St. Mary's College of Maryland
at Historic St. Mary's City

ST. MARY'S COLLEGE OF MARYLAND
Buffer Management Strategy

Biohabitats
Incorporated

Introduction

This document provides key background information on aquatic buffer types, functions and needs, along with distinct strategies for buffer establishment, protection and management for St. Mary's College of Maryland (SMCM). This document is intended to have practical use for SMCM, and may also be useful for engaging other local institutions and regional partners in providing sound buffer management for the campus, the St. Mary's River, its tributaries and related surface waters and wetlands. The information presented here is focused on interpreting and dissecting the most recent aquatic buffer management research for its application to typical rural and suburban settings found in St. Mary's County, Maryland, and consideration of the site-specific conditions of the SMCM campus.

Several decades of scientific research have gradually shed light on the importance of establishing, maintaining, and enhancing vegetated buffers along streams, rivers, lakes, ponds bays and wetlands. Aquatic buffers provide important ecological benefits, but they also provide significant social and economic benefits. In fact, healthy buffers should be thought of as natural capital that adds vitality, complexity and resiliency to our communities.

Research has identified the importance of maintaining the connectivity and complexity of aquatic buffers to sustain and regenerate the dynamic interaction between aquatic and terrestrial landscapes. The demands of institutional needs, and facilities operation & maintenance, expose a set of challenges that require a balance between site use and buffer functional integrity. Education, dialogue, and adaptive management are necessary tools for effectively managing buffers to facilitate a sustainable link between natural and human systems.

The following sections are presented in the document:

- Types of Aquatic Buffers
- Benefits of Aquatic Buffers
- Characteristics of Good Aquatic Buffers
- Buffer Strategy Recommendations
- Operations & Maintenance Considerations
- Glossary of Terms
- References and Resources

Types of Aquatic Buffers

There are four primary aquatic buffer types: 1) non-tidal stream (or riparian) buffers; 2) wetland buffers; 3) pond/lake buffers; and 4) tidal shoreline buffers. In each case, a buffer defines and establishes a vegetated transition zone between upland areas and an aquatic resource—surface water or wetland. It is this unique position in the landscape that enables buffers to influence and mitigate the impacts of one land use on another. In the absence of aquatic buffers, these impacts are magnified and become more damaging.

Stream Buffers

As stream channels meander through the landscape, they shape the land through cycles of erosion and deposition. Riparian areas adjacent to the active channels are needed to provide important hydrological and ecological "rights-of-way," (Figure 1) just as streets and roads have rights-of-way that are used for utility transmission and pedestrian paths. Vegetated stream buffers provide these rights-of-ways and

Figure 1. Example of a stream buffer. Vegetation starts from the stream bank and extends several feet away from stream. The buffer vegetation is comprised of various levels providing a habitat for many species.

help maintain the connectivity between the streams and adjacent floodplains, uplands, etc. Riparian buffers also provide longitudinal connectivity and habitat corridors, which provide important linkages between critical habitats such as forest patches. Riparian buffer widths vary depending on factors such as the size and slope of the stream/river and the quality of the stream and intended buffer functions. Forested riparian buffers are typically preferred over grassed buffers because they provide a broader range of benefits for habitat and water quality.

Figure 2. Example of a wetland buffer. Continuous native vegetation is growing in and around the inundated wet area.

Wetland Buffers

Wetlands are areas saturated or inundated by surface water or groundwater for extended periods during the year and are characterized by special soil types and plant communities (Figure 2). Wetlands are easily impacted by adjacent upland activities that affect their hydrologic budget (i.e., the flows in and out of the wetland). Most communities have requirements that limit direct wetland impacts, but few have recognized the importance and benefits of requiring wetland buffers. Wetland buffers are measured horizontally from the edge of the delineated wetland boundary and protect and enhance important wetland functions, including erosion control, pollutant removal, diversity of wildlife habitat, flood water storage, groundwater recharge, and increased aesthetic value. Wetland buffers also provide a separation that reduces human access to sensitive habitat and discourages dumping. Similar to stream buffers, wetland buffers can vary in size based on factors such as adjacent land use and wetland size, type, quality, and function. From a regulatory perspective nontidal wetlands, including isolated wetlands as well as those connected to other wetlands or nontidal waterways, require a minimum 25 foot buffer from development activities under provisions of the Maryland Nontidal Wetlands Act.

All tidal wetlands, waterways, and their tributaries in Maryland are required to have a minimum 100-ft forested buffer zone under the Critical Area law.

Pond/Lake Buffer

Fish & Wildlife diversity, water quality, and recreational value are directly proportional to the health or trophic state of a lake or pond. Vegetated shoreline buffers are an important feature of ponds and lakes that provide and enhance many functions essential to establishing and maintaining a healthy system. Vegetation composition of the shoreline buffer is also important. While it is common to see many ponds and lakes with turf grass edges, these buffers have limited benefits and often contribute pollutants to the water if they are managed with fertilizers and pesticides/herbicides. More diverse shoreline buffer plant communities that include emergent plants on aquatic benches, shrubs and trees are preferred and result in enhanced ecological integrity, erosion control, pollution filtration, and recreational and property values of ponds and lakes.

Tidal Shoreline Buffer

A tidal shoreline is a strip of land at the edge of an estuarine water body. Tidal shorelines occur along bays, rivers, creeks and ponds and are influenced by the forces of ocean tides into an estuary. The natural functions of a shoreline buffer protect coastal water quality and provide an area of transition for upland and aquatic habitats. Tidal shorelines are subjected to tidal pulses and currents, storm surges, wind, waves and boat wakes as well as run-off and disturbance from up-gradient and overland sources. Vegetated shoreline buffers can protect coastal waters from these influences as well as provide treatment of non-point source pollution through active filtration and uptake of excess nutrients, sediments, and other pollutants. Plant and wildlife communities flourish in the undisturbed environment of a shoreline buffer providing greater ecological value. The habitat diversity achieved through buffering is essential for plant and wildlife communities for movement, cover and food. From a community standpoint, buffers provide aesthetic benefits and low maintenance solutions for protecting shoreline zones and water quality.

Benefits of Buffers

Vegetated aquatic buffers offer a large array of ecological, sociological, and economic benefits to communities. In rural and suburban settings, it can be challenging to balance these benefits with the need for living spaces, working lands (e.g., agriculture) and public services. Often, engineered solutions are pursued that allow for increased development intensity and density adjacent to aquatic resources. Unfortunately, these expensive structural solutions can have limited effectiveness, can exacerbate undesirable conditions, and may simply transfer a problem to another location. In the end, the most ecological, sociological, and economical approach is to set aside an appropriately sized vegetated buffer around aquatic resources. It is helpful to consider the following benefits of aquatic buffers:

Figure 3. Extensive forested buffer along Fishers Creek.

Flooding Control

Flooding is a natural event of stream and river systems essential to floodplain health and maintenance. However, human development can increase the occurrence and severity of floods, often causing property damage. Riparian and other aquatic buffers provide an undeveloped, vegetated, natural area in the floodplain where floodwaters can be slowed, stored and gradually released. The dense vegetation of buffers increases surface roughness of the floodplain and slows the velocity of overland flow while promoting shallow groundwater recharge, depressional surface storage, and vegetative uptake. The reduced velocity and volume of water translates into reduced flood peaks and improved base flows resulting from the slow release of water stored in floodplain soils.

