monitoring nest boxes, removing invasive plants, restoring and preventing further erosion and sedimentation of the stream, and creating a strip meadow corridor with native flowers and grasses to connect the two forested areas across the agricultural area so wildlife can move safely between the habitat areas.

In conclusion, the hub and corridor concept as a model for a land conservation tool is incredibly effective and provides not only habitat for wildlife but allows it to move between sites, creating the necessary ingredients to ensure populations remain resilient. Some species, especially mammals with larger home ranges and birds with migratory habits will follow these green corridors from one site to another, as shown but the types and density we found of many species. Others may just use these corridors for incremental range expansion and genetic dispersal over time which is incredibly valuable to the long term survival of many species. The quality of these sites was shown by the diversity of species from a decent range within the expected local ecosystem including more sensitive amphibians. All of the sites to some degree included a mix of habitat types that not only serve a variety of species but the complex life cycle of species that, for instance may require seasonal wetlands to lay eggs and develop their young. It is our opinion that these sites are important wildlife hotspots in Cecil County and with some focused management and enhancements along with further protection of interconnecting lands, we can maintain a rich and healthy home for both wildlife and our residents alike.

Appendix G contains a full list of species found at the sites, as well as, notes on site conditions.

# Implementation Strategies

Various action items to protect, restore, and manage County green infrastructure are listed below, and are organized under five different themes. County staff worked with the steering committee, public and community partners, to identify and consider which agencies could support which action items, and whether that support would be through discussion, funding, or both. A list of acronyms for partners and funding sources is provided before the action item tables.

## Government Agencies & Community Partners

| Abbreviation | Name |
|---|---|
| ACB | Alliance for the Chesapeake Bay |
| AWI | Artesian Water Inc. |
| BGE | Baltimore Gas & Electric Company |
| CFDCB | Cecil County Forest District Conservancy Board |
| Choptank | Choptank Electric Cooperative Inc. |
| CLT | Cecil Land Trust |
| Colonial | Colonial Pipeline |
| CWA | Chester Water Authority |
| Delmarva | Delmarva Power |
| DES | Cecil County Department of Emergency Services |
| DNR CAC | Maryland Department of Natural Resources Critical Area Commission |
| DNR CCS | Maryland Department of Natural Resources Chesapeake & Coastal Service |
| DNR F | Maryland Department of Natural Resources Fisheries |
| DNR FS | Maryland Department of Natural Resources Forest Service |
| DNR WHS | Maryland Department of Natural Resources Wildlife & Heritage Service |
| DPR | Cecil County Department of Parks and Recreation |
| DPW | Cecil County Department of Public Works |
| ECG | East Coast Greenway |
| ESCAP | Eastern Shore Climate Adaptation Partnership |
| ESLC | Eastern Shore Land Conservancy |
| ESNG | Eastern Shore Natural Gas Pipeline |
| Exelon | Exelon Corporation |
| FEMA | Federal Emergency Management Agency |
| LSHG | Lower Susquehanna Heritage Greenway |
| MD PS | Maryland Park Service |
| MDE | Maryland Department of the Environment |
| MDOT | Maryland Department of Transportation |
| NRCS | U.S. Department of Agriculture Natural Resource Conservation Service |
| PIO | Cecil County Public Information Officer |
| SCD | Cecil County Soil Conservation District |
| SHA | Maryland State Highway Administration |
| SR | Shore Rivers |
| Town DPZ/DPW | Town Department of Planning & Zoning or Public Works Staff |
| UMSE | University of Maryland Extension Sea Grant |

| | |
|---|---|
| USACOE | U.S. Army Corps of Engineers |
| USFWS | U.S. Fish and Wildlife Service |
| WNA | West Nottingham Academy |
| WSA | Cecil County Watershed Stewards Academy |

Funding Sources

| Abbreviation | Name |
|---|---|
| CBT G3 | Chesapeake Bay Trust Green Streets, Green Jobs, Green Towns Grant Program |
| CBT WAGP | Chesapeake Bay Trust Watershed Assistance Grant Program |
| County/Town CIP | Cecil County or Town Capital Improvement Program |
| CREP | USDA Farm Service Agency Conservation Reserve Enhancement Program |
| DNR CR | Maryland Department of Natural Resources Community Resilience Grant Program |
| FMA | FEMA Flood Mitigation Assistance Grant Program |
| HMGP | FEMA Hazard Mitigation Assistance Grant Program |
| NFWF | National Fish and Wildlife Foundation Chesapeake Bay Stewardship Fund |
| PDM | FEMA Pre-Disaster Mitigation Grant Program |
| Staff Time | Personnel Hours required to develop program |
| VLT | Cecil County Video Lottery Terminal Grant Program |

