Dorsey Wetland Hub Habitat Assessment and Management Plan

July 2017

Prepared for Howard County, MD

A companion to the Green Infrastructure Corridor Analysis, this document offers habitat management guidance for Dorsey Wetland Hub. Preparing habitat management plans was listed as a priority project in Howard County's 2012 Green Infrastructure Network Plan. The first section is a Landowner Summary. The second section provides a general orientation to the Network, the concept of habitat value, and the primary stressors and threats to the Network hubs and corridors. It concludes with a brief menu of the most commonly recommended habitat improvement techniques. The final section describes existing conditions and identifies potential habitat enhancements for the Dorsey Wetland Hub.

HOWARD COUNTY
MARYLAND

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Landowner Summary

This Landowner Summary is intended to give landowners within and adjacent to the Dorsey Wetland Hub a brief introduction to the Howard County Green Infrastructure Network and the concept of habitat value. A summary is then given of existing conditions within the hub and the primary and secondary actions needed to improve those conditions to enhance the hub's habitat value. A reference section at the end of the summary provides links to sources for information on implementation techniques and potential funding assistance. Landowners who wish to learn more about specific resource conditions or enhancements listed in this summary will find more detailed information in the body of the Habitat Management Plan.

Howard County Green Infrastructure Network

The Network includes two basic building blocks:

- **Hubs - large, natural areas, including forests and wetlands, which provide core habitat for native plants and animals**
- **Corridors – provide natural connections between hubs, often along rivers and streams, and allow wildlife to move safely and freely between hubs.**

The Network offers multiple benefits for our communities and economy, including habitat for a variety of native plants and animals, opportunities for nature-based recreation, cleaner air and water, reduced storm runoff, and disrupted urban heat islands. The Network includes both public and privately owned land, so a shared sense of stewardship among landowners, no matter how large or small their property, is a critical asset in supporting a healthy Network.

Wildlife in Howard County

Howard County is home to familiar backyard wildlife, such as deer, rabbit, gray squirrel, woodchuck, skunk, raccoon, opossum, fox, and coyotes that coexist within the patchwork of urban and suburban land uses. The County's more secretive residents, such as long-tailed weasel, river otter, mink, flying squirrel, two species of bat, eleven species of salamanders, and an occasional black bear, have more specific habitat requirements that require blocks of high quality habitat in the woods and along streams and rivers. In addition to the resident wildlife, the Howard County Bird Club has documented over 200 species of migratory birds using the diverse habitats throughout the County for nesting or staging areas along their migration. The most sensitive of the County's wildlife are forest interior dwelling species, which require large blocks of forest (>50 acres) with 10 or more acres of forest interior (more than 300 feet from the forest edge). Overall, the abundance and diversity of wildlife throughout the County also supports various recreational and economically beneficial activities including birdwatching, hunting of deer, waterfowl and upland gamebirds (e.g., American woodcock, mourning dove), and fishing.

A complete list of wildlife species in the County can be derived from the Maryland Biodiversity Project. In order to establish habitat management and connectivity goals, the requirements of forest interior species and the County's 24 amphibians, 30 reptiles and 20 small mammals are a better guide than the needs of highly mobile species such as migratory neotropical birds. Additional lists of threatened and sensitive local wildlife, which can factor into management goals, are available from US Fish and Wildlife Service and the Maryland Department of Natural Resources Wildlife and Heritage Service.

What is Habitat?

Habitat is simply the area where a plant or animal makes its home and accesses the resources necessary to live. Each species has different habitat requirements, which can be defined in terms of the four resources that must coexist for plants and wildlife to live and thrive in a specific location: food, water, cover, and space. The greater the amount and variety of each of these resources, the more valuable the habitat is for a wider range of species. Accordingly, the habitat value of a property can be improved by the following:

- Food: Provide a variety of food sources
    - Food provides the sustenance and nutrition animals and plants need to survive and reproduce. For plants, it may be a certain set of nutrients and the availability of sunlight. For animals, it may be a selection of native plants, insects, or other smaller animals. Good habitat provides a variety of abundant food sources to accommodate a wide range of species year-round. Property owners and managers are most likely to increase food sources for wildlife by planting or protecting the native plants that provide food in the form of foliage, nuts, fruits, seeds, nectar and pollen.
- Water: Provide and protect clean sources of water
    - Water is a basic element for survival shared by all species, both as a source of hydration and as a home for all or a portion of a species' life cycle. Plants and animals need a variety of clean water sources, which can be available in the form of soil moisture, groundwater, vernal (or seasonal) pools, ponds, wetlands and streams.
- Cover: Provide a variety of cover
    - Wildlife need places to hide, rest, raise their young and take shelter from the weather. Depending on the species, cover can be found in rock or brush piles, downed logs, thickets, shrubs or trees. Forests, streams, wetlands, ponds and meadows with more structural diversity (vegetation in layers at differing heights) provide better cover.
- Space: Provide safe and appropriate space
    - Plants and animals need safe and appropriate space that can accommodate their entire life-cycle, and space needs can vary by species and by life-stages within a species. By providing large, connected habitat areas, the Network is better able to accommodate the space needs of a variety of native species. Property owners within the Network can ensure their land continues to provide good quality habitat by protecting and enhancing the woods, meadows, wetlands and streams on their property.

Existing Conditions in Dorsey Wetland Hub

The Dorsey Wetland Hub is important to wildlife because it is a diamond in the rough. The hub is located within a highly urban area in southeast Howard County in the vicinity of Dorsey Run Road, Route 1 and the CSX railroad track. Contained within the hub's approximately 78 acres are a mix of young and mature deciduous forest, a large 100-year floodplain, wetlands, vernal pools, Dorsey Run and two small tributaries to Dorsey Run. Land in the hub was likely cleared for farming and much of the forest is dominated by similarly aged trees of roughly 12-20" diameter at breast height, which suggests that clearing activity stopped about 50 years ago.

The forest and wetlands in the hub generally provide good habitat for the resident wildlife. There are a variety of food and water sources, including oak trees that provide acorns. Abundant downed wood, standing dead wood that host insects and grubs, and forests with layers of vegetation provide cover and nesting habitat. The wet soils and deep shade make the hub excellent habitat for amphibians (frogs, toads, newts, salamanders). Based on an informal, visual assessment, the instream habitat is supportive of an aquatic community of fish, aquatic insects and other invertebrates. There are signs of beaver, which is indicative of a robust wildlife population, and beaver create varied habitat and increase habitat value for other species.

Although the hub is in reasonably good condition, it suffers from water management impairments (storm drain outfalls and ditches), trash and an overabundance of deer. Conveying water in manmade channels increases its velocity during storm events, which has erosive effects on the receiving stream channel. The Dorsey Run stream channel is showing the erosive effects of unmanaged stormwater runoff. Old drainage ditches drain water from the wetlands in Dorsey Wetland Hub, depriving them of needed water and degrading the available wetland habitat. By draining the water directly to the streams, rather than allowing it to filter through the floodplain soil, the ditches also have the net effect of reducing water quality.

Notable amounts of trash and refuse were present throughout the hub: trash is washing downstream from upstream properties, being dumped on site, and being discharged through adjacent stormwater management facility outfall pipes. The trash includes tires and other large items such as automotive parts.

A dense deer population browses the native understory and shrub layer heavily. The result is a forest with a layer of tall canopy trees that the deer are unable to damage and an herbaceous groundcover that the deer don't eat. The deer's destruction of the understory impedes forest regeneration, because young trees are unable to grow to maturity and replace older, fallen or diseased trees.

Non-native invasive plants (NNIP) are present throughout the hub in low levels. These plants often have prolific reproduction and growth rates, so they can out-compete native plants for water, nutrients and space, yet rarely provide good food sources for native wildlife. Their presence is not currently a threat to forest regeneration in the hub, but deer generally prefer to eat native plants over NNIP, which aids in their spread.

Dorsey Wetland Hub – Potential Enhancements

There are several management techniques that could be implemented to improve habitat within the hub. The primary actions needed to address the threats to habitat quality identified through this assessment include: improve water management, create or support vernal pools, remove trash and address the sources of this trash, and manage deer populations. Secondary actions to enhance habitat quality could include installing bird and bat boxes or enhancing the forest and wetlands with supplemental plantings of native species.

Techniques to address water management problems could include: blocking the ditches draining the wetlands, creating vernal pools, retrofitting the adjacent stormwater management facilities to address erosive flows and trash, and restoring stream channels. These activities would largely require the assistance of environmental consultants and engineers to help evaluate and design any changes to site hydrology and consequent changes to habitat. These professionals can model the effects of changing the water flow and storing more water before it reaches streams. They can also ensure that the proper local, state and federal permits are acquired.

To address trash coming from upstream properties, the County has completed and is pursuing zoning violations against upstream property owners to remove trash and other materials from the floodplain. In addition, the Department of Recreation and Parks has held annual spring cleanups along this section of Dorsey Run. Trash dumping can be a difficult problem to address when the property owner cannot directly monitor access points for dumpers, but property owners can begin by posting their property with no dumping signs and reporting problems when they are observed. Adjacent landowners can monitor their individual properties to ensure that the trash is picked up and disposed of properly so it doesn't blow around or end up in the stormwater management facility.

Techniques to manage deer populations for the hub include fencing and hunting. Fencing the entire hub would be expensive, require each property owner to participate, and have negative effects on Network connectivity. In addition, the fence would need ongoing maintenance to be effective. Managed deer hunts may be possible with property owner permission within portions of the hub that meet setback requirements for firearm and bow and arrow use.

Additional management actions could also enhance the habitat value of the site, including most of the Common Habitat Enhancements in the second section of this document. Because such activities are not responding to specific, urgent threats, selecting among them would largely depend on the interest and energies of the landowners or other stakeholders. One of the best ways for a landowner to take a structured approach to selecting additional habitat enhancements would be to initiate a Forest Stewardship Plan with the Maryland Department of Natural Resources.

Further Information

Howard County Resources and Programs

- The Stream ReLeaf Program provides free trees for stream buffer plantings (https://www.howardcountymd.gov/ Forestry).
- The Howard Soil Conservation District (HSCD) supports several residential landowner programs such as Backyard Actions for a cleaner Chesapeake Bay http://mda.maryland.gov/resource_conservation/Documents/backyard.pdf. The HSCD also assists agricultural landowners with federal and state cost-share programs for habitat improvements, including the Environmental Quality Incentives Program (http://www.howardscd.org/cost-share)
- The Howard County Deer Management Plan further explains the causes, problems and solutions to overabundant deer populations.
- The Clean Water Howard stormwater management program provides information on managing water resources on private land http://www.cleanwaterhoward.com/

Additional Resources

- *The Woods in Your Backyard* is a state program that teaches forest management techniques to property owners with small forest acreage (https://extension.umd.edu/sites/default/files/_docs/WBYCreatingNaturalAreas.pdf).
- The Maryland Department of Natural Resources (MD DNR) provides overview information on invasive species (http://www.dnr.state.md.us/invasives/).
- MD DNR Forestry Division supports TREE-mendous Maryland, which provides free trees for planting on public lands (http://dnr2.maryland.gov/forests/Pages/treemendous/default.aspx).
- The MD DNR Forestry Division provides information on a variety of forest stewardship programs (http://dnr2.maryland.gov/forests/Pages/programapps/stewcon.aspx) and can prepare Forest Stewardship Plans for individual properties for a modest fee.
- Wildlife habitat certification programs, such as MD DNR Wild Acres, the National Wildlife Federation and the Wildlife Habitat Council, work with residential, school and commercial property owners (http://dnr2.maryland.gov/wildlife/Pages/habitat/wildacres.aspx).
- The USDA has an excellent resource on how to create vernal pools: www.watershedconnect.com/documents/science_management_interventions_wetlands
- The US Fish and Wildlife Service provides a guide to native plants Native plants for Wildlife Habitat and Conservation Landscaping: Chesapeake Bay Watershed
- The Maryland Native Plant Society provides guidance on buying native plants, including a list of local nurseries that sell native plants, at http://mdflora.org/forgardeners.html
- The University of Maryland Extension provides information on a variety of homeowner and agricultural landowner programs (http://extension.umd.edu/). The Extension's Home and Garden Information Center gives an overview of invasive insects and pests (https://extension.umd.edu/hgic/invasive-insects-0).
- The National Park Service provides a guide to identify and manage invasive plants - *Plant Invaders of Mid-Atlantic Natural Areas, 4th ed.* (Swearingen et. al. 2010) – that includes information on native plant alternatives (https://www.nps.gov/plants/alien/pubs/midatlantic/index.htm).
- The Nature Conservancy provides a guide for the control of invasive species - *Herbicide Use in Natural Areas* (TNC, 2010) http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/illinois/il-vsn-herbicide-use-manual-updated-2011.pdf .

Habitat Management in Howard County

Green Infrastructure Network

In 2010, Howard County made a formal commitment to enhancing and supporting its Green Infrastructure Network and the plants, animals and resources it contains, as well as fortifying the ecological functions, such as water storage or pollinator services, that it provides to sustain the health and quality of life in the County. The County started by defining the geography of the Network, with attention to providing connectivity with Networks in the state and in neighboring counties (Figure 1). The Howard County Green Infrastructure Network, as originally defined in the 2012 Howard County Green Infrastructure Network Plan, includes two basic building blocks: ***hubs***, which are large, natural areas that provide habitat for native plants and animals, and the ***corridors*** that connect them, often along rivers and streams.

What is Green Infrastructure?

Although Green Infrastructure is sometimes used in a narrow sense to refer to stormwater management, Howard County's Green Infrastructure Network is based on the original use of the term, as an ecological system on a scale comparable to other forms of urban infrastructure (for example, road networks or water and sewer systems), but composed of interconnected waterways, wetlands, forests, meadows and other natural areas. A Green Infrastructure Network with healthy resources offers multiple benefits for our communities and economy, including habitat for a variety of native plants and animals, opportunities for nature-based recreation, cleaner air and water, reduced storm runoff and forest that disrupts urban heat islands.

Hubs contain large areas of interior forest and wetlands. Interior forest is generally defined as forest found at least 300 feet from the forest edge and offers higher quality forest habitat, because it is generally more isolated, with a closed canopy that creates moist, shaded growing conditions. Forest interior habitat is also rare, especially in the south and east of the County, because development has fragmented or broken up our remaining forest into ever smaller forest patches.

Hubs were defined to meet the following criteria:

- Interior forests of 50 acres or more with a 300-foot buffer
- Wetlands of 25 acres or larger, including ponds, lakes and reservoirs, with a 100-foot buffer
- State and County parkland and open space that contain these interior forests and wetlands
- Forest, parkland and open space immediately adjacent to these areas

The 51 hubs in the Network include over 20,000 acres, or 14% of the total County area, and range in size from 25 to 2,407 acres. The hubs include major state and county parks as well as other public lands, but almost 28% of the land is privately owned, which creates an important opportunity to support stewardship and good habitat management or acquire easements or land.

Corridors link the hubs via narrow strips of forest or natural habitat that generally follow rivers and streams. The Green Infrastructure Network defined two minimum corridor widths of 300 and 500 feet, with extensions to include adjacent floodplain, wetlands, parkland and open space. The 500-foot corridor width is the preferred option for the Network. However, there are areas within the Network where a 300-foot corridor may be more appropriate, such as on agricultural land. There are 48 corridor connections in the Network, and the 500-foot corridor system contains just over 6,000 acres or 4% of the total County area. The corridors are ecologically important because they serve as physical links among easements, parks, and large blocks of valuable habitat that may not be protected.