Erosion Control

Channel and shoreline erosion occurs as a result of fast moving and turbulent water coming into contact with erodable and unstable soil surfaces. In rural and suburban settings, erosion is typically associated with uncontrolled stormwater runoff from impervious surfaces or through exposed soil (Figure 4). Hardened and compacted land surfaces contribute to increased volumes and higher velocities by lessening the degree of stormwater infiltration and increasing the rate of runoff. Where erosion occurs, landowners lose property, infrastructure becomes compromised, and habitat is destroyed. Furthermore, as the energy of the water dissipates, the eroded materials are deposited, frequently filling in ponds and lakes, wetlands, and stream channels. These depositional areas carry similar detrimental impacts such as smothered habitats, consumption of flood storage capacities, and fish passage blockages.

A healthy, deep-rooted, vegetated aquatic buffer can effectively dampen energy in the water, slow velocities and promote infiltration. The roots of trees and other woody vegetation promote stable soil and bank structure. Better structure gives the sediment more cohesiveness, protecting it from the erosive forces of water, resulting in smaller amounts of erosion and deposition. Structural diversity of the vegetated buffer can be created and enhanced by having a variety of canopy, sub-canopy, understory, shrub and herbaceous native species.

Water Quality Protection

Aquatic buffers can assimilate pollutants, such as sediment, nutrients, pathogens, and pesticides by filtering surface water and groundwater. Overland flow is slowed by the vegetation, causing larger sediments and the pollutants that adsorb to sediment particles to settle out. Smaller sediments, nutrients, pathogens, and pesticides not removed from surface water will be further removed through groundwater filtration, uptake by vegetation, biogeochemical processes, and microbial processes in the shallow soil profile. Without dense naturally vegetated buffers, common runoff pollutants such as pesticides and fertilizers

Figure 4. A view of St. John's Pond looking toward St. Mary's River. The existing vegetated buffer along the shore provides habitat and stabilization.

Managed Turf Impacts

Land uses associated with large areas of managed turf grass such as golf courses, athletic fields, cemeteries, and lawns are associated with high pollutant concentrations in stormwater runoff. Where these land uses are located next to surface water features or areas of shallow groundwater, water quality protection practices such as aquatic buffers and other pollution prevention measures (e.g., using environmentally friendly products, reducing frequency and rates of application, and selecting appropriate times for application) should be used.

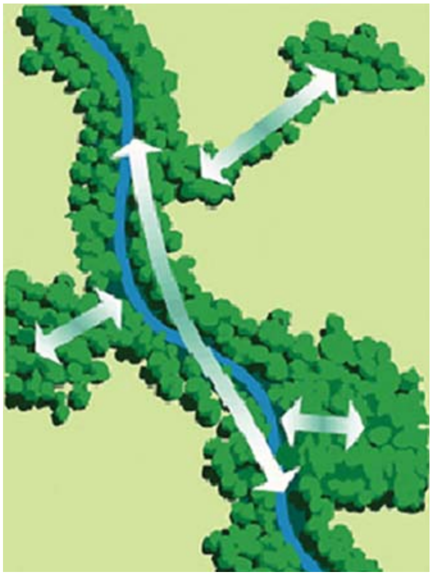


Figure 5. Schematic showing important wildlife corridors provided by buffers (Source: www.rivercare.org/wildlink/wl_corridors.php)

easily find their way into receiving waters and contribute to their impairment. Naturally vegetated pond and lake shoreline buffers also provide effective barriers to excessive resident waterfowl populations, which can contribute significant nutrient and pathogen loads.

Groundwater Recharge/Protection

Groundwater recharge and filtration is another benefit of aquatic buffers ultimately contributing to improved water quality. Vegetated aquatic buffers slow surface flows, which promotes infiltration and vegetative uptake. Pollutants such as nutrients and heavy metals can be reduced or sequestered if groundwater is in contact with roots of vegetation and denitrifying microbes in the soil column. Purification of alluvial groundwater is particularly enhanced when stream beds and banks act as a natural filtration system that reduces pollutant loads of waters that have been slowed and absorbed into adjacent floodplains and floodplain buffers.

Ecosystem Protection

Healthy, diverse aquatic buffers directly provide fish and wildlife habitat. This can include supporting critical habitat (e.g., areas that support rare, threatened or endangered species) to a variety of sensitive aquatic and terrestrial species. Species diversity and abundance translates into more resilient and stable natural systems that are able to adapt to natural and human-induced disruptions. Stable natural systems in turn provide reliable and consistent benefits to human systems.

The location and function of aquatic buffers make them critical links between aquatic and upland ecosystems. Equally important, they can provide continuous habitat corridors that are critical for wildlife movement and access (Figure 5). Too often in urban areas, these important corridors become fragmented, significantly limiting the range of key species and facilitating the presence of opportunistic invasive and predator species. Establishing aquatic buffers in rural and suburban areas can reduce this fragmentation and help maintain important floral and faunal populations on both a local and regional scale.

Natural Capital Value

Vegetated aquatic buffers are a component of the natural capital stock a community has, specifically in terms of the ecosystem services it provides. Natural capital refers to the resources and living systems which translate into value in a similar way as manufactured and human capital services to enhance human welfare and recognize the contribution of natural systems. Quantifying the natural capital value of the ecosystem services that buffers provide is challenging. However, it is becoming more relevant in the age of reducing carbon emissions, protection of water supplies, and endangered species protection strategies.

At a minimum, communities need to realize the presence of natural capital and establish inventories of natural capital stock. For example, aquatic buffers provide aesthetic value because of the natural habitat comprised of diverse flora and fauna. Aquatic buffers offer recreational and educational

Waterway Protection – Buffers as Habitat Thermostats

Buffer vegetation such as trees and shrubs shade the water and help stabilize the water temperature. Shading the water from sunlight decreases the production of blue-green algae, which commonly replaces native food sources. Streams, lakes, and wetlands devoid of vegetation will have higher water temperatures, hindering the reproductive cycles and increasing mortality rates of aquatic species that require cooler water temperatures. Water temperatures are also influenced by direct surface runoff from nearby impervious surfaces. These thermal impacts can be effectively managed by directing the surface runoff to vegetated buffers, allowing it to infiltrate and slowly return to the water body as shallow groundwater flows. Water temperature is inversely proportional to the solubility of dissolved oxygen. Therefore, maintaining cooler water temperatures results in higher dissolved oxygen concentrations, which reduces stress on aquatic species.

opportunities for neighborhoods and schools, promoting healthy lifestyles and enhanced community stewardship and spirit. Aquatic buffers provide cost-effective and reliable human health and safety services such as flood control, erosion control, water quality protection and enhancement, and recreational opportunities that would otherwise cost communities significant amounts of money through engineered or artificial systems. Additionally, provisions of the Critical Area regulations require expansion of the buffer along steep slopes and potential expansion of buffers where there are hydric or highly erodible soils.