## Land Use Policies

The County is considering the adoption of new policies to protect the GI network in priority areas, including land within designated preservation and growth areas.

| Action Items | Lead Agency | Partners & Support | Funding options | Timeline |
|---|---|---|---|---|
| Protect core areas and priority forests within the GI network with forest clearing limitations and higher mitigation ratios. | DLUDS | DNR FS, DNR WHS, ACB | staff time | 1-3 years |
| Protect intermittent streams with variable width buffers, which can yield benefits for the entire hydrology system and GI network. | DLUDS | DPW, MDE | staff time | 0-1 years |
| Expand the lateral extent of the regulatory flood zone boundaries to include the 0.2-percent chance or 500-year floodplain and determine the base flood elevations. | DLUDS | FEMA, MDE | PDM, HMGP | 1-3 years |
| Limit the amount of allowable impervious surfaces on land within cold-water fishery watersheds. | DLUDS | DPW, MDE, DNR WHS, DNR F | staff time | 1-3 years |

| | | | | |
|---|---|---|---|---|
| Create a policy for development on County owned land within the GI network to limit forest clearing, provide mitigation, and limit impervious surface amounts. | DLUDS | DPW, SCD, ACB, DNR CCS, DNR CAC | County CIP | 0-1 year |
| When the GI network is developed within designated growth areas, ensure adequate habitat protection areas and wildlife corridors are maintained on-site, in order for natural ecosystem processes to function normally in adjacent rural areas. | DLUDS | DPW, SCD, DNR WHS, USFWS | staff time | 1-3 years |
| Develop watershed master plans as a framework to offset new development and create incentives to implement targeted and strategic stormwater management solutions that benefit the entire watershed. | DLUDS | DPW, SCD | County CIP, CBT WAGP | 1-3 years |

## Planning and Program Development

The County wants to explore the creation of local funding sources to offer new programs that preserve and restore priority areas within the GI network. Collaboration with community partners, including identification of outside funding sources, will be critical to increasing strategic protection programs and initiatives. Staff time will also be necessary for long term planning, coordination, and implementation.

| **Action Items** | **Lead Agency** | **Partners & Support** | **Funding options** | **Timeline** |
|---|---|---|---|---|
| Consider establishing a County run native plant nursery, collect seedlings from partner utility company right of way areas, and use native plants to both beautify and create lower maintenance landscapes for utilities and County owned lands. | DLUDS | DPR, DPW, Town DPW, Exelon, Delmarva, ESNG, Colonial, BGE, Choptank | staff time | 1-3 years |
| Improve management of habitat protection areas within utility corridors and on County owned land. | DLUDS | DPR, DPW, Town DPW, DNR WHS, Exelon, Delmarva, ESNG, Colonial, BGE, Choptank | County/Town CIP, CBT WAGP, DNR CR | 1-3 years |
| Identify the transmission lines and incentivize the location of renewable energy projects towards mining reclamation areas, parking lots, and | DLUDS | DNR CCS | staff time | 0-1 year |

| | | | | |
|---|---|---|---|---|
| warehouse rooftops, and away from the GI network and prime agricultural lands. | | | | |
| Collaborate on watershed management strategies across political boundaries and with community partners to help increase grant funding opportunities. | DPW | DLUDS, Town DPZ/DPW, WNA, UMSE | County CIP, CBT WAGP | 1-3 years |
| Make data more accessible for effective response, recovery, and flood risk communication, including to help identify additional mitigation opportunities. | DES | DLUDS, FEMA | PDM, DNR CR | 0-1 year |
| Develop a local cost share program or other mechanism to fund the preservation of priority forests in and around the GI network. | DLUDS | DNR FS, SCD, ACB, UMSE | County CIP | 0-1 year |
| Set a goal to establish 70% of streams with riparian forest buffers using a combination of incentives and regulations, building on past programs like DNR's Stream Releaf or Healthy Forests/Healthy Waters. | DLUDS | DPW, SCD, ACB, DNR FS | County CIP, DNR CR, CREP, CBT WAGP | 1-3 years |
| Establish forest conservation and restoration as a primary tool for stormwater management and maintain forest cover in floodplains. | DLUDS | DPW, MDE, DNR FS, UMSE, ACB | staff time | 0-1 year |
| Consider incorporating the GI network as a new land use designation in the next update of the Comprehensive Plan. | DLUDS | | staff time | 1-3 years |
| Ensure long term drinking water supplies by preserving and restoring priority forests in places like the Big Elk and North East Creek watersheds. | DLUDS | DPW, Town DPW, AWI, CWA, ESLC, CLT | County/Town CIP, CBT WAGP, DNR CR | 1-3 years |
| Focus invasive species control efforts where they will have a high degree of success and ecological uplift. | DLUDS | DPW, DPR, ACB, DNR FS, DNR WHS | staff time | 1-3 years |
| Provide development incentives for minimizing impacts to the natural hydrology system. | DLUDS | DPW | staff time | 1-3 years |
| Implement Conservation Innovation Grants to explore new approaches for agricultural and forestry best management practices. | SCD | DLUDS, NRCS | CIG, CREP | 1-3 years |