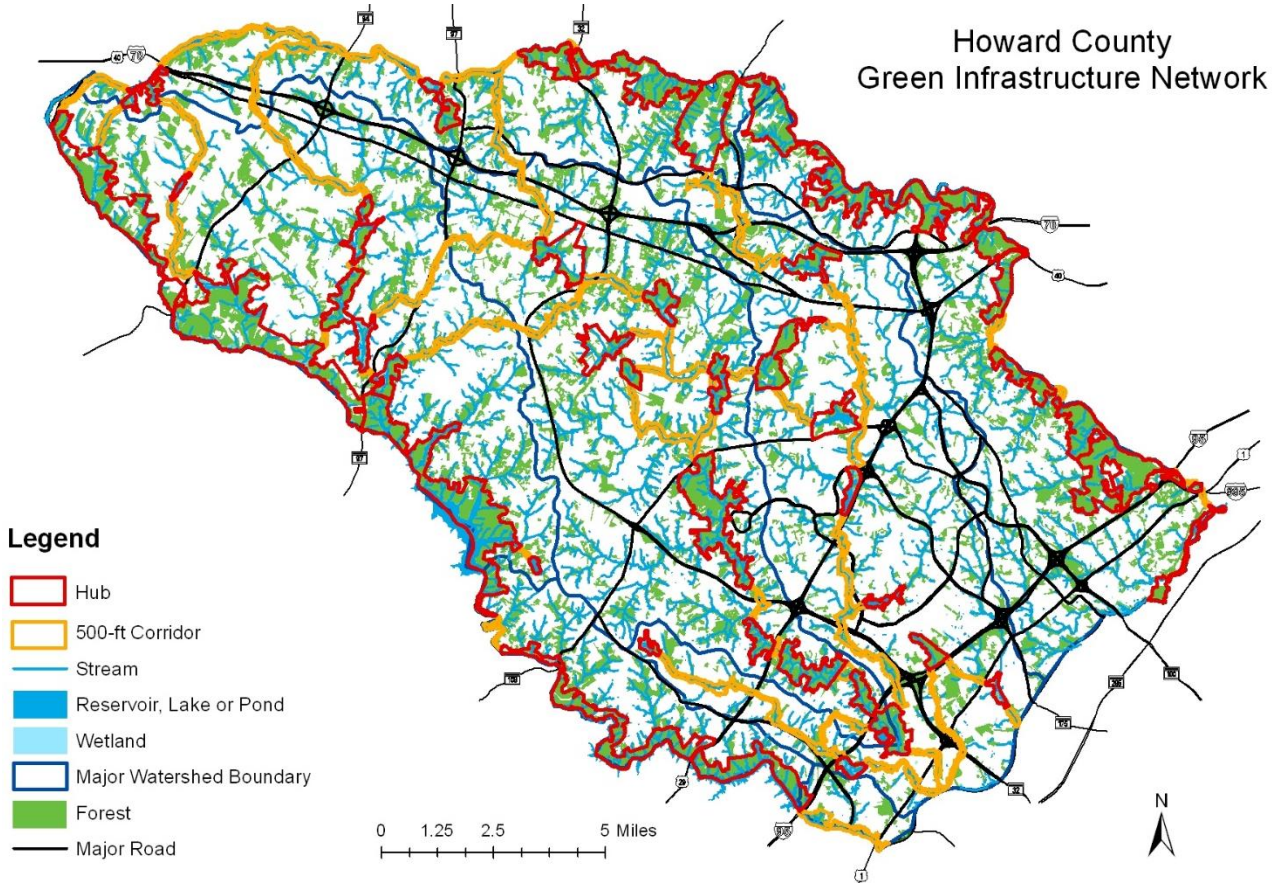

Figure 1. Howard County Green Infrastructure Network

Howard County Green Infrastructure Network Goals

The purpose of Howard County's Green Infrastructure Network Plan is to define, protect and enhance a Green Infrastructure Network that includes and links the most ecologically significant natural areas in Howard County. The Green Infrastructure Network Plan outlines two overarching goals, one for habitat and one for stewardship, each with supporting objectives.

Habitat Goal: Protect, enhance and restore the habitat and natural areas within the Green Infrastructure Network to support a diversity of plant and animal life.

Habitat Objectives:

- Retain, enhance and restore forests, interior forests and wetlands.
- Increase the habitat value of ponds, lakes and reservoirs.
- Enhance and restore stream habitat.
- Manage wildlife to support healthy and diverse populations of native species.

Stewardship Goal: Promote stewardship of the Green Infrastructure Network among individuals, community organizations, businesses, schools and others.

Stewardship Objectives:

- Increase awareness and personal involvement.
- Encourage participation in land preservation programs.
- Promote land management practices that conserve resources, reduce pollution and enhance habitat.

Hub Habitat Management Plans (or HMPs) help achieve both goals for the Network. The HMPs provide information on existing habitat conditions and how to improve those conditions. This information is useful for both public and private landowners who wish to improve habitat on their property. A shared sense of stewardship among landowners is a critical asset in supporting a Network that provides habitat for a diversity of native plant and animal life.

Defining Habitat Value

The Green Infrastructure Network provides an opportunity to enhance the quality of plant and wildlife habitat at a scale much larger than an individual property. For the Network to function as a living framework that shelters plants and wildlife and supports other ecological functions, it must provide both high quality habitat and connectivity (see box on Page 12), so that plants and wildlife can move across the landscape. Landscape in this context includes the physical elements of landforms such as hills and meadows, water bodies such as rivers, lakes and ponds, living elements of land cover including vegetation, human elements including different forms of land use such as agriculture, buildings and roads, and transitory elements such as lighting and weather conditions.

Habitat value can be defined in terms of the four resources that must coexist for plants and animals to live and thrive: food, water, cover, and space. The greater the amount and variety of each of these resources, the more valuable the habitat is for a wider range of species. The following sections offer general guidelines for meeting each of these four resource needs. Individual landowners can use this information to evaluate their property for opportunities to enhance its habitat value. Specific suggestions on how to do so begin in Common Habitat Enhancements (page 18).

1. FOOD: Provide a variety of food sources

Each species has individual nutritional requirements, so good habitat provides a variety of abundant food sources to accommodate a wide range of species.

Property owners and managers are most likely to improve feeding opportunities for wildlife by planting or protecting the native plants that offer food to the widest variety of native wildlife species. Native plants can provide food in the form of foliage, nuts, fruits, seeds, nectar and pollen. Native plants that provide food for a variety of animals, including insects, birds, small mammals, amphibians and reptiles, have the most habitat value. The US Fish and Wildlife Service (USFWS) publication Native Plants for Wildlife Habitat and Conservation Landscaping: Chesapeake Bay Watershed is a useful general reference for information on a wide variety of native plants that offer maximum wildlife value. Native plants have the added value of being well adapted to local growing conditions, so they are more likely to survive and require reduced maintenance once established. Including these plants in plantings can attract additional wildlife species to a property.

2. WATER: Provide and protect clean sources of water

Plants and animals need a variety of clean water sources, which can range from soil moisture, dew, rainfall, groundwater, vernal (or seasonal) pools, ponds, wetlands and streams. Water is needed by wildlife for drinking, bathing, breeding and raising their young. Healthy wetlands and streams with buffer areas of native vegetation support a host of wildlife species and complex plant communities, and improve water quality and water storage. Where these diverse, undisturbed vegetated buffers are wider than 15 feet along a stream or wetland, they also function as natural filter systems to clean surface runoff before it enters the waterbody.

3. COVER: Provide a variety of cover

Wildlife need places to hide, rest, raise their young, and take shelter from the weather. Depending on the species, cover can be found in rock or brush piles, downed logs, thickets, shrubs or trees. Forests, streams, wetlands, ponds and meadows with more layers of vegetation at differing heights provide a greater variety of cover and support more wildlife species.

Healthy forests with vegetative layers, or vertical structure, include well developed herbaceous, shrub, understory and canopy layers (see Figure 2). Supplemental plantings to replace missing vegetative layers can help improve forest habitat, as can allowing standing dead trees, or snags, to remain. Snags can provide cavities for cavity-nesting birds such as many owls, chickadees, and woodpeckers and mammals such as flying squirrels.

In streams, ponds, and wetlands, structural diversity is provided by having water of different depths and flow speeds. Healthy streams provide a mix of fast and slow moving water at shallow and deep water depths. In streams, structural diversity can be enhanced by wood or boulders that create complex cover for refuge from predators or higher flows. Beavers, as natural architects of the aquatic landscape, create a mosaic of habitats for other species, which thrive in the pools and wetlands they create. In ponds, structural diversity is provided by benches of shallow habitat that provide areas for emergent and aquatic vegetation to grow, create nursery areas for juvenile fish, and offer cover to escape predators.

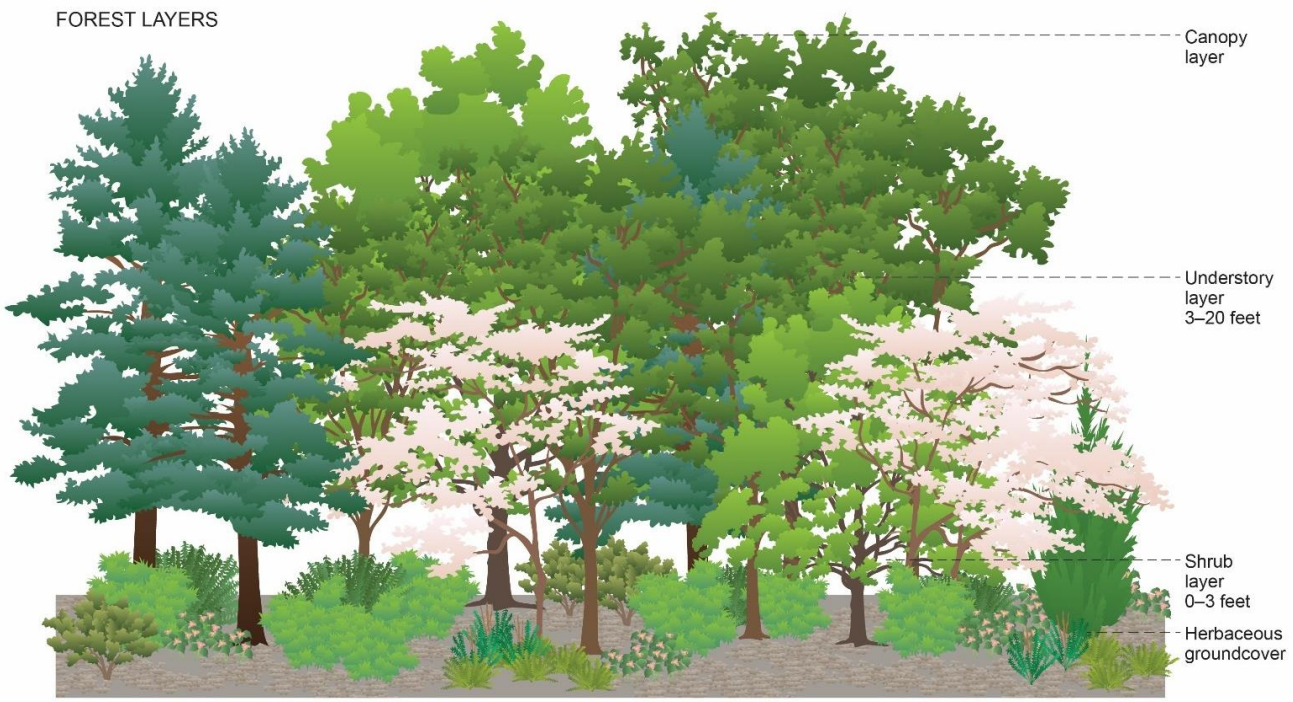

Figure 2. A forest with vertical structure includes herbaceous, shrub, understory, and canopy layers. The canopy is comprised of the trees receiving direct sunlight, whereas other layers are fully or partially shaded.

Protected access to streams, ponds, and other water sources is a key part of cover. Animals that live all or part of their lives in aquatic habitats and the wildlife that visit streams or ponds to drink prefer shelter at the water's edge. Ponds with more diverse natural vegetation along the edges provide a higher habitat value than those with a manicured or mowed edge. Adding native vegetation to exposed or mown pond edges and stream banks will introduce cover and structure in a way that will quickly enhance wildlife habitat.

Meadows provide important cover for nesting, raising young, and escaping predators in addition to ample seasonal forage, such as seeds and insects. On the east coast, meadows tend to naturally change (in a process termed succession) to a forested system if left alone, so management is often necessary to maintain an open meadow. Consequently, meadows are often mowed, which can have a profound effect on the overall quality of the habitat. Mowing does suppress weeds and prevent succession; however, mowing during peak nesting periods for wildlife (typically April through August) or too low to the ground can disrupt wildlife breeding and brooding activities and decimate local populations for ground nesting birds and mammals. Developing a mowing schedule can minimize the impacts of habitat disruption, provide the necessary year-round cover for desirable native wildlife, and potentially decrease the frequency and acreage that is mowed each year. Avoiding mowing altogether and managing for "rewilded" landscaping can also add habitat value to a site, but may require more labor to manage the growth of woody vegetation.

4. SPACE: Provide safe and appropriate space

Plants and animals need safe and appropriate space that can accommodate their entire life-cycle and provide food, water, and cover. Space needs can vary by species and by life-stage within a species. By providing large, connected habitat areas, the Network is better able to accommodate the space needs of a variety of native species. Property owners within the Network can ensure their land continues to provide good quality habitat by protecting and enhancing the woods, meadows, wetlands and streams on their property.

Easements are one way for property owners to ensure permanent protection of the resources on their land. Easements may be donated or purchased, and are held by a local or state land trust. Local land trusts in Howard County include the Rockburn Land Trust and the Howard County Conservancy, and the state land trust is the Maryland Environmental Trust.

If a property is not yet developed, buildings, roads, driveways, gardens, and other site features can be placed to optimize the space that remains. Site planning that minimizes the area of disturbance and development, preserves large blocks or tracts of undisturbed habitat, minimizes the amount of edge habitat where the forest abuts open or developed space, and maintains connections to adjacent habitat can help maintain the habitat value of the Network.

Properties may sometimes contain plant or animal species that are in need of conservation and are listed by the state as endangered, threatened or rare. An endangered species is defined by state law as any species whose continued existence as a viable component of the state's flora or fauna is determined to be in jeopardy. A threatened species appears likely, within the foreseeable future, to become endangered. A rare species or a species in need of conservation requires conservation measures for its continued ability to sustain itself successfully. The Natural Heritage Program at the Maryland Department of Natural Resources can provide guidance on conserving habitat for these species.

Species often become endangered, threatened or in need of conservation due to the loss or degradation of their habitat. It is important to provide habitats that are rare in the landscape, when possible. In Howard County, rare landscapes include forest interior, meadows, areas of low-growing shrubs and trees, and cold-water streams.

Managing landscapes for habitat value and creating or maintaining rare habitats and recreating linkages among habitat blocks improves biological diversity on a system-wide or regional scale. Biological diversity is generally defined as the variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

Primary Stressors and Threats

There are six primary threats to habitat quality that good management can help to address: loss of habitat and habitat connectivity; property management activities; waste and contaminants; water management impairments; wildlife community imbalance; and non-native invasive species. These threats are discussed in more detail in the following section.

Loss of Habitat and Habitat Connectivity

The County's landscape is a mosaic of habitats of varying value depending on land use. These range from high-value interior forests to low-value parking lots. Wildlife move most freely between habitats of similar value. For example, a forest interior dwelling species such as a pileated woodpecker is more likely to move between patches of forest interior through patches of forest than across agricultural fields. As the connections between like habitats begin to break (a process called fragmentation), the value of both habitats begins to drop. The more isolated a patch becomes from a core habitat such as that found in a hub, the lower the value of the habitat. Over time, urban and suburban development and agricultural activities have fragmented habitats throughout the county, which has isolated plant and wildlife communities and made them more vulnerable to permanent local extinctions by disturbances such as flooding, fire or strong wind storms.

Habitat Connectivity

To conceptualize the significance of habitat connectivity, imagine patches of habitat as stepping stones across a stream channel. If the stepping stones are large and close together, it is easy to walk across and your feet stay dry (high connectivity). The risk of getting your feet wet increases as the stepping stones get farther apart and/or smaller (fragmentation). At a certain point, the stones do not appear to have any value in helping cross the stream, so if you value dry feet, you can no longer cross the stream. As patches of habitat for dry feet, small dry rocks are no longer of value (see Figure 3).