Economic Value

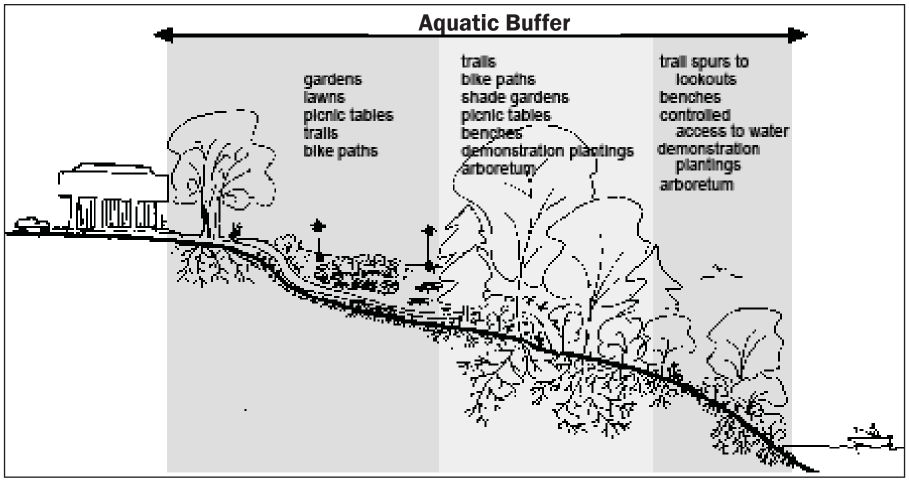
In addition to the natural capital value described above, communities and property owners that establish and implement aquatic buffers typically benefit from increased property values due to the aesthetic appeal of open space. Facilities and amenities next to streams, lakes, rivers or wetlands often have increased property value, and the juxtaposition can have great community benefits as long as the infrastructure doesn't impact or compromise the functions of the buffer. Where buffers are absent from aquatic resources, communities and property owners may be faced with mitigation and repair costs to protect infrastructure and property being impacted by erosion, sediment deposition and floods.

Characteristics of Good Aquatic Buffers

Figure 6. Streamside buffer planting to enhance existing wooded buffer.

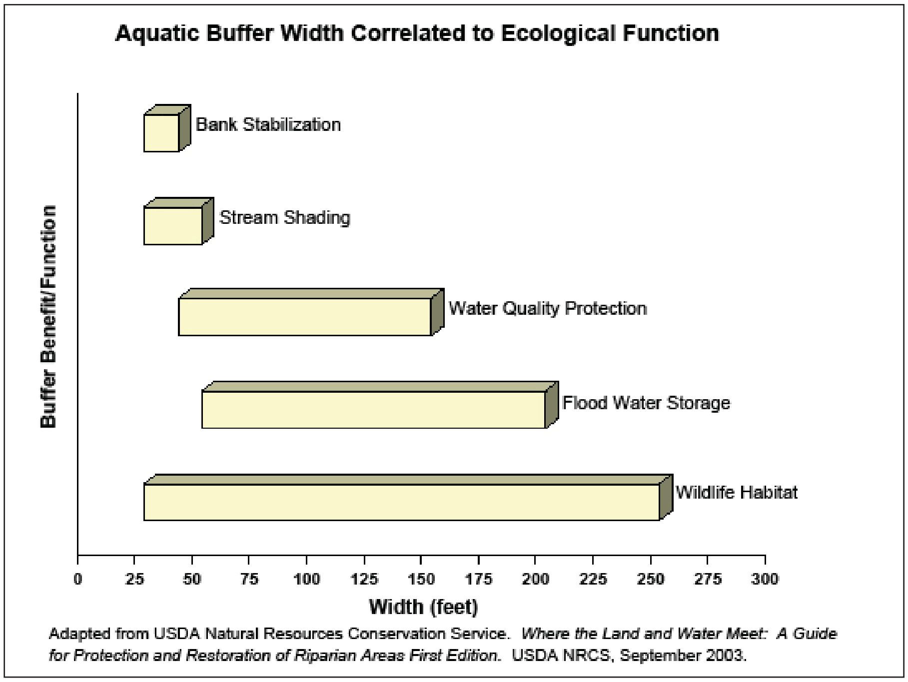
Good aquatic buffers are defined by three primary characteristics – width, vegetative composition, and allowable uses. The most effective buffers are commonly structured with three zones (inner/waterside, middle, and outer), where each zone has a specified width, vegetative composition, and set of allowable uses (Figures 6 and 7).

Adopting a single buffer specification is the easiest approach from a regulatory or administrative standpoint. However, a generic specification may not guarantee the protection of water quality, bank stabilization, and fish and wildlife protection, or accommodate human activities. Rather, buffer guidance and requirements are more effective when they can be adapted to site-specific features and community or regional objectives (e.g., watershed management goals).



Adapted from: CRJC, 2000

Figure 7. Schematic showing potential uses associated with each of the three zones.



Adapted from USDA Natural Resources Conservation Service. *Where the Land and Water Meet: A Guide for Protection and Restoration of Riparian Areas First Edition.* USDA NRCS, September 2003.

Figure 8. Buffer width correlated to benefit/function

Site-specific and unique factors that will influence buffer specifications include stream velocities, wave action, slope, shade, soil characteristics, land use, etc. Minimum criteria can be established to maintain basic buffer functions and avoid encroachment or disturbance.

Width

A substantial body of research exists that correlates aquatic buffer width with ecological function or value (Figure 8). Communities can use this information to help inform them as they establish buffer guidelines and requirements and balance these with the constraints found in rural and suburban settings. Buffer widths can begin with a minimum width based on certain baseline criteria and then be increased (and perhaps decreased) based on site-specific considerations and the goals and objectives of the buffer, e.g., protection of water quality, habitat, etc. As previously mentioned, the Critical Area Law requires specific minimums for buffers: a 100 foot buffer required for all tidal wetlands, waterways, and tributary channels and a minimum 25 foot buffer adjacent to all non-tidal wetlands.

Wetland buffers can be established using a similar minimum width approach that is augmented by site-specific features such as slope, plant and animal species, and soil characteristics and the relationship with a desired function such as nutrient reduction or habitat protection (Table 1).

Table 1. Recommended Buffer Widths for Various Wetland Functions

Wetland Function	Special Features	Recommended Minimum Width (feet)
Sediment Reduction	Slopes (5-15%) and/or functionally valuable wetland	100
	Shallow slopes (<5%) or low quality wetland	50
	Slopes over 15%	Consider buffer width additions with each 1% increase of slope (e.g., 10 feet for each 1% of slope greater than 15%)
Phosphorus Reduction	Steep slope	100
	Shallow slope	50
Nitrogen (Nitrate) Reduction	Focus on shallow groundwater flow	100
Biological Contaminant and Pesticide Reduction	N/A	50
Wildlife Habitat and Corridor Protection	Unthreatened species	100
	Rare, threatened, and endangered species	200-300
	Maintenance of species diversity	50 in rural area 100 in urban area
Flood Control	N/A	Variable, depending on elevation of flood waters and potential damages

Adapted from: Center of Watershed Protection and United States Environmental Protection Agency. Wetlands and Watersheds: Adapting Watershed Tools to Protect Wetlands. United States Environmental Protection Agency, 2005.

Riparian stream and river buffers, and shoreline buffers for ponds and lakes frequently adopted by rural and suburban communities range from 50 feet to 150 feet in width, with 75 feet being one of the more commonly applied widths. For more pristine or natural areas, buffer widths of 200 feet to 300 feet are commonly adopted to provide a higher level of resource protection, establish greenway or habitat corridors, or to support ecosystem functions. Some communities set buffer base widths based on a graduating scale tied to pond or lake surface area, where wider buffers are required as surface area increases. As with riparian and wetland buffers, widths should be expanded to include steep slopes, soil conditions and important habitats. In some rural and suburban settings, it might be reasonable to reduce a buffer if pre-existing development is located close to the shoreline and a consistent shoreline appearance, or a programmatic setback is desired. Since pond and lake surface water elevations can fluctuate, it is important to define the basis or benchmark for buffer delineation. Common delineation benchmarks are bankfull elevation, mean high water level or a designed permanent pool elevation (for engineered impoundments). For tidal bays, rivers, creeks and ponds, a related issue is the documented and projected sea level rise and the potential shoreline zone changes in the coming years and decades.