## Land Preservation

The GI Plan Steering Committee wants to preserve land and water resources that provide hazard mitigation and wildlife habitat protection, including floodplains, wetlands, forests, streams, and steep slopes.

| Action Items | Lead Agency | Partners & Support | Funding options | Timeline |
|---|---|---|---|---|
| Provide public access to coastal areas, which can increase public interest and support for living shoreline programs. | DPR | DLUDS, FEMA | PDM, HMGP | 1-3 years |
| Identify and acquire vacant lots in flood risk areas for habitat conservation and potential inclusion within public open space systems. | DLUDS | DPR, DES, FEMA, ESLC, CLT | PDM, HMGP, FMA | 0-1 year |
| Identify opportunities to both preserve gaps in the GI network and create recreational greenways or trails, such as creating linkages with the Lower Susquehanna Heritage Greenway and connecting some of the Towns. | DLUDS | DPR, DPW, LSHG, ECG | CBT G3 | 1-3 years |
| Review Montgomery County, MD Legacy Open Space program as a model for improving local land preservation programs. | DLUDS | DPR | staff time | 1-3 years |
| Increase funding and incentives for the Purchase of Development Rights (PDR) program, to strategically preserve more of the GI network, and collaborate with community partners to target high priority areas including wetlands, natural shorelines, and other open spaces. | DLUDS | DPW, Town DPZ/DPW, DNR WHS, DNR CCS, DNR CAC, FEMA, SR, ESLC, CLT | County CIP | 0-1 year |

## Restoration

The GI Plan Steering Committee wants to re-create natural areas, relocate and protect structures and critical facilities where appropriate, and implement natural solutions to reduce vulnerability to flooding and associated soil and nutrient pollution using stormwater management best practices like rain gardens, rain barrels, conservation landscaping, and living shorelines. The design of future projects should also take into account increased rainfall intensity, duration, and frequency.

| Action Items | Lead Agency | Partners & Support | Funding options | Timeline |
|---|---|---|---|---|
| Remove unnecessary dams in streams to improve migratory fish passage. | DLUDS | DPW, DNR WHS, DNR F | CBT WAGP, NFWF | 1-3 years |
| Design ways for existing open space areas to better address flood hazards, such as holding water and collecting sediment and debris, using places like Meadow Park in Elkton as a demonstration project. | DLUDS | DPR, DPW, Town DPZ/DPW, FEMA | CBT G3, CBT WAGP, PDM, HMGP, FMA, DNR CR | 1-3 years |
| Identify areas of flood concern in close proximity to capital improvements and prioritize mitigation solutions for high-risk assets, incorporating nature- | DLUDS | DES, DPW, Town DPZ/DPW, FEMA, ESLC | County/Town CIP, CBT G3, PDM, HMGP, FMA, DNR CR | 1-3 years |

| | | | | |
|---|---|---|---|---|
| based solutions to the maximum extent practicable. | | | | |
| Create habitats for pollinators along County roads, utility corridors, and County parks, using Brantwood Park as a demonstration project for natural meadow maintenance. | DLUDS | DPR, SCD, NRCS, DPW, DNR WHS, UMSE | CBT WAGP, CBT G3, DNR CR, NFWF, VLT | 0-1 year |
| Identify high priority stream restoration candidate sites. | DPW | DLUDS, CLT | CBT WAGP, DNR CR, NFWF | 0-1 year |
| Partner with Exelon to determine best management practices for debris removal within local waterways. | DPW | DLUDS, MDE, Exelon, | CBT WAGP, VLT | 1-3 years |
| Use the University of Maryland Extension Smart Tool to track various stormwater management practices throughout the County and partner with the Cecil County Watershed Stewards Academy to help with implementation. | DPW | DLUDS, WSA, UMSE | CBT WAGP | 0-1 year |
| Identify opportunities to use dredge material for living shoreline projects and determine candidate sites for developing a local grant program potentially using some Critical Area Buffer fee-in-lieu funds. | DLUDS | DNR CAC, USACOE, MDE, UMSE | CBT WAGP, DNR CR | 1-3 years |