Small patches of forest are not only compromised in terms of their extent, but also by the increased amount of forest that is edge habitat. Forest edges, where the forest abuts open or developed space, are hotter, drier, and more prone to being taken over by invasive species. Many native species cannot or will not live near a forest edge, but instead require interior forest, with its cooler, moister and more isolated habitat. Forest interior species are not adapted to the presence of species that live in edge environments. Edge species can include cowbirds, crows, jays, opossums, raccoons, skunks and domestic dogs and cats. These edge species are often predatory and can reduce the populations of forest interior species such as low nesting birds. Songbirds, for instance, have greatly reduced nesting success in forest edges because that is where brood parasites such as cowbirds are common. Brood parasites lay their eggs in the nest of other birds, and the young intruders are fed by the host parents at the expense of their young. Forest interior species may use habitat closer to the edge if the transition to open space is gradual rather than an abrupt edge.

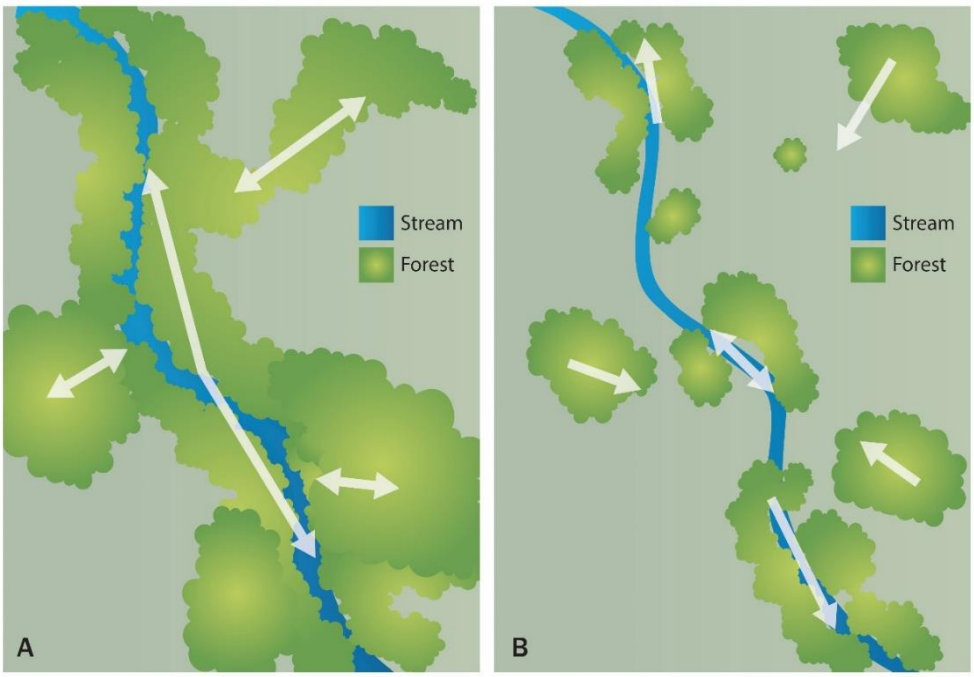

Figure 3. Connected landscapes (A) generally have better habitat value than less connected ones (B). This example shows a riparian corridor that has been fragmented by the loss of forest habitat. Credit: Biohabitats, based on graphic by NRCS.

The Network is specifically designed to respond to the loss of habitat connectivity at the regional scale. The County envisions a living Network of sites that allows animals and plants to migrate across and through the landscape in corridors of high-quality habitat.

Property Management Activities

Every square foot of land has a potential habitat value – a rotting log can host dozens of invertebrates (centipedes, potato bugs, slugs, etc.) which may feed a salamander, a milkweed plant in an urban garden can sustain a handful of monarch caterpillars, a dead tree on the edge of the woods supports invertebrates that are eaten by woodpeckers. Consequently, land management has a direct impact on the abundance and diversity of wildlife inhabiting a space. Habitat values can be compromised by an assortment of routine property management activities, especially if they are performed without consideration for their effects on the ecological systems of a site. Mowing, clearing standing forest for fields or agriculture, and dead tree removal can destroy breeding habitat, remove nesting sites, and reduce the habitat value of a site by destroying cover and foraging opportunities. Other habitat disturbances include unplanned foot trails or informal roads that can cause erosion and fragment existing natural resource areas, as well as dumping trash, contaminants, or even yard waste. Of these, mowing regimes are one of the easiest to alter and control for the benefit of wildlife.

Managing unused open areas for turf by regular mowing reduces available cover and food for local wildlife populations. In addition to the cost of labor, fuel and equipment, regular mowing can have a profound influence on plant and animal diversity. Mowing too frequently, for example, halts the normal successional processes by which a plant community develops and diversifies over time. Instead of

allowing a gradual addition of low-growing woody plants, mowing favors grasses, homogenizes plant heights, and keeps the overall habitat complexity very low, which means limited nesting sites and food sources. The loss of cover is especially important at habitat transitions such as water and woodland edges. Mowing close to ponds and streams directly compromises habitat by forcing animals to access a vital resource without the benefit of shade or cover for protection from predators. Mowing next to ponds and streams also reduces the vegetative buffer that absorbs the overland flow of water during rain events, which reduces water quality and thereby impairs aquatic habitat (see Photo 1).

Photo 1. A restored wetland (left) typically offers ample vegetation for cover at pond edges, whereas mowing to the edge of a pond (right) reduces its habitat value.

Waste and Contaminants

Similar to humans, wildlife are sensitive to physical and chemical contaminants in their habitat, especially those in water. Examples of materials hazardous to wildlife include glass, fishing line and hooks, plastic bags and packaging, bottles, cans, and scrap metal. Fishing line can trap and/or constrict limbs and necks, fishing weights can cause lead poisoning, and broken glass can cut feet. Small animals can become trapped inside containers. Sea life often mistake floating plastic or balloons for food. The plastic mesh around a Christmas tree or on erosion control products and even plastic rings for six-packs can entangle and entrap wildlife, leaving them exposed and vulnerable to the elements or predators.

Contaminants of concern in improperly disposed of trash include household, automobile, and personal care products, including pharmaceuticals, and pesticides. These can suppress animal immune systems, disrupt reproduction, cause mutations, change how animals try to avoid predators, and disrupt thyroid function, which controls metabolism. The higher an animal is in the trophic structure (food chain) of a community, the more likely it is to ingest contaminants. For example, a bald eagle is much more susceptible than a chickadee, because of the accumulation of toxins through the food chain. Aside from being a threat to wildlife health and safety, trash is an aesthetic and structural intrusion on the landscape, occupying space that would otherwise have ecological function.

Water Management Impairments

Naturally vegetated areas such as meadows and forests allow stormwater or runoff from rainfall and snowmelt to flow across the ground and filter slowly through the soil and vegetation before entering nearby waterways. Often the majority of natural flow paths are below the surface in the groundwater. This ensures the waterways receive a steady supply of cool, clean water. As land use changes, these natural flow pathways are disrupted and threaten plants and wildlife by altering the availability of water.

With an increase in impervious cover from buildings, roads, and parking lots, stormwater cannot infiltrate into the ground to reach nearby streams and wetlands (see Figure 4). Instead, the stormwater rushes across the pavement, washing pollutants such as oil, pesticides and salt into nearby storm drains. In older developed areas, this stormwater may be discharged directly to nearby streams through ditches or pipes, which release a torrent of warm, polluted water that erodes banks and the bottoms of the stream channels, dislodging and displacing aquatic life.

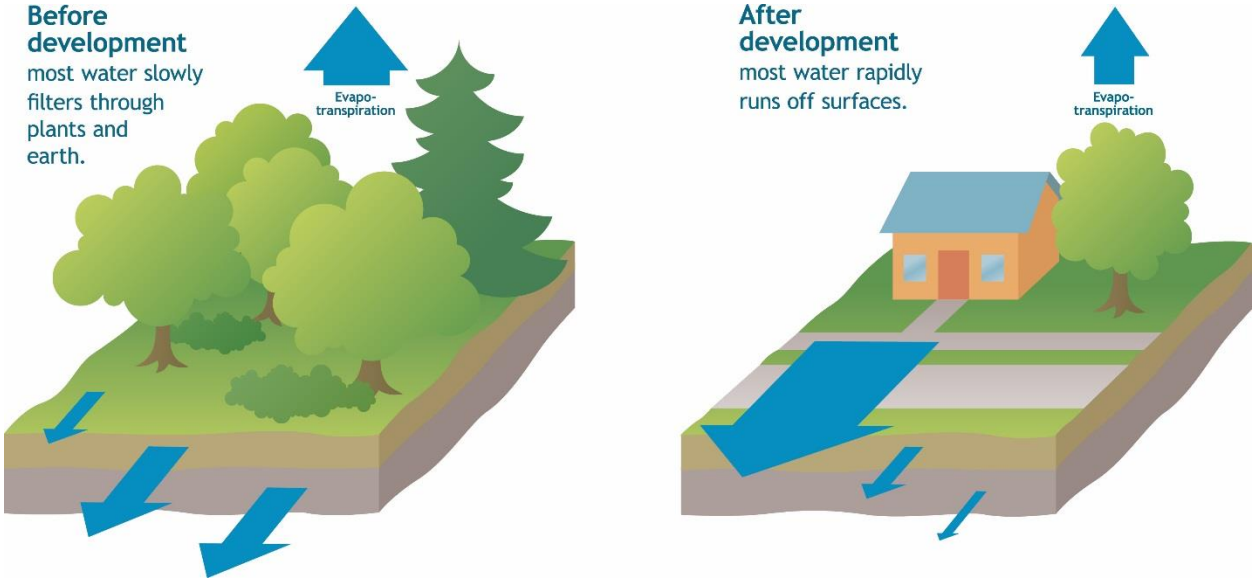

Figure 4. Natural hydrological flows (left) and altered flows after development (right). Credit: Biohabitats.

When unmanaged runoff causes stream channels to cut down or incise and erodes soil from the stream banks, streams cannot easily overflow onto the adjacent floodplain at times of high storm flows. In contrast, most healthy stream systems can readily overflow their banks during storms onto broad floodplains that absorb or at least temporarily hold much greater quantities of water. This is an important function in systems that are subject to flooding, because the floodwaters cause less channel erosion, and sediment and pollutants can settle out of the floodwaters onto the floodplain.

Wetlands can also be damaged by polluted stormwater discharges and changes to their water regime. In the past, ditches or swales were dug in wetlands to quickly drain water and allow the land to be farmed. Plugging or filling these ditches can help restore normal water flows within the wetland.

Streams and wetlands also reflect upstream conditions within their watershed and even continue to do so through time. Some legacy issues such as past land clearing and development with poorly managed stormwater continue to affect downstream stream and wetland health and the diversity of plants and wildlife they support.

Stormwater management has been required in Howard County since 1984, and over time, management measures have improved to better treat the quantity and quality of the stormwater discharging to nearby streams. More recent changes to stormwater management requirements now specify methods of treatment that include onsite retention and infiltration through vegetation and soil to greatly reduce the volume, speed, and contamination of runoff.

Wildlife Community Imbalance

A healthy wildlife community is one where available resources (food, water, cover, space) can sustain the community in dynamic equilibrium over time. Wildlife community imbalance occurs when one or more species knock an ecosystem out of balance through overconsumption or displacement of other species, or disruption of other key habitat features. This is often associated with the presence of non-native invasive species, which outcompete or simply outnumber the native species and disrupt the balance of the system. Sometimes, however, the imbalance can occur with a native species whose control mechanisms have been disrupted or removed.

One striking example of a wildlife community imbalance in Howard County and throughout central Maryland is the overpopulation of native white-tailed deer relative to the space available to support them, which is due to both habitat loss and to the elimination of natural apex or top predators (wolves and mountain lions). These deer thrive in edge habitat, eat vegetation in farm fields and suburban gardens, endanger drivers on our roadways, and serve as a reservoir for ticks and insect-borne diseases.

Dynamic equilibrium

The concept of dynamic equilibrium is similar to a checking account. Resources (money) come in and resources are consumed (bills). Sometimes there is a little more money at the end of the month and sometimes a little less, but on average there is enough. If consumed resources exceed the incoming resources for too long, the system becomes stressed. Over time a new equilibrium may need to be established based on fewer or different resources (for example, need to shift from eating rabbits to mice).

Overabundant deer populations are also having a negative impact on our remaining forests and other natural areas, reducing the populations of many native plants and compromising habitat for a variety of other animals. One of the critical habitat impacts from deer is effects on forest regeneration. Forests in which too many tree seedlings are consumed by deer may become unable to regenerate and develop a stratified vertical structure wherein only the largest canopy trees and an herbaceous groundcover are able to persist (see Photo 2).

The overabundance of deer is simply one symptom of a larger problem. White-tailed deer are overabundant because they have less competition from other browsers and no natural predators left in this region. Disruption of these natural systems of predation and competition is a problem that is not limited to deer. The effects of other imbalances may be less apparent but they are pervasive, and some cause additional problems for humans. For instance, where wetland habitat is degraded or the patch of land is too small to support healthy populations, there might be few or no frogs and salamanders to consume insect larvae, and pests such as mosquitoes are more likely to flourish in puddles and standing water.

Photo 2. Overpopulations of deer can damage plant communities and prevent forest regeneration. Rubbing (L) and browsing young plants (R) prevents them from reaching maturity. Credit: Biohabitats.

Non-Native Invasive Species

Globalization and the easy transport of plants and animals across oceans and over great distances has resulted in the introduction of non-native invasive plants (NNIP) that compete with native plant species. According to the Invasive Plant Atlas, over 1,200 NNIP are present in natural areas of the US. These non-native invasive species are sometimes heartier than natives during times of disturbance and they often have prolific reproduction and growth rates, so they compete with native plants for water, nutrients and space and can even displace the more valuable native plants. NNIP often do not provide the same habitat value as native plants, because they do not provide the same food sources for native wildlife.

Historically some plants were introduced to help prevent soil erosion on public lands before it was understood how destructive they could be in native ecosystems. Disturbed and fragmented habitat patches are especially susceptible to competition from invasive plant species, whereas robust and diverse native plant communities are better able to resist them. Pro-active management of the vegetation in a hub or corridor can reduce the likelihood of it becoming overtaken by invasive plants. Property owners should take care not to introduce or plant NNIP, such as English ivy, bamboo, butterfly bush, Bradford or Callery pear and Norway maple, which are commonly sold at garden centers. Plant Invaders of Mid-Atlantic Natural Areas, published by the USFWS, is an excellent general reference for learning how to identify and control NNIP.

Damaging invasive species can include various types of organisms, and introduced invertebrate pests are among the most harmful. The Emerald Ash Borer (EAB), for example, which appeared in the US in 2002, has required treatment, removal, and replacement of affected native ash trees that has cost over 10 billion dollars according to the US Department of Agriculture (USDA) Forest Service estimates. This invasive, non-native insect species destroys native ash trees when their larvae burrow and feed in the ash bark, eventually damaging the tree's ability to transport moisture and nutrients from the soil to the tree's leaves, causing the tree's decline and death. The EAB is beginning to be an issue for all ash tree species in the region, creating an imbalance in the makeup of regional forests and removing important

habitat for other native wildlife species. This has happened previously in our forests, when the native American Chestnut and American Elm were decimated by the chestnut blight and Dutch elm disease, respectively, both accidentally introduced fungal diseases. The gypsy moth and Asian long-horned beetle are other common and damaging invasive species in our forests. The European starling was introduced to New York's Central Park in the early 1890s and now competes with our native birds for nesting cavities. The northern snakehead fish that was introduced from Asia is a voracious predator that is disrupting natural food webs. Further information on invasive species is available from the University of Maryland Cooperative Extension.