Where a three-zone buffer is adopted, width requirements and guidelines should also be specified for each zone. These can be accomplished using fixed or minimum width approaches, percentages of the total buffer width, or some combination of these. For example, it is best for the inner/waterside zone of three-zone buffers to have a minimum width requirement of 25 feet (this width might be increased if special site features are present such as steep slopes and soil conditions specified above).

Vegetation Composition

Vegetation composition can have a significant effect on the health, function, maintenance and effectiveness of a buffer. Specifying vegetation for buffers is an important consideration, and it can be influenced by factors such as existing conditions, desired and allowable land use, and aesthetics. As a guiding principle, however, native plants (grasses, shrubs, and trees) should be used to the greatest extent possible. Native plants are the best choice because they are adapted to the climate and relatively resistant to most diseases and insects in the area, leading to a greater likelihood of creating a regenerative (i.e. self-sustaining) ecosystem. Utilizing native plants also provides specific and unique habitat and food sources that are preferred by native wildlife, which in turn contributes to a more robust and diverse ecosystem in challenging rural and suburban settings.

Altering Turf Management

Instead of frequently mowing turf grass areas along streams and ponds, reducing a mowing schedule to an annual frequency can promote the growth of denser, more deeply rooted grasses or other herbaceous plants. This will go a long way toward improving the health of the stream corridor and downstream water resources.

Vegetation composition can vary based on identifying different planting zones within a buffer in conjunction with the three-zone designation illustrated in Figure 7. For example, it is common to see buffers where outer zones (i.e., the buffer zone furthest away from the aquatic resource) are more highly managed and maintained and often are comprised of meadow grasses, herbaceous plants or even turf grass (If sustainably managed). Middle zones are commonly comprised of managed areas of shrubs and trees, and inner zones are dominated by shrubs and trees subject to limited management.

There are different approaches available for buffer establishment, typically dictated by the existing buffer condition and type and locations of wetland or water body. The best and most cost-effective situation is where a naturally vegetated buffer already exists to some extent and the focus is on allowing a natural regeneration of the buffer to occur through succession of native plants, and animal, wind, and insect dispersal. Early successional species will stabilize the riparian zone and eventually be replaced by longer-term species. This natural regenerative process can also be enhanced through beneficial management that includes selective thinning, invasive species management, supplementary native plantings, or reduced mowing practices.

A second approach to buffer establishment is active revegetation, which allows for faster or enhanced results in areas that have little or no beneficial vegetation. In these situations, a more detailed planting plan prepared by a qualified plant ecologist, botanist or landscape architect that targets specific native species to meet certain buffer functions and benefits is warranted. Examples of buffer benefits provided by vegetation types are provided in Table 2.

Native plant lists are available online through the Chesapeake Bay Critical Area Commission, and the Maryland Department of Natural Resources, as well as the U.S. Fish and Wildlife Service (see section entitled "Guidance on Buffer Systems & Planting Buffers" for web links.)

Recommended Uses

In rural and suburban settings it is often a necessity to accommodate multiple uses in aquatic buffer areas. Properly planned and managed buffers can allow for many uses while still providing intended environmental benefits. Similar to the vegetation composition discussion, it is useful to think about allowable and recommended uses within a buffer based on a three-zone approach. Within each zone, certain uses are allowed, with uses becoming more restricted as you get closer to the aquatic resource. Only water-dependent facilities and direct water access are permitted within the 100 foot Critical Area buffers. Conditional approval, or in certain cases a designation as a Buffer Exemption Area, is required for all development activities within the 100 foot buffer including structures, utilities, stormwater facilities, trails and bike paths.

Table 2. Effectiveness of Different Vegetation Types for Specific Buffer Benefits

BENEFITS	Grass/ Perennials	Shrubs	Trees
Stabilize streambanks	░	▓	▓
Filter sediment and the nutrients, pesticides, and pathogens bound to it	▓	▒	▓
Filter nutrients, pesticides, and microbes from surface water	▒	░	▒
Protect groundwater and drinking water supplies	░	▒	▓
Improve overall aquatic habitat	░	▒	▓
Improve wildlife habitat for field animals	▓	▒	░
Improve wildlife habitat for forest animals	░	▒	▓
Moderation of water temperatures	░	▒	▓
Provide visual interest	▒	▒	▓
Protect against flooding	░	▒	▓

░ Low ▒ Moderate ▓ High

Adapted from: Connecticut River Joint Commissions, 2000. *Riparian Buffers for the Connecticut River Watershed: No. 8 Planting Riparian Buffers (and Plant List).*

Buffer Strategy—Recommendations

Recommendations Overview

SMCM requested that Biohabitats prepare specific aquatic buffer management strategies for the campus waterways that their facilities managers reviewed with Biohabitats. There are two levels of concern for buffer management strategy recommendations. The priority buffer strategy needs include St. John's Pond and a non-tidal stormwater management pond along N. Campus Entrance Road. The secondary buffer strategy needs are for other opportunities including Fishers Creek, non-tidal tributary streams, and the St. Mary's River shoreline. There are three main buffer management goals indicated by SMCM staff; these include:

- Ecosystem protection and enhancement.
- Environmental education and stewardship.
- Viewshed Assessment
- Operations & maintenance considerations.

Included within the three goals above are a set of prevailing objectives for the campus buffer management strategies, as follows (and in Table 3):

- Improve water quality and aquatic habitat.
- Improve native biodiversity and fish & wildlife habitat.
- Enhance landscaping aesthetics, safety, and provide access to waterways.
- Demonstrate environmental stewardship and provide environmental education opportunities.
- Reduce landscape maintenance needs, costs, & resource impacts.

The following sub-sections provide detailed buffer management recommendations for St. John's Pond and the non-tidal stormwater management

Figure 9. Selected natural features at St Mary's College.

Table 3. General Buffer Objectives, Benefits and Recommendations for SMCM

Objective	Ecological Benefit	Recommended Buffer Widths**
Improve water quality and aquatic habitat	Nitrogen reduction	100 feet
	Phosphorous reduction	50 feet
	Pesticide / herbicide reduction	50 feet
	Water temperature moderation	50 feet
Improve native biodiversity and fish & wildlife habitat	Maintenance of species diversity	50 – 100 feet
	Bird habitat	130 – 450 feet
Enhance landscaping aesthetics, safety & access	Stakeholder engagement and community access	NA--Follow widths above based on identified ecological objectives
Demonstrate environmental stewardship and provide environmental education opportunities	Student education / ecological "capacity building"; learning by doing & on the ground projects	"
Reduce landscape maintenance needs, costs & resource impacts	Restoring biodiversity, reduce nutrients, pesticides; and carbon budget	"
Maintain important viewsheds	Diversifies habitat & transition areas	Variable

** Buffer widths based on a broad literature review (see "References and Resources" section).

pond. More general recommendations are included for non-tidal tributary streams, Fishers Creek / Wherritts Pond, and the St. Mary's River shoreline. Each sub-section includes buffer zone identification, widths, vegetation types, composition notes, and operations & maintenance (O&M) specifications. Additional overall campus O&M considerations related to buffer strategies are also identified, along with a summary of recommended next steps for sound buffer management.

Figure 10. The stormwater pond along College Drive.