## Education

The GI Plan Steering Committee wants to communicate the cost savings of using natural solutions for flood mitigation and continue to publicize efforts and solicit feedback on GI planning program modifications and improvements.

| **Action Items** | **Lead Agency** | **Partners & Support** | **Funding options** | **Timeline** |
|---|---|---|---|---|
| Promote hunting on County owned land to help manage deer populations. | DPR | DLUDS, MD PS, USFWS | staff time | 1-3 years |
| Develop and implement habitat management guidelines for use by foresters and land managers. | DLUDS | DNR WHS, DNR FS, ACB, SCD | staff time | 1-3 years |
| Reduce impacts from road salt, herbicides, and other contaminants within the GI network, by working with the appropriate agencies at MDOT, SHA, County, and Towns. | DPW | DLUDS, Town DPW, MDOT, SHA | staff time | 1-3 years |
| Inform and motivate the public to implement stormwater management practices and runoff | DPW | DLUDS, Town DPW, SCD, SR, UMSE | County CIP, DNR CR | 0-1 year |

| | | | | |
|---|---|---|---|---|
| retention, including rain barrels, rain gardens, and conservation landscaping with native plants. | | | | |
| Measure cost savings of nature-based restoration projects to citizens via the GI plan webpage, press releases, and other communication tools, and showcase the North East Town Hall as a demonstration project. | DLUDS | DPW, PIO, SCD, Town DPZ/DPW, UMSE | County/Town CIP, DNR CR | 1-3 years |
| Target areas in and around the GI network to market available cost share programs. | DLUDS | DPW, SCD, NRCS, ACB, DNR FS, CFDCB | CREP, DNR CR | 0-1 year |
| Develop flood risk communication and messages for different audiences, and consider creating a regional program for public information with other community partners and jurisdictions, including Towns and Counties. | DLUDS | DES, PIO, ESCAP, UMSE, FEMA, MDE | County CIP, DNR CR, PDM | 1-3 years |
| Identify structures with flood risk and target outreach related to purchasing flood insurance and mitigating risk with design considerations for sill elevations, foundations, and utilities. | DLUDS | DES, FEMA, MDE | County CIP, DNR CR, PDM | 1-3 years |
| Develop an online map viewer of the GI network and associated mapping assessments with the capability of tracking ongoing preservation and restoration activities. | DLUDS | DNR CCS | staff time | 0-1 year |
| Encourage local plant nurseries to phase out the sale of non-native and invasive forest plants. | DLUDS | DNR WHS | staff time | 1-3 years |
| Encourage the creation of citizen science groups to assess stream habitats and conditions. | DLUDS | DPW, DNR WHS, DNR F | NFWF | 1-3 years |

## Plan Maintenance

Implementation and maintenance of the GI plan is critical to the success of this planning process. Once adopted, plan maintenance will adhere to a schedule of developing an annual progress report on the action items identified in the section on Implementation Strategies. Members of the GI plan steering committee will be invited to an annual meeting conducted by the Department of Land Use and Development Services to discuss collaborative efforts with community partners, monitor funding sources, and recommend any adjustments to lead and support agencies, funding sources, and timeframes for completion. Understanding local capacity will be a key part of the discussions and will revolve around new approaches getting projects into the ground, engaging different groups and new technical experts, and developing incentive programs.

The Department of Land Use and Development Services is responsible for preparing the annual progress report and will submit the document to the appropriate agencies for review and comment. The Department is also responsible for coordinating with other Departments and the Towns to integrate the appropriate Green

Infrastructure strategies into future updates of the Comprehensive Plan, Hazard Mitigation Plan, Stormwater Management Plan, Land Preservation, Parks, and Recreation Plan, and Strategic Plan. Finally, the plan must be updated every ten years and include any changes within the GI network, mapping assessments, and implementation strategies. This plan is anticipated for adoption in 2019, so the next plan update should occur in 2029.

## Conclusion

This plan was developed over a one-year time frame and began with data collection, identifying focal species for the hubs and corridors analyses, and conducting the mapping assessments. The steering committee met throughout the planning process to provide input and refinements along the way. Two community meetings were held to acquire additional feedback from the public and to develop priorities for the action items. The action items include revising land use policies and existing programs to support the planning and implementation of the GI network, as well as, identifying partners to collaborate with on future land preservation, restoration, and educational activities. The implementation of the action items contained herein will go a long way towards ensuring the wise use of our resource lands when making future land use decisions.