Common Habitat Enhancements

Many properties within the Network could benefit from habitat improvements. A variety of techniques can be used to improve a property's ability to provide food, water, cover and space. Because hubs were identified according to the natural features and without regard to property ownership, private landowners have an important role to play in the management of their habitat value, both for the land they own that falls directly within hubs and as "good neighbors" to the hubs. Landowners can sometimes make simple changes in property management that will save them time and money and increase their property value, while also increasing habitat quality. There are several techniques that are broadly applicable to most properties within the Network:

- Adjust mowing schedules and strategies
- Install bat boxes and bird houses
- Remove trash and contaminants
- Manage stormwater and restore natural flow patterns
- Enhance ponds and wetlands
- Create and enhance vernal pools
- Manage deer populations
- Enhance forests with native species and vegetation management
- Manage non-native invasive plants (NNIP)

These techniques are discussed in general terms in the following sections and the Habitat Management Plans for the individual hubs elaborate upon those that respond to specific threats in the hub. In addition links to supplemental resources on implementation, maintenance and operation of the techniques are embedded in applicable sections.

Adjust Mowing Schedules and Strategies

Hubs usually contain large wetlands and forests, so broad-scale mowing is not a common practice. However, mowing is used in areas such as parks, near ponds and along shorelines and in neighboring lands. The properties adjacent to hubs are critically important to the habitat connectivity that animals experience as they move across a landscape, and mowing sometimes proceeds according to tradition or routine rather than through consideration of the costs and benefits of the activity. Properly timed mowing and rotational mowing can be used to stimulate growth of the native warm-season grasses and

flowers that provide food and cover in the latter part of the growing season. For example, it can be used to control annual weeds, maintain plant communities of different heights, maintain trails, and control woody invasion in grasslands.

In general, mowing should be done only in the early spring (March 1-31) or late summer (August 16-31) to avoid the primary nesting and brood-rearing season for grassland wildlife, including eastern meadowlarks, bobwhite quail, rabbits and deer. Mowing too soon before nesting season reduces the height of wildlife cover, while mowing too late in the season reduces the amount of winter cover (including thermal protection) and possibly winter food supply (seeds and berries). Before the growing season, landowners should decide whether particular species are of special interest on their property, which may affect mowing regimens.

Pond shorelines are often mowed to limit the growth of woody vegetation on the dam or maintain access. Limiting mowing to allow naturalized buffers along ponds provides the added benefit of discouraging nuisance wildlife such as Canada geese, which gather in open grassy areas. Large goose populations can lead to overwhelming amounts of fecal coliform (bacteria) associated with concentrated amounts of their waste washing into the water, but they are less likely to gather in areas with diverse native vegetation along a waterway.

MD DNR provides more information about mowing at http://dnr2.maryland.gov/wildlife/Pages/habitat/wamowing.aspx.

Install Bat Boxes and Bird Houses

The conversion of forest to other land uses and changes in land management practices have greatly reduced the availability of suitable nesting habitat for wildlife that use knotholes or excavated cavities in large dead trees and branches. Loss in this type of nesting habitat can lead to declines in the abundance and diversity of local wildlife populations, especially birds and bats. One strategy to improve the availability of this type of nesting habitat is to install artificial bird houses and roosting structures, which are known as nest boxes. Nest boxes for birds or bat boxes are manmade structures in various forms, shapes and sizes, that meet the nesting requirements of the target species (e.g., eastern bluebird, tree swallow, American kestrel, little brown bat). Nest and bat boxes that are properly installed and maintained in an area with adequate food, water, cover and space improve wildlife reproductive success. Selecting the location and number of nest and bat boxes depends heavily on context. They can generally be used to enhance all types of habitat, depending on the target species. Young forests can be good sites for nest and bat boxes because they often have few standing dead trees for forest interior cavity nesters. Boxes along fencerows and forest edges are good for other species such as bluebirds and swallows. Therefore, each nest box enhancement should begin with identifying the target species.

Once the nest boxes are installed, they should be monitored and maintained on an annual basis. Maintenance includes ensuring the box is in good structural condition and removing old nesting materials, mice, insects and debris that have accumulated.

Larger projects can involve volunteers for construction, installation and/or maintenance and monitoring. The Howard County Department of Recreation and Parks currently maintains and monitors bluebird nest

boxes in several parks. These boxes are maintained and monitored by volunteers and results are reported to a national database, NestWatch.org.

Nest box plans and installation directions are readily available for download from The Cornell Lab of Ornithology at http://nestwatch.org/learn/all-about-birdhouses/. For additional species such as bats, more resources can be found through the Pennsylvania Game Commission at http://www.pgc.pa.gov/InformationResources/GetInvolved/Pages/WildlifeHomePlans.aspx.

Remove Trash and Contaminants

Property owners should ensure that trash is disposed of properly and use wildlife proof storage containers. Some properties may contain dump sites, where previous landowners disposed of trash, often in low lying areas such as wetlands or stream banks. If possible, these dump sites should be cleaned up, but sometimes the trash removal may cause more harm than good, particularly if it leaves an area susceptible to erosion. In these cases, it may be better to remove the top layer of trash and stabilize the area with added soil and native vegetation. Consultation with land management agencies may be helpful to determine the best course of action.

Although the commitment to clean up onsite trash may be significant, getting the job done usually does not require training, experience, or up-front research. It probably will, however, require resources either in the form of time or financial compensation to a contractor. Depending on the size and components of trash deposition, large equipment may be required, which will typically disturb the soil to some degree via tracks and/or digging. In this case, the guidance beginning on page 25, “Enhance Forests with Native Species and Vegetation Management,” and “Manage Non-Native Invasive Plants,” may be useful.

Contaminants are more complicated to address and may require transport to an appropriate disposal area or consultation with the County Health Department for cases where contaminants have entered the soil or water. The nature and source of contaminants will need to be identified, the source discontinued, and the pathway of contaminants ascertained. Cleanup options will depend on the materials affected and which contaminants are of concern.

Manage Stormwater and Restore Natural Flow Patterns

There are many techniques for improving water management in and near the hubs. These techniques are selected for given sites based on the historic pathways of streams and drainages, existing and nearby development, current stormwater management infrastructure, topography, vegetation and cost. When developed areas border the hubs, such as is often the case in the southern and eastern portions of the county, stormwater from offsite is one of the most important habitat threats. Managing hub habitat will sometimes mean improving off-site water management. Techniques can include redirecting drain spouts so flow is across vegetation rather than paved areas, capturing rain water in rain barrels for use in irrigation, installing rain gardens to filter the runoff through vegetation and soils, and establishing forested streamside buffers.

Within the hubs, where streams are severely eroded, stream restoration may be the best way to enhance habitat. Eroded streams with deep channels and high stream banks can be lifted so that the water in the channel overflows the stream banks onto a broad floodplain during storm events. In other

cases, eroded stream banks can be reshaped to form narrow floodplain benches adjacent to the channel (see Figure 5). Restored floodplain connectivity traps fine sediments, engages various ecological processes in the riparian area to store and filter water, and provides breeding habitat for amphibians. Stream restoration can also add meanders or bends to overly straightened streams, stabilize eroding banks, and add pools, rocks, and large woody debris to increase the variety of habitat within the channel. Most stream restoration efforts require the expertise of professionals to select and design the appropriate restoration techniques and require county, state and federal permits.

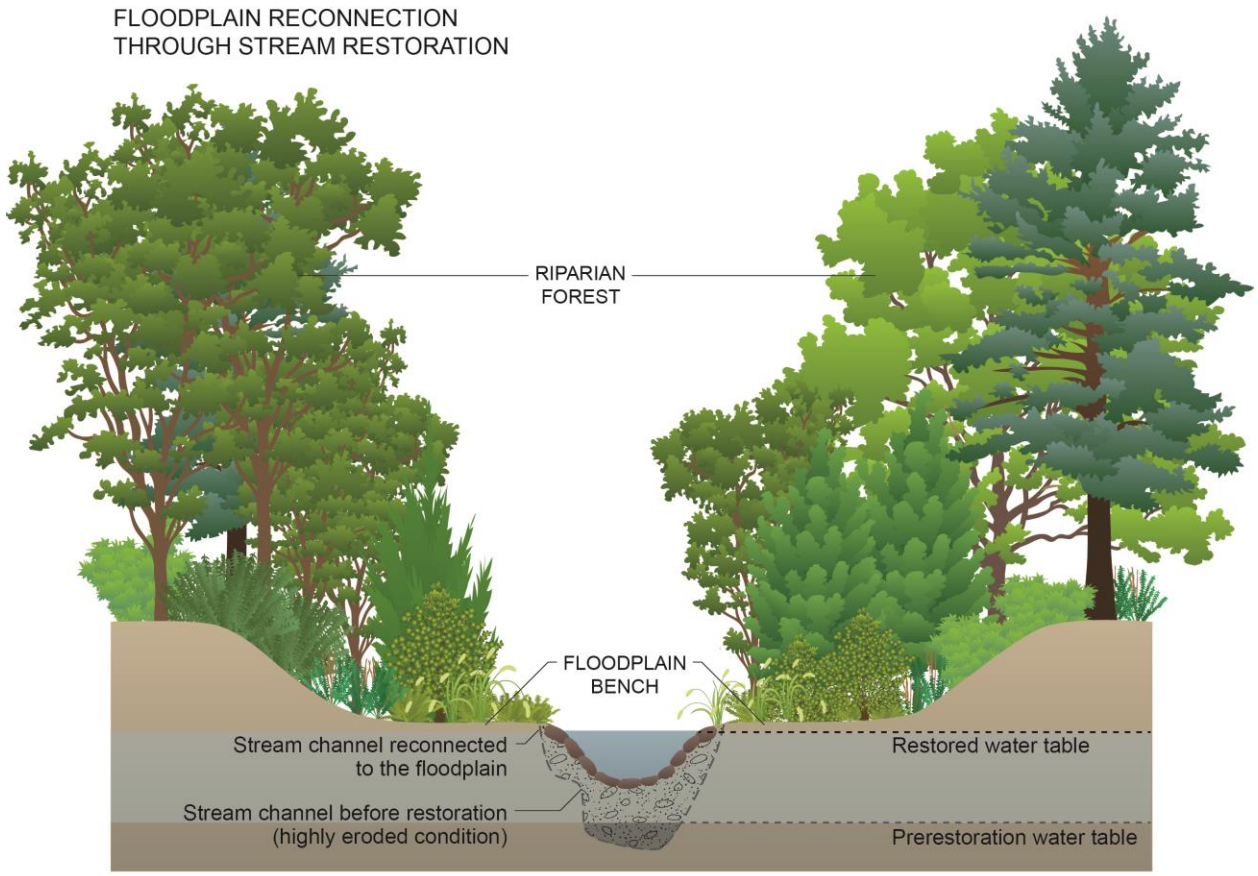

Figure 5. One common goal of stream restorations is to reconnect the stream to its floodplain and recreate the floodplain bench (flat streamside areas that are regularly inundated) of hydric (poorly drained) soils that support water-loving and flood tolerant plant species.

The Clean Water Howard stormwater management program provides information on managing water resources on private land http://www.cleanwaterhoward.com/ .

Enhance Ponds and Wetlands

All ponds and lakes in Maryland were created by dam construction, so they are not a natural feature of the landscape. However, most can still provide valuable habitat and can be enhanced by increasing the variety of habitat within and adjacent to the pond (see Figure 6). Many of these enhancement techniques are also applicable to wetlands with open areas of water.

Ponds with steep edges are inferior habitat. Aquatic wildlife fare better in ponds that have a variety of water depths, including shallow water areas with gradual slope changes used to access the shelter of vegetation, woody debris or rocks. This gives smaller fish a place to escape predation from larger fish, provides macroinvertebrates (insects, snails, clams, worms) refuge from small predators such as crayfish, and provides those small predators refuge from raccoons and other larger predators. There are several techniques for enhancing pond habitats to provide shallows and shelter.

One of the simplest habitat enhancements is supplemental planting of native wetland plant species to increase the diversity of native plants. In addition to providing habitat benefits, establishing fringe or shoreline wetlands and buffers also protects water quality by providing a surface for plants to uptake nutrients and other pollutants and stabilizes the pond edge with dense root mats. Where pond edges are steep or eroded, live-branch layering is a stabilizing technique that weaves branches together to fill holes and slumps and provides a foundation of natural material that can trap soil and support plants.

Floating wetlands can add escape habitat and improve water quality in ponds. They are small man-made islands covered with native wetland plant species that can provide similar wetland habitat functions in ponds, but they are anchored in the safety of open water, which reduces the risk of predation by some more terrestrial species. It is possible to purchase designed installations and also to create them on the small scale, though they must be maintained.

Finally, adding structure along pond or wetland edges in the form of logs and boulders is one of the easiest ways to improve foraging habitat and provide refuge for amphibians and other aquatic organisms. Such structure also provides basking habitat where turtles and snakes can warm themselves, which is important for their metabolism. Land-based wildlife also fare better if they can access ponds from the shelter of shoreline vegetation or other structures that offer cover such as rocks or logs.

See Wetland and Pond Enhancements for more details and links to installation methods.

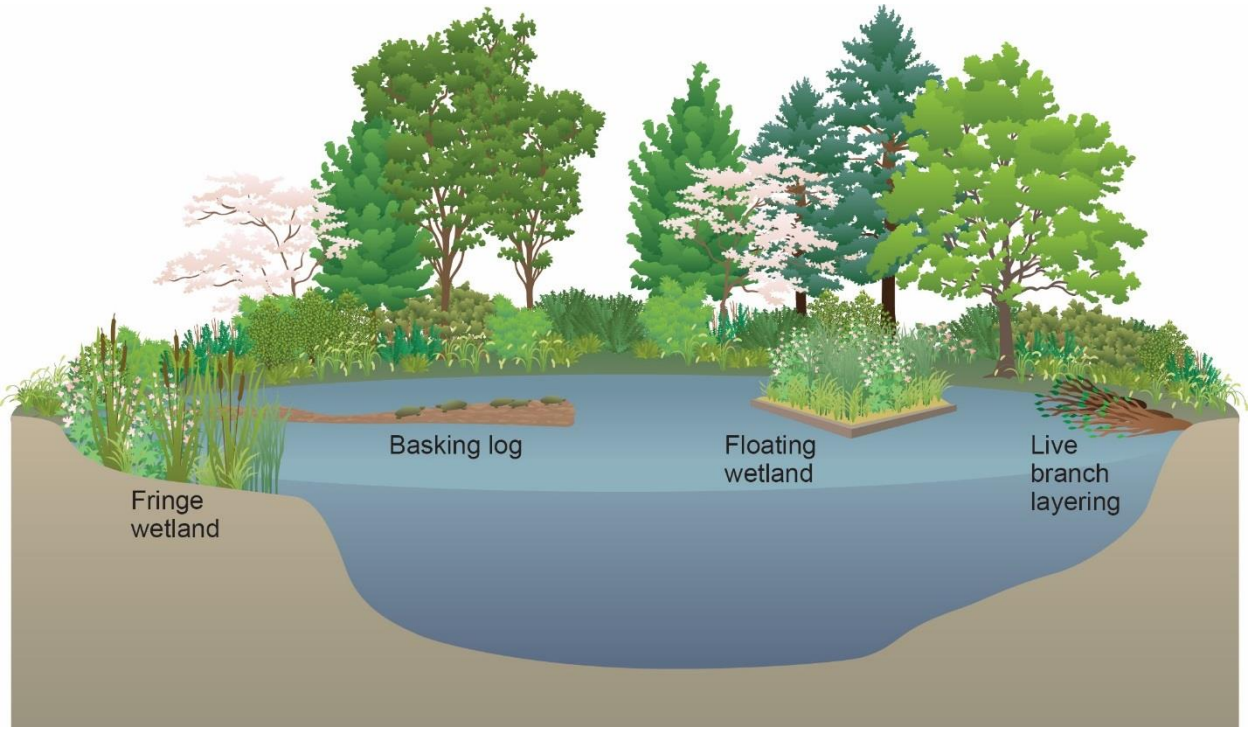

Figure 6. There are a variety of techniques that can be used to enhance the habitat provided by ponds and wetlands.