Priority Buffer Strategy Areas

St. John's Pond Buffers

Description

St. John's Pond, a tidal creek embayment on the St. Mary's College campus, is a water body influenced by the tides of the St. Mary River/Chesapeake Bay estuary. This tidal pond is a prominent feature on the campus along MD State Route 5, a main road along the campus, and the pond is near a center of campus activity at the Library and Campus Center. There are maintained landscaping, paths and access roadway areas around the perimeter of the pond. The pond is approximately 650' long on its longest axis by 200-300' wide, and covers a wetted area over 4 acres in size. Water quality conditions in the pond are influenced by land-based stormwater run-off and high sediment loads transported in from the St. Mary's river as evidenced by high turbidity and continually shifting and accumulating sand bars. There are areas of existing woody vegetation on steeper slope areas along the banks and riparian zone; however, much of the adjacent area is mow-maintained or is otherwise part of formal landscaping or infrastructure maintenance. Other associated ecological degradation noted, includes patches of non-native invasive plant species. Tidal fringe marsh areas are present along portions of the pond shoreline.

Figure 11. Aerial view of St. John's Pond.

Primary Concerns

- Water quality/sedimentation in the pond.
- Diminished aquatic habitat.
- Limited terrestrial wildlife habitat.
- Access and selective views.

Buffer Strategy

Establish, augment and restore buffers around the perimeter of the pond to enhance water quality and enhance wildlife habitat, while maintaining aesthetics and access (Table 4; Figure 12). Although this pond is surrounded by well-used campus infrastructure, it is connected to many larger ecological corridors through the adjacent upstream non-tidal stream corridor and the St. Mary's River at its outlet. It should be managed to provide natural woodland, shrub and meadow buffers that support native plant diversity. On the north-western edge of the pond the buffer identified as Zone 2 area would be an area where shoreline restoration would

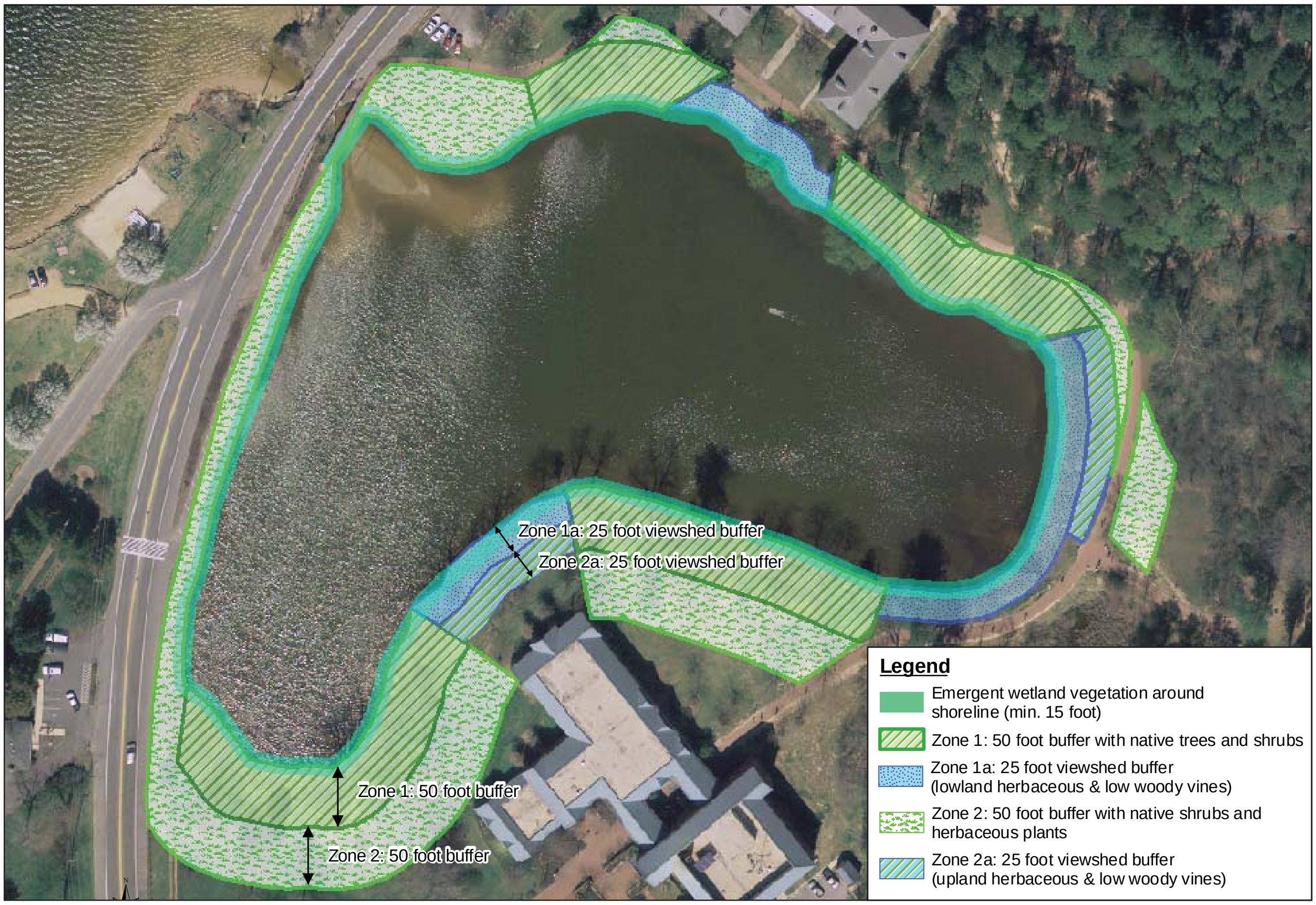


Figure 12. Recommended conceptualized buffer zones for St. John's Pond.

also be advised (Figure 13). The buffer strategy is also intended to improve local wildlife habitats, including neotropical migratory birds, waterfowl, wading birds, amphibians, as well as estuarine fish and invertebrates. Trees, shrubs, grasses, and forbs/wildflowers along the perimeter of the pond can help to keep banks stable, create areas of shade, provide input of vegetative materials, and provide cover for terrestrial and aquatic organisms.

Operations and maintenance recommendations are included in Table 5.

Figure 13. St. John's pond shoreline.

Table 4. St. John's Pond Buffer Zones

Area	Location	Vegetation Types	Notes
Zone 1	Edge of pond to 50' from edge of pond OR intersection with hard infrastructure	Native trees (space and limbed) low shrubs, woodland ground cover	Trees are spaced to accommodate view corridors and access. Low coastal plain shrubs will protect banks and allow lower profile buffer areas
Zone 2	50' from edge of pond to 100' from edge of pond OR intersection with hard infrastructure	Native grasses, wildflowers, and low shrubs and vines	Native landscaping is an important component in form of planting beds, "Bayscape" or other thematic gardens (e.g., butterfly gardens)

Table 5. Operations and Maintenance for St. John's Pond Buffer Zones

Area	O & M Task	Specifications
Zone 1	Active invasive species management Maintained height of native shrubs and prune lower limbs of large trees	Invasive species inventory and suppression on 6-month cycles Periodic, 2-3 year interval pruning of shrubs along selected viewing areas, limited tree limb removal
Zone 2	Limited mowing of grasses	Mow to 6" above ground surface at the end of winter season

Non-Tidal Stormwater Pond Buffers

Description

The stormwater pond to the northeast of Fishers Road on St. Mary's College campus was originally constructed to capture and treat stormwater flows from the upper campus, before draining into the St Mary's River. The pond is approximately 450' long by 120' wide at its widest point, and covers a wetted area of approximately 1 acre. Water quality conditions in the pond appear eutrophic, as evidenced by high turbidity, blue green algae, and aquatic vegetation. This is likely due to the presence of nutrients within the stormwater runoff (or groundwater) entering the pond; the long residence time of water in the pond, which is only able to reach the outlet riser during large storm events; and impermeable soils, which prevent higher rates of infiltration. The current perimeter vegetation maintenance includes mowing turf grass to the edges of the pond shoreline. This provides a well-maintained look, but restricts the establishment of natural vegetation that would help treat direct drainage runoff and provide additional habitat.

Figure 14. Aerial view of stormwater pond

Figure 15. Recommended conceptualized buffer zones for the stormwater pond. Ideally Zone 1 would be 50' and Zone 2 would be 50', but to accommodate programmatic needs for field south of the pond, portions of buffers are suggested at smaller widths along the southern edge.

Primary Concerns

- Water quality in the pond
- Degraded aquatic habitat
- Lack of wildlife habitat
- Lack of aesthetic landscaping

Buffer Strategy

Reestablish buffers around the perimeter of the pond to enhance water quality in the pond, and provide enhanced wildlife habitat and aesthetic native landscaping (Table 8; Figure 15). Because the pond is surrounded by well-used campus infrastructure, it is not connected to any larger ecological corridors, and thus should be managed to promote localized habitats, for aquatic insects, amphibians, and small fish and other wildlife including migratory and resident birds, reptiles and small mammals. Trees and shrubs near the perimeter of the pond can help to regulate temperatures, provide input of vegetative materials, and provide cover for aquatic organisms.

When established with appropriate native vegetation, these buffers will require minimal maintenance. No mowing, irrigation, fertilizers, pesticides, or other treatments are required within the designated buffer zones, with the exception of limited mowing to suppress woody plants in Zone 2 and active invasive species management (see Table 7). Invasive species management is needed for highly invasive species that are present in the area, such as kudzu (Pueraria montana). Invasive species management techniques will include physical/mechanical, chemical (controlled herbicide use) and biological methods. The control method is specific to the species being controlled, as well as the treatment context and setting. (e.g., Special consideration must be paid to infested areas that are adjacent to wetlands or within non-target native vegetation.)

Table 6. Stormwater Pond Buffer Zones

Area	Location	Vegetation Types	Notes
Zone 1	Edge of pond to 50’ from edge of pond OR intersection with hard infrastructure	Native trees and shrubs	Native wetland plantings in the permanently wetted areas may be established to further improve water quality conditions and habitat diversity
Zone 2	50’ from edge of pond to 100’ from edge of pond OR intersection with hard infrastructure	Native grasses and shrubs	

Table7. Operations and Maintenance for Stormwater Pond Buffer Zones

Area	O & M Task	Specifications
Zone 1	Active invasive species management	Invasive species inventory and suppression every 6-months
Zone 2	Limited mowing and / or burning of grasses	Mow to 6” above ground surface at the end of growing season
	Active invasive species management	Invasive species inventory and suppression every 6-months

Secondary Buffer Strategy Areas

Non-Tidal Tributary Stream Buffers

Description

Non-tidal tributary streams on the St Mary's college campus include the tributary to St John's Pond, which flows west into St John's Pond through the campus, originating in agricultural fields east of Mattapany Road. This stream is low gradient, meandering through a well-vegetated, 100' – 150' wide wetland basin below Mattapany Road. Directly upstream of its confluence with St John's Pond, it is intersected by a berm (the walkway accessing the library and campus center), and funneled through a culvert. A wide vegetative buffer exists on both sides of the stream, averaging more than 200' wide on both the right and left banks. Mature woodland, riparian, and wetland vegetation predominates. Although a full assessment of this area has not been performed, the common presence of invasive vegetation in other parts of the campus makes it likely that invasive vegetation also occurs in this buffer area.

The other main tributary stream system in the campus vicinity includes the non-tidal stream channel reaches that flow into Fishers Creek. Intermittent tributaries to Fishers Creek northwest and northeast of the baseball diamond also exhibit wide, relatively undisturbed forested buffers. However, confirmed infestations of kudzu on the south slope of Fishers Creek is evidence that the buffer vegetation is likely impacted by the presence of invasive species.

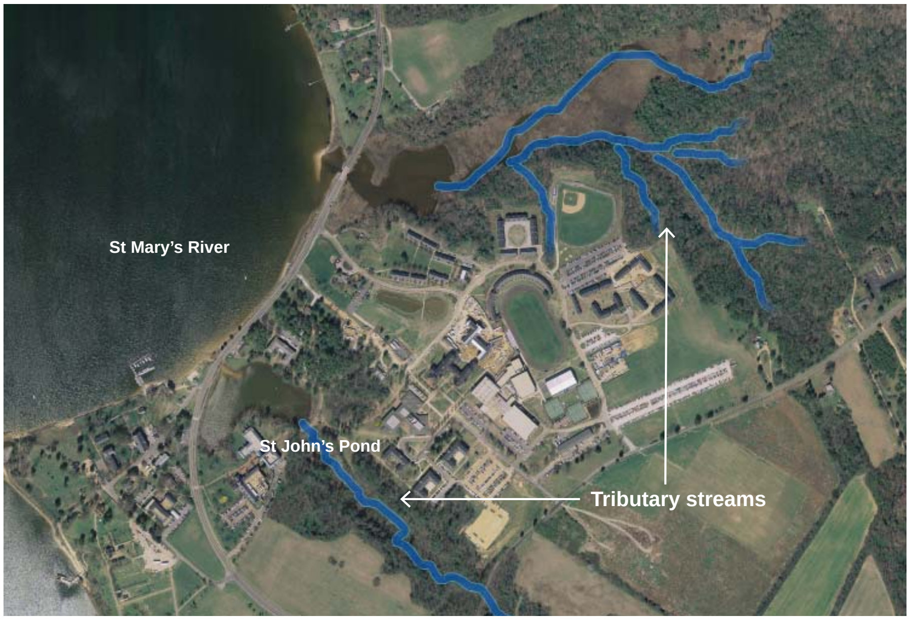


Figure 16. Aerial view of non-tidal tributary streams on the SMCM properties

Figure 17. Wetlands and vegetated buffer along the St. John's Pond tributary.

Primary Concerns

- Maintain width of current riparian buffer areas
- Invasive species

Buffer Strategy

The widths and composition of existing buffers are adequate to provide a large suite of ecological functions, including wildlife habitat, water quality protection, erosion control, and temperature regulation. The existing vegetative buffers on the non-tidal tributaries should be maintained and protected from development or encroachment. However, the threat of invasive species infestation is high, and active invasive species inventory and control is necessary to enhance the ecological function and diversity of these buffer areas.

General Recommendations

No active maintenance is required, with the exception of invasive species management in the currently vegetated areas:

St John's Pond Tributary – Invasive species inventory and suppression every 6 months.

Tributaries to Fishers Creek – Invasive species inventory and suppression every 12 months.

Fishers Creek—Wherritts Pond Buffers

Description

The Wherritts Pond portion of the Fishers Creek system, a tidal creek embayment on the St. Mary's College campus, is a water body influenced by the tides of the St. Mary River/Chesapeake Bay estuary. This tidal pond is a natural feature along the northwest side of the campus. There are maintained landscape areas and an access roadway along one edge of the pond. The pond is approximately 600' long on its longest axis by 100-400' wide, and covers a wetted area over 4 acres in size. There are areas of existing woody vegetation on steeper slope areas along the banks and riparian zone and extensive areas of tidal marsh along the pond and creek edges. Some of the adjoining campus area is mow-maintained or is otherwise part of formal landscaping or infrastructure maintenance. This location has significant occurrence of non-native invasive plant species including an expanding patch of kudzu (*Pueraria Montana;* Figure 20), a highly aggressive and rapidly spreading species, and common reed (*Phragmites australis*).