Outside of manmade ponds, there may be other opportunities to create or enhance wetlands within the hubs. If the hydrology of wetlands has been disrupted, restoring it to a more natural pattern is often the most effective way of enhancing wetlands. For instance, blocking man-made ditches or gullies can create wetlands where water filters into the ground slowly. As the water seeps through the soil it is cleaned and cooled before more slowly discharging to a stream channel. Such wetlands, whether forested, in scrub-shrub habitat, or in meadows, host abundant amphibian populations. Depending on the activity, wetland enhancement may require county, state and/or federal permits, and changing wetland hydrology may require the expertise of professionals, at least in the planning stages.

Create and Enhance Vernal Pools

Vernal pools are shallow, seasonal or temporary wetlands that form when spring rain or snowmelt fills low areas that have poor drainage and are not directly connected to a flowing stream. Vernal pools are small features, typically less than one acre in size. Periodically they dry up, most often in late summer and early fall. In part because they were often drained for agriculture and because they do not enjoy the same level of regulatory protection as streams, vernal pool habitats are rare and threatened across the landscape.

Even small patches with stable vernal pools provide a variety of habitat benefits. The pools provide critical habitat for breeding amphibians and macroinvertebrates because their seasonal nature eliminates the risk of predation by fish and other aquatic predators. To allow insect and amphibian larvae to develop, ninety or more consecutive days of pooled water are needed over the winter and spring. When the conditions are right, a small pool can support breeding activities for hundreds of

amphibians in early spring, and many of the individuals reared in a pool will return to the same pool to breed when they reach maturity. Vernal pools also reduce runoff, capture sediment, and recharge groundwater.

Creating a vernal pool involves design, construction, maintenance and monitoring. Vernal pools can be constructed by making a shallow depression in the soil, and they may or may not require a liner to hold rainfall, depending on the local soils. If small vernal pools are already present, they can usually be enhanced to last more than ninety days and improve breeding habitat for amphibians, generally by deepening or expansion. Factors to consider in the design or enhancement of a vernal pool include existing topography, soils, drainage patterns, and underground utilities (water, gas, sewage pipes). Care should be taken not to disturb existing wetlands and any digging within a wetland or vernal pool will require a federal/state wetland permit. It is possible for a private landowner to design and create a vernal pool, but many landowners will need assistance from experienced consultants or contractors. Creating a vernal pool may also require county, state or federal permits.

The USDA has an excellent resource on how to create vernal pools:
www.watershedconnect.com/documents/science_management_interventions_wetlands

Manage Deer Populations

Since 1999, Howard County has had a Comprehensive Deer Management Plan in place. This plan outlines the growth of the County's deer population and the actions required to manage it so that conflicts with county residents and the harmful effects of deer on natural systems are minimized. The plan includes two categories of management options: both lethal and nonlethal population control measures and techniques to manage deer behavior or prevent access to certain areas.

Controlling deer populations through hunting is often a recommended habitat management strategy. Reducing deer populations improves forest growth in the long run, with attendant benefits to the cover and forage available to wildlife. The County uses hunting to manage deer populations on County parkland and open space. Many hunters are willing to pay or barter goods, services or labor (help on the farm or occasionally skilled services such as those by a licensed electrician) for exclusive permission to hunt on private land. Landowners can develop contracts for how, where and when they allow hunting on their property. Most hunters are respectful and appreciative of the opportunity to hunt.

Property owners considering allowing hunting on their land should be aware that Howard County prohibits the discharge of firearms on properties of less than ten acres within the metropolitan district (the eastern portion of the County) and within 100 yards of the right-of-way of any public road. State law also prohibits the firing of any firearm or bow and arrow within 150 yards of occupied structures without the owner's permission.

Managing deer behavior and preventing their access is possible but not easy or inexpensive. Fencing is an effective but expensive option that reduces the habitat value for other wildlife. Other possibilities that reduce the attractiveness of a property to deer, such as removing preferred food and cover plants, or using chemical repellants or scare devices, also compromise the habitat suitability. In addition, large-scale applications for natural area protection are often financially or logistically impractical.

Additional information about deer management is available from Howard County Department of Recreation and Parks at https://www.howardcountymd.gov/Departments/Recreation-and-Parks/Natural-Resources/Wildlife#Tab_ModuleID_13781_TabID_1395

Enhance Forests with Native Species and Vegetation Management

Forest enhancement comprises a suite of methods for both hubs and neighboring lands, and a strategic approach can be guided by a Forest Stewardship Plan. Many forest enhancement methods focus on increasing and supporting native plant communities, which provide habitat value to wildlife both within the hubs and in neighboring properties.

Landowners near the hubs are encouraged to maintain and, if possible, replace portions of their non-native landscaping with native plant species. This is especially important when planting near naturalized areas. Most native species of wildlife will be best served by communities of native plants that are adapted to the local climate and soils, and therefore require less fertilizer and watering than non-native species to do well. They also tend to be more resistant to insects and disease, so they need less pesticide intervention.

Native plant communities, if allowed to undergo normal succession, are represented by a diversity of grasses, forbs (herbaceous flowering plants), shrubs, and different age classes of canopy-forming trees. Succession is the progression of one plant community to another over time. In Maryland, plant succession typically progresses from grassland or meadow to shrubs then to young forest and ultimately to mature, old-growth forest. Wildlife species have different preferences for the changing conditions in openness, canopy cover and height, plant species assemblages, food availability, and the presence of standing or fallen dead trees that succession brings. Some species, such as ruffed grouse, woodcock, voles, mice, and shrews, require the openness of early forest successional stages. Other species, such as bald eagles, flying squirrels, red-backed voles, and some bats, prefer old-growth forests.

Although forest interior species will avoid edges no matter their species composition, a multi-tiered vegetative structure encourages local wildlife diversity, especially if there is a patchwork of community types that includes fields and woodlands. Edges that transition from forest to more open shrub habitat and eventually to open fields are less harsh and therefore preferred by desirable songbirds, fox, opossum, and raccoon. In contrast, abrupt transitions from forest to hot, bright, open fields deter wildlife and tend to be avoided.

Most forest patches in Howard County have been heavily impacted by non-native invasive plant (NNIP) species and the increased numbers of white-tailed deer. The combination of competition from NNIP and intense browsing from the deer has caused a drastic reduction in the regeneration of desirable canopy tree species and reduced the diversity of understory shrub species. Vegetation management strategies can address these problems, but they are likely to recur if the threats of deer and NNIP are not controlled. Therefore deer exclusion or control and NNIP control should be addressed prior to investment in vegetation management. Where these conditions can be met, vegetation management strategies could include:

- Supplemental Interior Planting – to increase diversity and jumpstart understory development by installing plants that have grown above the browse height of white-tailed deer.
- Supplemental Edge Planting – to provide transitional habitat that supports increased wildlife diversity while improving the quality of forest interior.
- Thinning – the removal of select species with little habitat value in thick stands can offer more of a chance for trees that offer better habitat to grow and promote diversity in tree age classes.
- Soil Enhancement – to supplement planting pit soils to facilitate establishment of native vegetation.

Few forest enhancement activities require permitting, but it is strongly recommended that these activities be done under the guidance of a Forest Stewardship Plan, prepared by a licensed professional forester. A Forest Stewardship Plan prepared with a goal of habitat enhancement, will provide site specific guidance for practices such as NNIP management, thinning and supplemental planting.

Additional information about forest stewardship is available through the Maryland Department of Natural Resources: http://dnr.maryland.gov/forests/Pages/programapps/stewcon.aspx.

Manage Non-Native Invasive Plants (NNIP)

Ideally, property owners and managers should control the NNIP to a level that does not interfere with the diversity of the native plant community and its ability to regenerate. This can include reducing the existing coverage of NNIP and reducing the potential for new invasions of NNIP. For certain NNIP, called noxious weeds, the state mandates their control due to their threat to agriculture.

Factors that facilitate the establishment of NNIP include ground disturbance, mowing, new plant species invasions, and nuisance wildlife herbivory (e.g. the feeding by white-tailed deer, which tend to prefer native plants over NNIP). Many common management activities allow NNIP to flourish, including:

- Mowing along roadways
- Farm field abandonment, which leads to increases in weedy vegetation
- Planting of NNIP in ornamental landscape plantings
- Physical disturbance of the soil and seed bank by clearing and grading

It is important to know which species are NNIP, as many native plants are easily mistaken for non-natives. Also, some plants thought of as “weeds” are palatable to wildlife, such as some nettles and ragweed.

Due to the diversity of NNIP, the strategy to reduce them at each site will likely be multi-faceted and include reducing the risk of spreading NNIP through management, as well as direct control techniques – mechanical, chemical, and biological. Mechanical methods include cutting, mowing, girdling or pulling. Chemical methods include foliar or cut stem herbicide applications. Biological methods include releasing predators or bacterial populations in the NNIP population.

Confronting NNIP varies greatly by species and is generally more expensive for every year the plants are allowed to spread, which means that it may be desirable to start control measures where NNIP are not yet dominant. Control can be especially difficult if NNIP are present on adjacent properties that are not undergoing management efforts, so property owners may wish to coordinate efforts with their neighbors. Because deer tend to prefer native species, overabundant deer populations can impede natural or supplemented regeneration, so NNIP management should occur in conjunction with deer management if both are needed. Although specific permits are not generally required, non-mechanical control methods such as using herbicides are usually regulated to prevent environmental contamination. At a small scale, this may simply mean complying with the directions on the herbicide packaging. While small-scale efforts can be undertaken by a landowner, significant infestations may require volunteer labor crews or professional landscape contractors and licensed herbicide applicators. Once control of NNIP is achieved, ongoing monitoring and follow up efforts are necessary to maintain control.

The National Park Service and U.S. Fish and Wildlife Service regularly update their guide to invasive species, which includes information on 80 species and guidance on their control: https://www.nps.gov/planTs/alien/pubs/midatlantic/index.htm

Habitat Assessment Purpose and Methods

As stated in the Green Infrastructure Network Plan, Howard County's goal is to develop a habitat management plan (HMP) for each of the hubs in its Green Infrastructure Network. This document is one of the first hub HMPs developed for the Green Infrastructure Network, though some of the county and state-owned hubs have existing management plans that address habitat value. Each HMP begins with a site assessment of the hub to identify the natural resources present, their condition and any enhancement and restoration opportunities. The foremost considerations are habitat value in terms of a hub's ability to provide food, water, cover and space, but opportunities to improve stormwater management are an important secondary consideration, given the pervasive effects of poorly managed stormwater.

The Dorsey Wetland Hub was assessed by ecologists in November 2014. This assessment used tailored habitat assessment sheets that included separate forms for site overview, non-native invasive species, and stream and wetland quality. For each forest stand within the hub, the most important features and plant species of the hub were described. The datasheets used for the assessment are provided in Appendix 1.

The following habitat variables were characterized and mapped:

- Wetlands: presence/absence/classification
- Wildlife community: evidence of habitat use through direct observation and spoor
- Stream habitat quality
- Vegetative community and structure
- Non-native invasive species: occurrence inventory

Aerial photography was used to determine initial forest stand boundaries, and then a field survey was used to confirm or adjust the boundaries. Field work was largely structured around vegetation transects, routes through the various forest communities that the ecologists walked to make observations. Biohabitats conducted a qualitative vegetation inventory by classifying the habitats into vegetation communities and walking transects through those communities. While walking these routes, plant species were identified and recorded, along with a relative abundance metric with values of present, common, or abundant.

Forest structure and tree species were examined according to several metrics, including the % closed forest canopy, successional stage, and depth of the litter. Each species of tree was recorded and marked as rare, common or abundant. Height data on the tree species were collected to reflect the vertical structure in height-class layers of herbaceous, shrub, understory, and canopy vegetation (see Figure2). Many species appeared in more than one size class—so, for example, young tulip poplars could occur in the understory and mature ones in the canopy. In addition, the canopy structure was recorded, so that tulip poplars might be recorded as both dominant in the canopy (receiving full sun) and co-dominant (if some individuals were shaded but over 20 feet tall). Tree canopy species were recorded as suppressed if they received little or no direct light and were therefore unable to grow to their full potential. Figure 7 shows the relationships among various crown position classes.

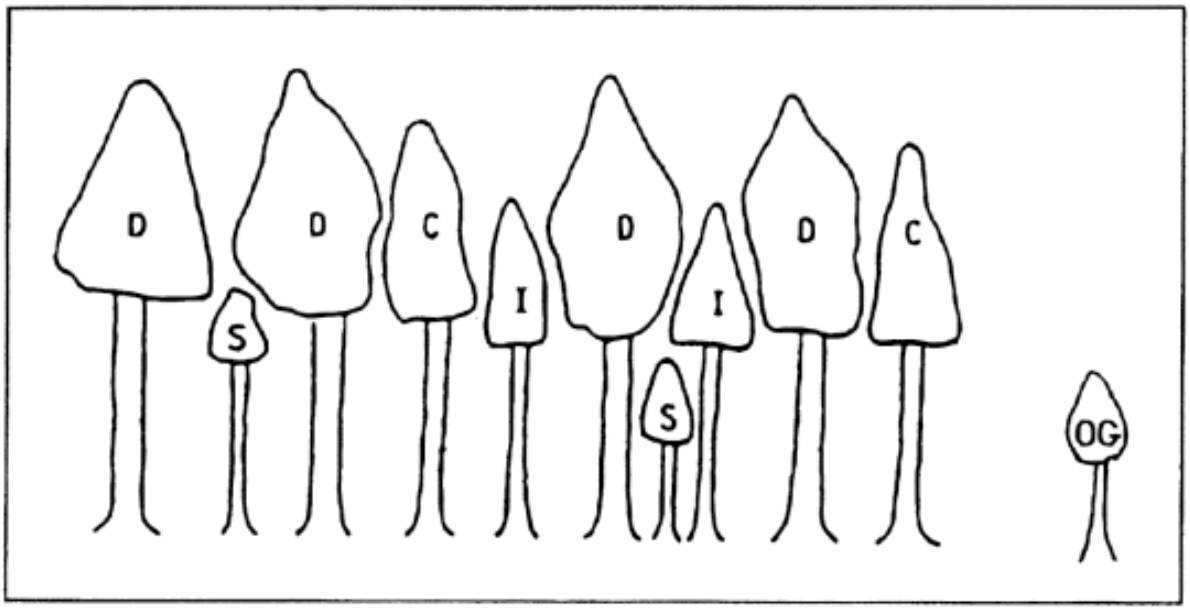

Figure 7. Crown Position Classes: D = dominant, C = codominant, I = intermediate, S = suppressed, OG = open–grown. Dominant trees receive the most light, whereas the codominant class is shaded from the sides. The intermediate class reaches the canopy, but never penetrates up to full sun, and suppressed trees do not reach the canopy level and never receive full sun. Source: https://www.fs.fed.us/psw/publications/documents/gtr-155/06-duriscoe.html

This habitat assessment did not include a wetland delineation for regulatory purposes, but instead captures field observations that were then sketched onto the field maps and represented in Figure 11. The wetlands were assessed according to the US Fish and Wildlife Service classification scheme originally

developed in 1979. The Cowardin system groups wetlands according to their physical (water and soil), chemical (salinity) and biological (vegetation) features. For further information on the Cowardin Classification, refer to *Classification of Wetlands and Deepwater Habitats of the United States* (https://www.fws.gov/wetlands/documents/classwet/index.html).

Stream habitat quality was evaluated using a slight modification of the Maryland Biological Stream Survey (MBSS) Habitat Assessment (http://dnr2.maryland.gov/streams/Publications/R4Manual.pdf), which is broadly applicable and provides a high-quality, standard departure point for an evaluation of instream habitat. Streams are scored according to factors including their substrate (woody debris and pebbles in the streambed that can shelter invertebrates vs. fine sediment as would be washed down in eroded streams), water velocity and depth (diverse versus uniform flow), pool and eddy quality (complexity versus lack of pools), embeddedness (whether pebbles in the streambed are buried in sediment), and shading from overhead vegetation along the streambank. Other observations on the presence of trash and bank erosion were also recorded. Because this protocol was designed to assess the habitat quality of free-flowing streams, the scoring system penalizes stream segments with still, deep pools such as those formed by beaver dams. Although they receive lower scores, pools in some cases do increase the overall habitat quality of a stream by adding structural diversity to the aquatic habitat. Areas with MBSS scores that are incongruous with the quality of the wildlife habitat are noted in the text.

Finally, the relationships among the habitat elements listed above were evaluated to determine habitat suitability and availability. This evaluation guided the management recommendations for the hub.

Dorsey Wetland Hub

Dorsey Landscape Context

The Dorsey Wetland Hub is located in the transition zone between the Atlantic Coastal Plain and Piedmont physiographic provinces in southeast Howard County (see Figure 8), and is a locally important forested wetland complex of approximately 78 acres. It falls within a state-designated Stronghold Watershed that extends into Anne Arundel County. Stronghold Watersheds are home to high numbers of rare, threatened or endangered fish, amphibians, reptiles or mussel species, and are therefore a special focus of conservation efforts. The hub itself, at the convergence of two smaller streams and Dorsey Run, is an important stepping stone and conduit for wildlife habitat connectivity within the Network.

The nearest Network hub is the Guilford Branch Forest Hub to the northwest, which, though separated from Dorsey Wetland Hub by Interstate 95 (I-95), represents an ecologically important patch on the landscape. The corridor between the two hubs follows a stream that flows through an active mining site, Chase Quarry, which is a sizeable ecological disturbance. The stream's flow is impeded by I-95, however a railroad crossing adjacent to the corridor provides some habitat connectivity across the Interstate. The Dorsey Wetland Hub is also connected by a corridor along Dorsey Run to the Anne Arundel County Greenways system to the south.

Zoning and Land Use

The Dorsey Wetland Hub is a finger-shaped stretch of land bounded by Dorsey Run Road to the south and a railroad track to the east. There are 12 property owners that share the hub. Two major property owners are the Howard County Department of Recreation and Parks, which owns a 30.43 acre Natural Resource Open Space parcel in the southwest corner of the hub, and the Maryland Food Center Authority, which owns a parcel of land that runs along the eastern side of the hub.

Dorsey Wetland Hub *At a Glance*	
Size	Approximately 78 acres
Habitat types	Young and Mature Deciduous Floodplain Forest, Mature Mesic Forest, Streams, Wetlands, & Vernal pools
Threats	Manmade drainage ditches; Trash; Overabundant Deer
Management Opportunities	Block ditches; Create vernal pools; Manage Deer; Trash pickup
Habitat Values	
Food	Diverse communities of native plants with high wildlife value and year-round food supplies
	Understory and shrub layer present, but heavily browsed
	Abundant downed woody debris and snags host insects and grubs
Water	Diverse mix of wetlands, vernal pools and stream channels
	Instream habitat is marginal to suboptimal
	A high degree of velocity/depth diversities (fast shallow, fast deep, slow shallow and slow deep) throughout the hub
	Moist bottomland/floodplain soils regulate temperature and host terrestrial organisms all year
Cover	Abundant woody debris, snags and cavities present in all stands
	Complex cover adjacent to and within water features
	Good canopy cover and structure in mature forest
	More shrub cover in young forest with canopy gaps
Space	Habitat refuge from adjacent commercial and industrial developments

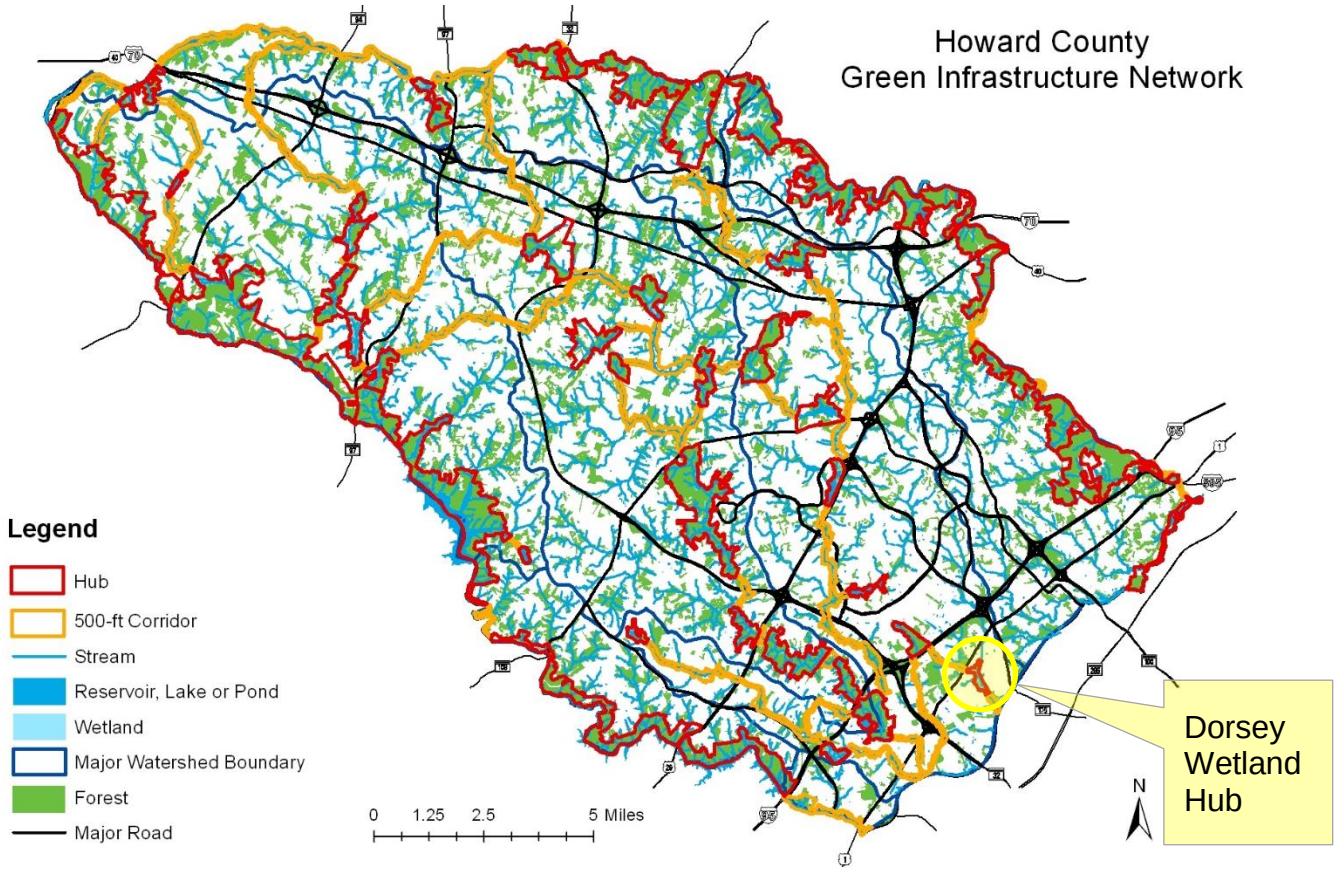

Figure 8. Dorsey Wetland Hub within the context of the Howard County Green Infrastructure Network

Most of the hub is zoned industrial (M-2), as is the majority of the land surrounding the hub. The northern end of the hub, along with the surrounding land in that area, is zoned office/commercial (CE-CLI). There is also a small area of high density residential (R-MH) zoning, with a mobile home park, on the adjacent land to the west of the hub. The hub's other neighbors to the east, southwest and north, are light industries such as Sysco Baltimore and Del Monte Fresh Produce Company. The majority of the hub lies within the 100-year floodplain and therefore does not have development potential.

A major sewer line is located on the east side of the hub, with a branch sewer line running along the Northern Tributary to Dorsey Run. The County periodically clears the sewer line rights-of-way to prevent the growth of woody vegetation. The County is planning a project to increase the capacity of the major sewer line. This project has the potential to at least temporarily disrupt habitat, although mitigation will be required for any loss of wetland habitat.

Dorsey Site Features

Encompassing the confluence of two smaller tributaries with Dorsey Run, the hub is a mosaic of wetland habitat, floodplain forest, and mesic forest. Mesic forests have medium moisture supplies, as compared to wet conditions (hydric) or dry conditions (xeric). Mesic forests are sometimes called upland forests. The land was likely cleared for farming early in Maryland's history, and many of the forest stands are

dominated by similarly aged trees of roughly 12-20" diameter at breast height (DBH), which suggests that clearing activity stopped about 50 years ago.

Topography and Soils

Generally, the Dorsey Wetland Hub is characterized by flat bottomland floodplain soils (see Figures 9 and 10). Hatboro-Codorus silt loams, with slopes of only up to 3%, occupy about 75% of the hub. These are hydric, poorly-drained soils, and the water table is within 6 inches of the surface. Hydric soils are usually found in association with wetlands and stream headwaters. Hydric soils are soils that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part of the soil. Other soils in the hub are mostly Sassafras Series upland soils on the western slopes. They are deep and well-drained, typical of ravines in the Atlantic Coastal Plain. The land neighboring the hub is urban land, with soils that are entirely altered by development.

Wildlife Benefits

The forest and wetlands of the Dorsey Wetland Hub generally provide good habitat for the plants and wildlife. There are a variety of food and water sources, including oak trees that provide acorns for wildlife food. The forest has several layers of vegetation and includes abundant downed wood and standing dead wood to provide cover, structural diversity and nesting habitat. However, the evidence of browse and rub-marks by deer and the absence of understory in some patches suggest that the current structural diversity may be endangered in the future if seedlings and young trees are eaten or prevented from growing by deer. According to an informal, visual assessment, the streams support most of the expected species such as crayfish and aquatic insects. There are signs of beaver (see Photo 3), which is indicative of a robust wildlife population, and the beaver activities can create varied habitat and increase habitat values for other species. Where they are not posing threats to sewer or other infrastructure, beavers are assets to forested wetlands.

Photo 3. Fresh beaver sign observed in Forest Stand 2.