Primary Concerns

- Non-native invasive plant species
- Water quality/sedimentation in the pond
- Wildlife habitat protection
- Selective views

Buffer Strategy

Establish or augment buffers on the slopes along the edge of the pond to enhance water quality and enhance wildlife habitat, while maintaining aesthetics. Although this pond is influenced only by one edge of the campus, it is part of an important larger ecological corridor including the adjacent upstream tidal creek and non-tidal streams, and the St. Mary's River at its outlet. It should be managed as a native woodland and shrub community buffer. The buffer strategy recommended here is consistent with the St. Johns Pond strategy. Particular attention is needed for invasive species management and control.

Figure 18. Aerial view of Fishers Creek and Wherritts Pond.

Figure 19. Transition from a wetland buffer to a mowed, maintained lawn.

General Recommendations

- Install and manage native tree, shrub, ground cover and grasses/wildflower as recommended for St. John's Pond to protect steep slopes and banks.
- Employ invasive species inventory and suppression periodically.

Figure 20. Kudzu is an invasive plant species - seen here rapidly overcoming other vegetation.

St. Mary's River Shoreline Buffers

Figure 21. Aerial view of the St. Mary's River shoreline.

Figure 22. Existing buffer conditions along the St. Mary's River shoreline. (Sandbags are temporary, pending future shoreline protection project.)

Description

The St. Mary's River shoreline forms the western edge of the SMCM campus, west of Route 5, and it is a major tidal tributary river to the Potomac River and Chesapeake Bay. In some locations the River shoreline is very close to the Route 5 shoulder. There is a significant amount of roadway, bridges and utility infrastructure associated with the interface of Route 5 and the River. However, this shoreline zone is still a very ecologically important part of the campus and regional aquatic environment. A portion of the River shoreline has previously been protected with a shoreline stabilized marsh and stone sill treatment. The shoreline is made up of areas of bare sandy beaches and much of the rest of the vegetated cover is herbaceous grasses and forbs, shrubs and limited trees. There is also a section of shoreline with timber bulkhead and a boathouse complex with a pier and moorings.

Primary Concerns

- Shoreline stabilization
- Infrastructure protection
- Water quality protection
- Aquatic habitat protection
- Recreation, access and aesthetics

Buffer Strategy

The buffering opportunities are extremely limited along this portion of the St. Mary's River due to the roadway and associated infrastructure. Any buffer enhancement also needs to be accompanied by shoreline stabilization (such as breakwaters/sills and fringe marsh), which the College is looking at from a long-term planning standpoint. There are associated limits to the buffer width and composition (e.g., areas suitable for trees and shrubs or woodland zone). The buffer strategy also recognizes long-planned facility improvements including a new boathouse that also provide an opportunity for shoreline ecological improvements. The prevailing state Critical Area requirments are a primary driver for a 100-foot managed buffer zone management for the River shoreline, and are a recognized part of the shoreline and boathouse improvements the College has been studying, planning and designing accordingly.

General Recommendations

- Conserve existing shoreline beach, marsh and buffer habitat.
- Employ low-impact development, sustainable (and regenerative) project design and construction for any future shoreline development.
- Incorporate additional O&M, material storage and handling practices.
- Invasive species management through inventory and periodic control.
- Native landscaping and innovative stormwater management techniques.
- Explore collaborative project and funding opportunities with Maryland SHA and other partners for Route 5 corridor and St. Mary's River shoreline improvements.

The new River Center and rowing facilities are located along a portion of the river shoreline designated by the Critical Area Commission as a Buffer Exemption Area. Although the water-dependent facilities and uses in this area preclude a full vegetated buffer, mitigation offsets for this area are required to be performed elsewhere along the campus Critical Area buffer zone. Required mitigation measures include developing a native buffer planting plan within specified planting densities and establishing a densely planted 25 foot bufferyard.

Maintaining Campus Viewsheds

The primary purposes of buffering wetland and waterway resources are the protection of water quality and ecosystem functions, including the preservation or enhancement of fish and wildlife habitat. Other key buffer functions include infrastructure protection, recreational uses and providing aesthetic amenities including viewsheds. Several campus building areas, including the library and campus center adjacent to St. John's Pond, have important distinct views of the St. Mary's River shoreline zone. In order to provide for the maintenance of these unique views and maintain buffer function, specific buffer planning, design and maintenance approaches are needed. The following are general view corridor protection recommendations for buffers that need to be implemented as landscape plans are developed for specific buffer areas as the area is planted and maintained. These recommendations include:

- Varying the density and spacing of plants, particularly (large and medium) trees which may be tall and full at maturity, in order to allow for the maintenance of viewsheds from prominent points on campus,
- Emphasizing lower height native shrubs and ground cover to provide primary buffering functions along strategic viewsheds,
- And where trees are specified, select native species that can be maintained as they mature to accommodate important view corridors by the pruning of lower branches and limbs, examples include pin oak and loblolly pine.

The specifics of how the buffer landscape achieves viewshed attributes are to be planned and designed by the projects' landscape architect and/or ecological designer.

Buffer Management—Next Steps & Opportunities

To minimize the impacts of campus uses, reduce operations and maintenance, and to realize the low-cost benefits of aquatic buffers, SMCM can take meaningful steps towards establishing and improving aquatic buffers for wetlands and waterways on the campus that are important coastal ecosystem resources for the College community. Several approaches and management opportunities are available to SMCM and other landowners as described below.

Baseline Inventory and Assessment

As a first step, SMCM should establish a current inventory of existing aquatic buffer resources to serve as a baseline condition. SMCM already has a good start on this effort from the Water Quality Comprehensive Plan (Biohabitats, and AMT 2001) produced for the campus. Additionally, a Geographic Information System (GIS) is a powerful tool for developing a baseline map, as it provides both geospatial and database information that is flexible and easy to update. With a baseline data set available, it is then possible to apply regulatory or voluntary buffers around aquatic resources and keep an up-to-date accounting of buffer location, type and condition. Using aerial photos, SMCM staff can conduct simple desktop analyses to identify priority areas to establish buffers as well as track existing aquatic buffer condition and extent over time.

Critical Area Buffer Documentation

Managing buffers in accordance with the requirements of the State Critical Area Law and Commission requirements is an important component of long-term regulatory compliance. This is most important for campus development/ construction projects that trigger Critical Area Commission review; which SMCM has consistently addressed for past and current projects. The Water Quality Comprehensive Plan included maps of Critical Area buffers on all tidal shorelines and adjacent wetland and tributary buffers (100-ft buffers, plus extended areas for steep slopes and erodible soils).This plan was reviewed and commented on by the Commission. Buffer management should be tracked over time, allowing SMCM to have dialogue with the Commission on the buffer status, future projects and comprehensive planning up-dates.

Buffer Project Implementation

Implementing aquatic buffer management projects and strategies involves a range of activities. These activities include changing current vegetation maintenance practices such as mowing, planting of native species in buffer zones and landscaped areas, natural succession management and invasive species control. Specific recommendations for the SMCM by buffer type are provided in the Buffer Strategy Recommendations section of this document. When combined with modified operations & maintenance, monitoring and adaptive management, these steps will help to ensure long-term achievement of the riparian landscape and natural resource protection goals of SMCM.