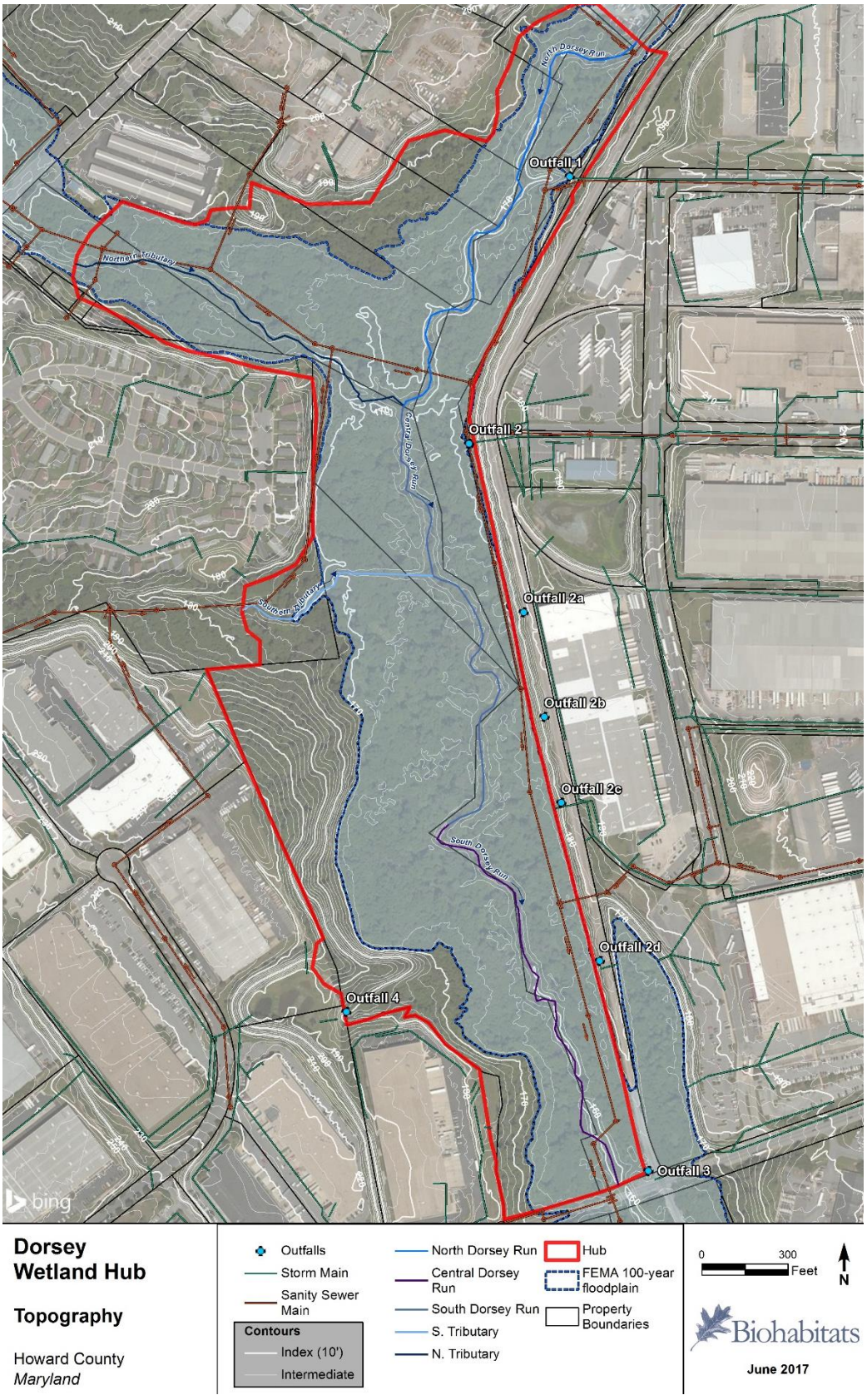

Figure 9. Dorsey Wetland Hub Topography

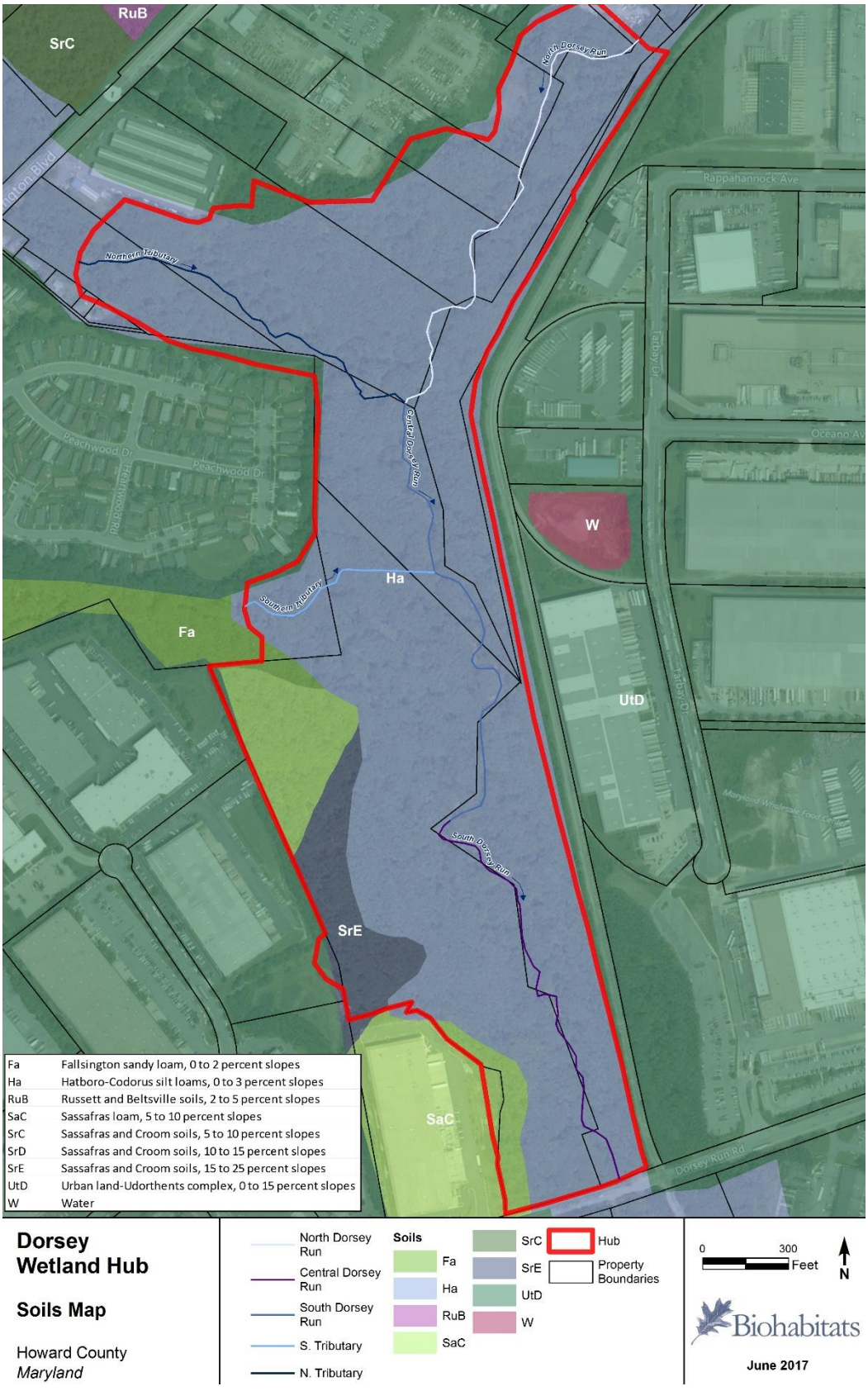

Figure 10. Dorsey Wetland Hub Soils

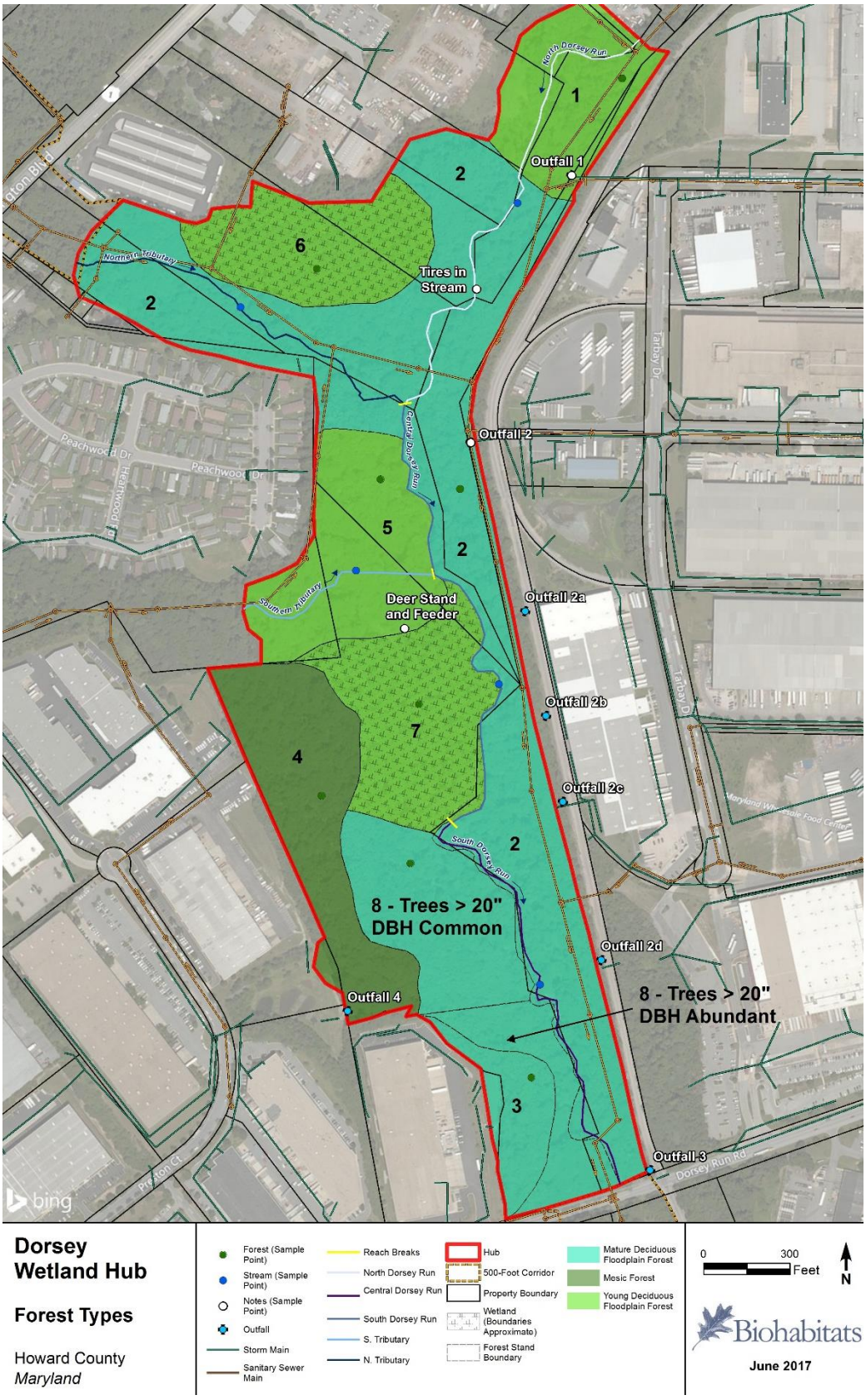

Figure 11. Dorsey Wetland Hub Community Types

Forest Community Types

Dorsey Wetland Hub contains three forest community types, young deciduous floodplain forest, mature deciduous floodplain forest, and mature mesic forest, within eight forest stands. Please see Figure 11 for a delineation of the hub community types and Appendix 2 for a list of the plant species observed in each forest stand.

YOUNG DECIDUOUS FLOODPLAIN FOREST (STANDS 1, 5, 6, & 7)

This forest community occurs in the central and northern portions of the hub, and is part of a stream floodplain/wetland community. These stands mainly consist of young, mixed deciduous, hardwood forest (see Photo 4) containing both areas of open canopy (30-50% closure) and areas of closed canopy (>80% closure). The dominant canopy trees in this forest include >20" DBH pin oak, tulip poplar, sycamore and pignut hickory. In addition to the dominant species, the co-dominant species that comprise the main canopy include a mix of 12-20" DBH white oak, red maple, and green ash. The sub-canopy section of the canopy layer contains <12" DBH young suppressed red maple, pignut hickory, green ash, American beech, sweetgum, swamp white oak, pin oak and American elm. Boxelder, American holly, musclewood and pawpaw are typical understory trees. The shrub layer provides some cover in the form of regenerating green ash, along with winterberry, arrowwood, spicebush and greenbrier. Because the canopy is a little less dense in young deciduous floodplain forest, there is more light, and the layers were healthy despite some deer browse. NNIP within these stands are abundant and include Japanese stiltgrass, ground ivy, multiflora rose, Japanese barberry and Japanese honeysuckle. Woody debris is present, but not extensive in much of this young forest.

Photo 4. Representative young deciduous floodplain forest along the sewer right-of-way.

Stands 6 and 7 contain seasonally flooded, persistent, palustrine forested wetlands (PFO1C according to the USFWS wetland classification) that are dominated by broad-leaved, deciduous vegetation. Although the majority of the hub falls within wetland habitat, as shown on the National Wetland Inventory (NWI) maps, these stands bear special mention because they offer unique habitat opportunities. Stand 6, to the north of the Northern Tributary stream, is dominated by trees of DBH < 12" and appears to have recently converted from a scrub-shrub wetland that likely lost its shrubs as the tree canopy closed over top and shaded out the shrubs. It has some standing water and deep muck in pockets associated with a relic or old stream channel. The areas of shallow (approximately 3" deep) ponded water may provide vernal pool habitat, which may be a significant resource for the local breeding amphibian populations. The southern wetland in Stand 7 likely provides vernal pool habitat as well, particularly in deeper depressions of up to 6" and where trees have fallen over, leaving depressions

where the roots once were. On the other hand, Stand 7 has remnant drainage structures in the form of excavated ditches that lower the quality and extent of the wetland habitat.

MATURE DECIDUOUS FLOODPLAIN FOREST (STANDS 2, 3 & 8)

This forest community occurs within the stream floodplain in the southern, eastern and northern portions of the hub. Some of this forest, particularly in Stand 8, seems to have been drained for agriculture at some point in the past, as evidenced by old drainage ditches. These stands are mature, mixed deciduous, hardwood forest (see Photo 5). The dense canopy of this forest contains dominant >20" DBH tulip poplar, elm, sweetgum, northern red oak, pin oak and green ash within a mix of co-dominant 12-20" DBH red maple, pignut hickory, white oak, sweetgum, green ash and cherry, with a few Virginia pine. Within the canopy layer (trees over 20 feet tall), the sub-canopy contains suppressed <12" DBH red maple, suppressed tulip poplar, as well as boxelder, musclewood and flowering dogwood. There are some areas of dense understory in these stands, containing large numbers of green ash, pignut hickory and boxelder regeneration, along with understory and shrub layer species smooth arrowwood, southern arrowwood, spicebush, young musclewood and greenbrier. Overall, however, the heavily shaded shrub and understory layers are suppressed, that is, stunted and/or absent, because of deer browse pressure. NNIP within these stands are abundant and include garlic mustard, Japanese barberry, multiflora rose, Japanese honeysuckle, Oriental bittersweet and wineberry. Woody debris is present and extensive in some areas of this mature forest. This downed debris is particularly important in Stands 2 and 8, where there are outfall channels or small vernal pools that sustain the moist soil conditions preferred by amphibians.

Photo 5 Representative mature deciduous floodplain forest along the sewer right-of-way

MATURE MESIC FOREST (STAND 4)

This forest community occurs on the western side of the hub on a sloped area adjacent to the floodplain. This stand is comprised of a mature, mixed deciduous, hardwood forest with a canopy dominated by >20" DBH mixed red and white oak species, but also containing 12-20" DBH white oak, red oak and tulip poplar (see Photo 6). The sub-canopy contains <12" DBH red maple, tulip poplar, white oak, beech, black gum, and sassafras. The understory contains red maple, American beech, and some small white oak. The shrub layer is very open, which suggests heavy browse pressure from deer that is limiting plant recruitment and survival, but where present, the shrub layer includes serviceberry, lowbush blueberry, highbush blueberry and holly. Woody debris is extensive in this mature forest, with a few large diameter logs on the ground. Among all of the stands, this one had the fewest NNIP species. Only a few NNIP were found on the edges of the stand.

Photo 6. Representative mesic forest. Note sparse or absent shrub layer.

Stream and Wetland Assessments

For the collection of field data, the stream habitat in the hub was subdivided according to its ecological characteristics. The main stem of Dorsey Run was divided into the segment above the first confluence, the segment from that tributary to the beaver activity, and the stream segment below with its associated vernal pools, the North, Central, and South Dorsey Run segments, respectively. The two un-named perennial tributary streams were evaluated separately as the Northern and Southern Tributaries. In addition to the stream segments, four large stormwater outfall channels draining adjacent commercial properties were identified. Four additional outfalls, which have not formed significant channels, were also mapped.

Photo 7. North Dorsey Run at confluence with Outfall Channel 1

Photo 8. Central Dorsey Run backwatered by beaver dam

North Dorsey Run

North Dorsey Run extends upstream and to the north of the confluence with the Northern Tributary for approximately 1,500 feet before exiting the hub. It is characterized as a slightly incised, perennial, riffle/pool stream with large amounts of woody debris and a predominantly sand bed (see Photo 7). Overall, these characteristics resulted in the stream segment habitat's scoring in the suboptimal range, which is common for streams in developed and urban landscapes, even if they have significant forest buffers at the assessment sites. Significant quantities of trash in the form of tires and other auto parts were observed in and adjacent to the channel. This trash appears to originate from upstream properties outside the hub. When the channel floods, the stream readily transports floating garbage, debris and trash downstream.

Some seasonally flooded/saturated, palustrine, scrub-shrub wetlands (PSS1E) dominated by broad-leaved deciduous plants were observed near the stream. The wetlands generally lacked standing water at the time of the investigation, and no vernal pools were observed. These wetlands may be threatened by future stream channel incision that could lower the local water table.

Central Dorsey Run (South to beaver dam)

Central Dorsey Run is defined by a beaver dam downstream and extends approximately 1,500 feet upstream to the confluence with the Northern Tributary and North Dorsey Run. The Southern Tributary also joins Central Dorsey Run. Central Dorsey Run is characterized as an impounded perennial channel dominated by deep pool habitat with a sand and gravel bed (see Photo 8). Woody debris and submerged rootwads provide structure to the habitat; however, the overall habitat within the stream segment scored in the suboptimal to marginal range. Due to the backwater conditions created by the beaver dam, the stream segment generally lacked riffle/run habitat and the stream flow velocity/depth diversity was dominated by sluggish, deep pool habitat. These habitat characteristics, in part attributable to beaver activity, lower the stream habitat score, but this stream segment does provide some habitat benefits, such as allowing overhanging banks close to the water's surface, which improves the escape habitat and shelter function of the banks. In this section, the stream bed is highly embedded, and the stream segment lacked the flow to flush out the finer materials. Significant quantities of trash in the form of tires and other auto parts were observed in and adjacent to the channel. Due to the dynamic and episodic nature of beaver activities, the character of the channel is likely to change over time.

South Dorsey Run (South to Dorsey Run Road)

South Dorsey Run extends from Dorsey Run Road upstream approximately 1,400 feet to the beaver dam. South Dorsey Run is characterized as a perennial riffle/pool stream with a sand and gravel bed. Woody debris and submerged rootwads provided structure to the habitat; however, the overall habitat within the stream segment also scored in the suboptimal range. The broad channel relative to its wetted width (see Photo 9), heavy sediment load, and bank erosion contributed to this suboptimal score, which is common or even a little better than many streams in urban settings. One exception to the suboptimal score was the epifaunal substrate, which was marginal due to a high degree of embeddedness (70%). Epifauna are aquatic organisms that, instead of burrowing, live on top of the rocks or sediment that

make up the bottom of the stream (substrate). Trash was present in minor amounts within the vicinity of this stream segment.

Photo 9: South Dorsey Run

Seasonally flooded, persistent, palustrine emergent (PEM1C) wetlands were observed adjacent to South Dorsey Run. These wetlands are consistent with the NWI maps. The wetlands are bordered by broadleaf deciduous forests and consist of saturated and shallow (5" deep) ponded areas in ruts along the sewer right of way. The ponding water in these ruts and shallow excavations provide vernal pool habitat, which may be a significant resource for the local amphibian populations. Planned improvements to the sewer line will likely disturb these resources, since the sewer easement will be leveled out for construction access and deep excavations will be necessary for the sewer installation. The regulated wetlands will be restored after construction, but it may take a few seasons for the habitat to fully naturalize and recover from the disturbance.

Northern Tributary

The Northern Tributary is an un-named perennial stream that flows east for approximately 1,200 feet through the hub to its confluence with Dorsey Run at the juncture of the North and Central Dorsey Run sections. It has a riffle/pool dominated channel with a sand and gravel bed. The overall habitat scored within the suboptimal range because of its relatively high degree of embeddedness (45%), likely the result of sediment supplied from bank erosion. Overall the channel is fairly well connected to its adjacent floodplain and the water is less turbid than that of the mainstem. Trash was present in minor amounts within the vicinity of this stream segment.

Southern Tributary

The Southern Tributary is another un-named perennial stream that flows east for approximately 600 feet through the hub to its confluence with Central Dorsey Run. It has a riffle-dominated channel with a sand and gravel bed. The overall habitat scored in the poor to marginal range due to an abundance of sand in the stream bed and lack of flow diversity and structure. The channel is likely incised with limited access to its floodplain and is experiencing some erosion. Trash was present in minor amounts within the vicinity of this stream segment.

Outfall Channels

There are several outfall channels or pipes that drain stormwater runoff from nearby commercial properties to the hub. Four were particularly noteworthy based on their persistence and erosion in the

channel (see Photos 10-13). Outfall 1 drains to North Dorsey Run, Outfall 2 drains to Central Dorsey Run, Outfalls 3 and 4 drain to South Dorsey Run. Outfalls 1, 2 and 3 drain land to the east of the hub and convey flow under the railroad track. Outfall 4 drains land to the west of the hub. Outfalls 1 and 2 are very large and heavily armored with rock and concrete. A hydrological analysis would be necessary to determine whether that degree of armored channelization is necessary to withstand stormwater flows, or whether the channels are overbuilt and might be a retrofit opportunity. The concrete channel at Outfall 1 is breaking up, and there was a large amount of trash and debris along the channel. Outfall 3 is backwatered, which forms a small wetland that may provide some habitat value, but compromises the stormwater function of the outfall. Outfall 4 drains a stormwater management pond to an incised channel that splays out onto the floodplain in Stand 8. Some wetland pockets have formed in scoured areas of the floodplain along the flow path of Outfall 4, but gully erosion that is progressing up the flow path from South Dorsey Run is threatening these areas.

Photo 10. Outfall 1 draining to North Dorsey Run.

Photo 11. Outfall 2 draining to top of Central Dorsey Run

Photo 12. Outfall 3 draining to South Dorsey Run.

Photo 13. Outfall 4 draining to South Dorsey Run.

Four additional outfalls, 2a-2d, drain developments directly east of the hub (see Photos 14 and 15), but the volume of water entering the hub from them seems to be less than in the other four outfalls at present, and minimal erosion or downstream effects were noted. The small channel below outfall 2d was entirely blocked, resulting in a backwatering of the pipe.

Photo 14. Outfall 2c.

Photo 15. Outfall 2d, with silted channel backwatering the pipe.

Current Management

The only known management activity within the hub is periodic clearing along the sewer lines by the Department of Public Works. There is a deer hunting stand located in the center of the hub, but it is not clear how much, if any, deer hunting takes place within the hub.

Primary Threats and Recommendations

Overall, the Dorsey Wetland Hub provides reasonably good habitat for its size, though its elongated shape and proximity to developed areas limit the extent of core interior habitat within the hub. There are three primary threats that could be addressed through management actions: water management impairments, trash, and an overabundance of deer. Non-native invasive plant species are classified as a secondary threat, because the populations of NNIP in the Dorsey Wetland Hub are not yet posing a significant threat to habitat. However, such conditions change quickly, so the appropriate monitoring should be included in habitat management planning.

Additional management actions could also enhance the habitat value of the site, including most of the Common Habitat Enhancements in the second section of this document. Because such activities are not responding to specific, urgent threats, selecting among them would largely depend on the interest and energies of the landowners or other stakeholders. One of the best ways for a landowner to take a structured approach to selecting additional habitat enhancements would be to initiate a Forest Stewardship Plan with the Maryland Department of Natural Resources.

Water Management

Impairments

Ultimately, many of Dorsey Run's hydrological challenges are created by offsite stormwater and water management impairments. In addition, historic uses and drainage ditches have altered the site hydrology. One of the effects of these alterations has been the loss of vernal pools. The combination of changes in the watershed, stormwater flows and alterations to the site hydrology has led to Dorsey Run's becoming both incised and widened via bank erosion, such that today, it has less frequent contact with its floodplain.

These threats can be addressed by managing stormwater by slowing upland flows, restoring and improving water management on site to restore natural flow patterns, creating vernal pools, and stream restoration. Environmental consultants or engineers should be consulted to help evaluate and design any changes to site hydrology. Even if projects can be implemented without equipment or special training, professionals can model the effects of such changes to water flow and upland storage of water, and ensure that the proper local, state and federal permits are acquired.

Slowing upland flows

Although not a management recommendation for land within the boundaries of the Dorsey Wetland Hub itself, addressing stormwater by slowing upland flows is an important recommendation for neighboring property owners. Much of the stormwater flowing into the hub is piped in from nearby commercial and industrial properties. There may be opportunities to retrofit some existing stormwater management facilities so that water is retained or filtered before reaching Dorsey Run. Where flows are not piped, increasing the surface roughness of flow paths by allowing downed wood to remain on the landscape or by allowing the natural regeneration of grasslands can slow water and give it more opportunity to filter into the soil. Whatever the strategy, water that filters through uplands more slowly, with more time in contact with the soil microbes, is better for wildlife and ecosystem health because it discharges more slowly, less violently and water quality is improved.

Restore and Improve Water Management on Site

Within the hub, there are several interruptions of the natural site hydrology that could be repaired to improve wildlife habitat. Old drainage ditches in Stands 7 and 8, likely created to support agriculture, drain water completely from Stand 8 (where there are no wetlands today) and also from Stand 7, where there would otherwise be more extensive wetlands. Blocking or plugging those ditches would allow water to pool and collect on the landscape, expanding the forested wetland habitat that is both an excellent resource for wildlife and rare on the landscape.

Secondly, the outfall channels, mostly found in Stand 2, from adjacent industrial properties that drain directly to Dorsey Run could be similarly obstructed, forcing the water to flow over more area and through the soil to reach Dorsey Run. This would both expand the forested wetland habitat and serve to improve water quality. Consequently, cleaner, cooler water will be discharged into Dorsey Run, buffering its temperature and sustaining a higher baseflow condition. In addition, lower velocity discharges may reduce bank erosion locally at the outfall discharge points.

Create Vernal Pools

There are two major opportunities for creating and supporting vernal pool habitat in the Dorsey Wetland Hub, centered on the two forested wetland patches adjacent to the confluences of Dorsey Run and the Northern and Southern Tributaries. Both have some vernal pools already, indicating that the soils and general hydrological regime are conducive to the development or expansion of vernal pools.

Permits would be required to create the pools, since these areas fall within the 100 year floodplain, and the current utility map should be examined before any expansion of the vernal pool habitat is planned. The in-situ soils at Dorsey can most likely hold water (given the existing pools in the area), so a clay or synthetic liner is probably unnecessary. This may mean that pools can be created without equipment or a complex design process once the appropriate locations and depths are determined. Further information and technical guidance is available in the USDA Vernal Pool Guide:

www.watershedconnect.com/documents/science_management_interventions_wetlands

Stream Restoration

Because of Dorsey Run's streambank erosion and channel incision, which is particularly acute in the North Dorsey segment, there are opportunities to make a more concerted effort at stream restoration, as well. Stream restoration and channel improvements can range from relatively simple interventions such as placing large rocks and downed wood near the banks to increase structural complexity and improve the habitat quality of the channel, to wholescale regrading and erosion control projects that could permanently change the face of the landscape.

However, it should be noted that erosion and incision are the products of offsite hydrologic dynamics, and repairing the stream should be addressed in conjunction with managing offsite stormwater. Without offsite management, reducing bank erosion and channel incision will likely require significant armoring in the form of rock on the stream bed and bank, which provides limited habitat value. As the first step in restoring the streams in the hub, a feasibility study should be performed by an experienced professional to understand the hydrology and hydraulics as they pertain to any stream restoration opportunities and the potential impacts to the existing regulated floodplain, private property and infrastructure. Stream restoration should only be undertaken if it can be demonstrated to provide measurable ecological uplift in the form of better habitat.

Trash

Habitat quality in the Dorsey Wetland Hub is degraded by the extensive presence of trash. In several areas, tires have been dumped into Dorsey Run or they have been washed downstream from areas outside the hub (see Photo 16). At other locations, and throughout the northern section of the hub, there are deposits of large trash items such as automotive parts. The tires and other large discarded items obstruct water flow, are unsightly, and may be releasing unwanted chemicals or contaminants such as heavy metals into the environment through oxidation and weathering.

Photo 16: Trash in North Dorsey Run.

Remove Trash

The County has completed and is still pursuing zoning violations against upstream property owners to remove trash and other materials being stored in the floodplain. However, dumping from easily accessed points such as the sewer right-of-way at Dorsey Run Road continues to be a problem. The multiple storm drain outfalls also appear to be a source of trash. The County and other property owners should continue to monitor the hub to determine if additional actions can be taken to address the trash problem. For example, the adjacent properties could be investigated for ways to reduce trash accumulating and discharging through storm drains and stormwater management facilities into the hub.

Because the trash problems at the Dorsey Wetland Hub are an ongoing issue, the Department of Recreation and Parks holds annual volunteer spring cleanups along Dorsey Run. Such efforts to remove waste from the site improve habitat quality, and perhaps equally importantly, provide an opportunity to seek out and engage partners in stewardship of the site, building environmental awareness and a shared sense of responsibility for the hub.

Unbalanced Communities of Wildlife

Although the effects are not evenly distributed across the hub, in many patches of forest, the dense deer population has created a two-layer forest. Instead of a diverse vegetated structure, the forest consists of a layer of tall canopy trees that the deer are unable to damage, and an herbaceous groundcover that the deer do not eat. The understory and shrub layers have been lost because deer have killed the adult plants and eaten the woody saplings before they were able to grow to maturity. Rubbed and girdled trees can be observed throughout the site.

MANAGE DEER POPULATIONS

At over 75 acres, the site could likely support managed deer hunts within portions of the hub that meet setback requirements for firearm and bow and arrow use. Hunting is not always easy to manage in populated urban areas, so property owner and neighbor permission and education would be an important preliminary step prior to introducing any form of lethal deer control. On the other hand, managed hunts can be a revenue source.

Secondary Threats and Recommendations

In addition to the primary threats, there is also a secondary threat to habitat quality from non-native invasive plants (NNIPs). NNIPs are present throughout the hub in the understory and herbaceous layers (see Table 1), but are more abundant along the forest edges. Overall, their presence is not currently a pressing management concern or priority for investment of resources, because they are not showing signs of rapid expansion or inhibiting forest regeneration. The invasive species that are present are at low levels and distributed across the entire hub, which would make eradication or control a very costly and time-consuming process. Since they are at low densities and native plants would be difficult to establish in their place because of browse of the native plants by the heavy overpopulation of deer, addressing this issue is not a pressing priority. Nevertheless, it does bear mention and observation into the future.

Monitor and Assess Non-native Invasive Species

The forest cover is relatively robust throughout the hub, and there has not been extensive penetration of NNIP species into the forest. Many of the most common invasive plants are present and may dominate in some places, but there is not a current critical problem with invasive species. This may be poised to change in future years, so the best course for the present would be to establish a protocol for monitoring NNIP species and their densities into the future. Annual visual inspections coupled with more detailed plot documentation every five years should be adequate to detect any important changes in the NNIP populations and catch sudden changes or impairments to habitat quality before they become unmanageable. Along with plant species it will be important to monitor any other invasive pests that may be an issue in the region, such as the Emerald Ash Borer.

Table 1. Non-native Invasive plant species observed at Dorsey Wetland Hub.

	Common Name (Scientific Name)	Forest Stand (Abundance/Strata)							
		1	2	3	4	5	6	7	8
Herbs	Garlic Mustard (*Alliaria petiolata*)		P/H						
	Ground Ivy (*Glechoma hederacea*)	P/H							
	Japanese Stiltgrass (*Microstegium vimineum*)	P/H				E/H		E/H	P/H
Shrubs	Japanese Barberry (*Berberis thunbergii*)		P/U	P/U		P/U			P/U
	Autumn Olive (*Elaeagnus umbellata*)		P/U						
	Multiflora Rose (*Rosa multiflora*)	E/UH	E/UH	E/UH	P/U	P/UH	E/UH		
	Wineberry (*Rubus phoenicolasius*)						P/U		
Vines	English Ivy (*Hedera helix*)							P/UH	
	Japanese Honeysuckle (*Lonicera japonica*)	P/UH	E/UH	E/UH	P/UH	E/UH	E/UH		P/UH
	Mile-a-Minute (*Persicaria perfoliata*)					P/UH			
	Oriental Bittersweet (*Celastrus orbiculatus*)		E/UH						
	Abundance: P = Present, E = Extensive Strata: U = Understory, H = Herbaceous								

Glossary of Terms

Baseflow – stream flow as maintained between storms and runoff events by groundwater discharge.

Biodiversity – the variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

Buffer - a vegetated area near a water body that filters stormwater runoff, and helps shade and partially protect the water body from the impacts of adjacent land uses.

Connectivity - the degree to which the landscape facilitates animal movement and other ecological flows.

Diameter at breast height (DBH) – tree diameter measured at 4.5 feet above the ground.

Downed woody debris – dead branches or trees that fall to the forest floor, where they provide habitat for amphibians and host dense concentrations of grubs and other invertebrates.

Dynamic equilibrium – a dynamic equilibrium is a stable balance of processes such as that reached in a mature forest where the numbers of individuals in various age classes stay roughly the same.

Edge habitat – Habitat located at an abrupt transition between habitat types, such as a forest next to a mowed lawn or an agricultural field.

Embeddedness –the extent to which rocks (gravel, cobbles, and boulders) are sunken into the silt, sand, or mud of a stream bottom. Generally, the more the rocks are embedded, the less rock surface is available as habitat for aquatic macroinvertebrates and for fish spawning. Excessive silty runoff from erosion can increase a stream's embeddedness.

Emergent – emergent plants are taller than their neighbors.

Epifaunal substrate - the relative quantity of natural resources in the stream, such as cobble, large rocks, fallen trees, logs and branches, and undercut banks. These features provide feeding locations or sites for spawning and nursery functions of aquatic invertebrates and other organisms.

Floodplain - an area of low-lying ground adjacent to a river, formed mainly of river sediments and subject to flooding.

Floodplain access – a stream has floodplain access if it is able to overflow its banks and saturate the stream-side soil within its floodplain. As a rule of thumb, a functioning stream should access the floodplain every year or two.

Forest Stand - a contiguous community of trees that are uniform in species and age (compared to neighboring communities).

Forage – *v*, search over an area in order to obtain food or provisions; *n*, food for animals.

Forbs – herbaceous flowering plants.

Fragmentation - the division of large blocks of contiguous habitat into small patches.

Forest interior - areas of forest more than 300 feet from the forest edge.

Hydric Soils – soils formed under saturated conditions.

Invertebrate – animals that have no spine, a class that includes all insects.

Incised – rivers and creeks that have cut downward into the riverbed and eroded the bottom of the channel. Incised channels are often the product of rapid stormwater discharge.

Landscape -- includes the physical elements of landforms such as hills and meadows, water bodies such as rivers, lakes and ponds, living elements of land cover including vegetation, human elements including

different forms of land use such as agriculture, buildings and roads, and transitory elements such as lighting and weather conditions.

Mesic - Refers to environmental conditions that have medium moisture supplies as compared to wet conditions (hydric) or dry conditions (xeric). Mesic forests are sometimes called upland forests.

Metabolism - physical and chemical processes needed to maintain life.

Macroinvertebrate - organisms that lack a spine and are large enough to be seen with the naked eye.

Neotropical – of or designating the biogeographic region that includes southern Mexico, Central and South America, and the West Indies.

Palustrine – inland wetlands that do not have flowing water.

Physiographic province – a geographic area in which the geology and climate history have resulted in landforms that are distinctly different from adjacent areas. Howard County's physiographic provinces include the Piedmont, or plateau under the Appalachian Mountains, and the Coastal Plain, which extends down to the Atlantic Ocean.

Rewilded landscaping – rewilded is a landscaping aesthetic that draws on natural looks and allows plants to jumble and overlap in riotous energy. Can be a form of restoration.

Riparian - of or relating to lands adjacent to rivers and streams.

Rootwad – the base of a tree, including the root fan and lower trunk.

Scrub-shrub – a type of wetland dominated by woody vegetation under 20 feet tall including true shrubs and young trees.

Snag – a standing dead tree.

Spoor – animal sign such as scat, tracks, or scent.

Stream flow - water moving down a stream or channel.

Structural diversity – refers to the physical complexity of the habitat. In a forest, structural diversity is high if there is a mixture of species and height classes in the trees. In a waterbody structural diversity is high if there is water of different depths and flow speeds.

Succession – the change in an ecological community over time. For example, after a larger disturbance such as a flood, the first plants to grow on newly deposited sediment might be called a "young" community. Once large, long-lived shade trees are present, the community might be referred to as "mature."

Upland flow - water that moves across a landscape towards a stream or drainage channel.

Urban heat island – a city or metropolitan area that is significantly warmer than the surrounding rural area due to human activities.