Pilot Projects

As a first step to improved buffer management it may be advisable to implement one or more pilot projects as a first stage. This approach will allow planning, installing, maintaining and tracking the progress of new techniques. Over time this will allow for better determination of resource needs, and the development of a more refined approach towards buffer management objectives. This process will also help to garner more support and partnering collaboration in pursuit of improved buffers and aquatic resource protection.

Educational Opportunities

Buffer implementation and management involves a number of aspects that can provide educational opportunities. Buffer management can involve implementation activities for students, faculty, staff and community members/citizens groups such as planting, invasive weed pulling, debris clean-up and plant care. Additional educational aspects include informative displays and academic study of buffer conditions and aquatic resource including educational signage and interpretive materials, and experimental design research studies. The research component can include the monitoring of vegetation, water quality and animal species (including fishes, amphibians, and birds).

Operations & Maintenance

Landscape and other infrastructure and facilities maintenance plays a big part in maintaining buffer integrity and protecting aquatic resources, along with potential savings for the O&M budget and available resources. Some key aspects of landscape O&M are as follows:

- Institute mowing and other vegetation maintenance (e.g., periodic pruning) changes and schedule them to be compatible with identified buffer strategies in this document.
- Develop a buffer planting program to include volunteer participation, donations, community involvement, grant funding and fiscal year budget resources, as applicable.
- Prepare and implement a riparian corridor invasive species inventory and management plan to identify priority control needs, techniques/specifications, timing and thresholds.
- Plan and track nutrient management measures to reduce loadings for buffer zones and contributing drainage areas, including fertilization, liming and soil amendments, etc.

Critical Area Buffer Management & Maintenance Guidance

The effective management of the vegetation within the Critical Area Buffer will require regular and ongoing efforts to ensure the viability of these ecologically important areas. The following general management and maintenance guidance measures are recommended for each type of buffer condition corresponding to functional aspects and campus use. While this guidance is not overly prescriptive or exhaustive, it is the suggested minimum effort that will be required to effectively manage campus buffers.

Condition 1
Existing Natural Forested Buffer Areas

- Inspect and monitor for invasive plant species (minimum once per year during growing season).
- Control targeted invasive species using appropriate physical/mechanical and selective stem-cut approved use herbicide treatment.
- Replant buffer voids in areas where invasive species are removed using native species corresponding to layers, including trees, understory, shrubs & ground cover

Condition 2
Existing Non-Forested Meadow or Scrub-Shrub Areas

- Monitor for invasive species the same as for forested buffer areas, and use physical/mechanical, stem-cut or foliar herbicide, treatments accordingly.
- For herbaceous meadow, mow once per year at the end of winter or in early spring.
- For scrub-shrub areas maintenance, prune existing vegetation to a height of 5 feet for viewshed corridors and 8 feet for non-viewshed corridors every 1-2 years to maintain shrub community.

Condition 3
Planted Buffer Areas (zoned as tree & shrub & herbaceous meadow)

- Inspect and monitor for planted vegetation survival/health and invasive plant species.
- Treat invasive species using appropriate physical/mechanical and selective stem-cut or foliar application of approved-use herbicide.
- Conduct supplemental replanting of voids greater than 25 square feet resulting from plant mortality or invasive species management.

Condition 4
Existing Viewshed Corridors & Access Point Areas

In areas identified as valuable viewshed corridors and access points, and where additioinal woodland cover is not to be re-established:

- Conduct limited pruning of existing canopy tree limbs to keep open views below canopy crown (do not damage main beams or leaders).
- Limb-up maturing canopy trees as they grow larger (e.g., prune limbs to about 15-ft up the trunk for a 25-40 ft. tall tree.
- Periodic pruning of shrub layer to a height of 5 feet every 1 -2 years.
- In order to allow natural woodland succession to occur, do not cut or clear small woody seedlings and ground cover.

Guidance on Buffer Systems & Planting Buffers

There are several factors to consider when planting an aquatic buffer. Key considerations include: biological requirements of plants, rate and volume of flow for streamside plantings, maintenance requirements of plants, site preparation, purchasing healthy plants, selecting native species, and planting for function (e.g., deterrence for deer and other wildlife, a living barrier to limit trespassing, erosion control, or aesthetics). More detailed information on native species for planting buffers is provided by the U.S. Fish & Wildlife Service, the Chesapeake Bay Program and the MD Department of Natural Resources at the following website links:

Native Plants for Wildlife Habitat and Conservation in Maryland –
http://www.nps.gov/plants/pubs/chesapeake/

Chesapeake Bay Riparian Handbook: A guide for Establishing and Maintaining Riparian Forest Buffers –
http://www.chesapeakebay.net/pubs/subcommittee/nsc/forest/sect01.pdf

Riparian Forest Buffer Widths –
http://www.chesapeakebay.net/pubs/Buffer_Width_Brief_12_2003.pdf

Riparian Buffer Management: Riparian Buffer Systems –
http://www.agnr.umd.edu/MCE/Publications/PDFs/FS733.pdf

Riparian Forest Buffer Survival and Success in Maryland –
http://dnrweb.dnr.state.md.us/download/forests/rfb_survival.pdf

Riparian Forest Buffer Restoration: Maryland Stream ReLeaf –
http://www.dnr.state.md.us/forests/programapps/rfbrestoration.asp

Glossary of Terms

adaptive management – An explicit, iterative and analytical process for adjusting management and research decisions to better achieve management objectives. Adaptive management recognizes that knowledge about natural resource systems is uncertain. Therefore, some management actions are best conducted as a dynamic (learn as you do) process to find a way to achieve the objectives as quickly as possible while avoiding inadvertent mistakes that could lead to unsatisfactory results.

adsorb – To accumulate gases, liquids, or solutes on the surface of a solid or liquid.

alluvial – Relating to the sand, silt, clay, gravel, or other matter deposited by flowing water, as in a riverbed, floodplain, delta, or alluvial fan.

aquatic bench – Shallow, flat zone along the edge of the permanent pool that is comprised of emergent wetland vegetation that acts as a biological filter.

base flow – That portion of stream discharge derived from groundwater.

biogeochemical – The relationship between the geochemistry of a given region and its flora and fauna, including the circulation of such elements as carbon and nitrogen between the environment and the cells of living organism*s*.

denitrification – The process whereby microbial organisms reduce nitrate and nitrite, highly oxidized forms of nitrogen, into gaseous nitrogen, which in turn is released into the atmosphere.

floodplain – The low-lying land adjoining a river that is sometimes flooded; generally covered by fine-grained sediments (silt and clay) deposited by the river at flood stage.

forest patch - A relatively homogenous forest unit where the composition, structure, and ecological functions are similar.

hydrologic budget – An accounting of the inflow to, outflow from, and storage in, a hydrologic unit, such as a watershed, wetland, aquifer, or lake.

natural capital – An extension of the economic notion of capital (manufactured means of production) to environmental 'goods and services'. It refers to a stock (e.g. a forest) which produces a flow of goods (e.g. new trees) and services (e.g. carbon sequestration, erosion control, habitat).

riparian – of or relating to or located on the banks of a river or stream.

trophic state – Indication frequently associated with ponds and lakes of their biological productivity (i.e., the amount of living material supported, primarily in the form of algae).

References and Resources

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8. USDA Natural Resources Conservation Service. *Where the Land and Water Meet: A Guide for Protection and Restoration of Riparian Areas First Edition.* USDA NRCS, September 2003.
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