

JAMES RIVER PARK NATURAL RESOURCES MANAGEMENT PLAN

JULY 2025

FOREWORD

The James River Park System is one of Richmond’s greatest treasures—a dynamic urban wilderness that provides unmatched opportunities for recreation, education, and connection with the natural world. Stretching over 600 acres along the banks of the James River, this beloved park is more than a scenic landscape; it is a living ecosystem, a cultural touchstone, and a vital community resource. With ever-increasing visitation and growing environmental pressures, the need for thoughtful, proactive stewardship has never been more urgent.

This Natural Resources Management Plan is a critical step forward in ensuring the long-term health and resilience of the James River Park System. Developed with guidance from scientific experts, City staff, and community partners, the plan offers a comprehensive roadmap for conserving the Park’s ecological integrity while enhancing the visitor experience. It addresses pressing challenges such as invasive species, erosion, habitat degradation, and climate change impacts, and it outlines practical strategies for restoration, education, and sustainable use.

The Friends of the James River Park is proud to have funded and supported the development of this plan as part of our ongoing mission to protect and enhance the Park for current and future generations. This investment reflects our deep belief that urban natural areas must be actively cared for—not only for their beauty and biodiversity, but for the countless ways they enrich the lives of Richmond’s residents and visitors.

We are grateful to the City of Richmond’s Parks and Recreation Department for their collaboration and commitment to implementing this plan, and to the many individuals and organizations whose input helped shape its vision. Together, we are laying the foundation for a more resilient, accessible, and ecologically vibrant James River Park System. We look forward to working with our donors, philanthropic partners, and local corporations to implement the ambitious goals laid out in this plan.

On behalf of Friends of the James River Park, thank you for being part of this shared journey of stewardship and conservation.

Sincerely,

Josh Stutz

Executive Director

Friends of the James River Park

PROLOGUE

A Note to the Reader

The James River Park System (JRPS) Natural Resource Management Plan is quite a mouthful! After three years of discussing, planning, and critiquing this project, the project team became comfortable with the acronym “NRMP,” and so we’ll be using that here and out in the world as we apply this framework to management of the park system.

We could not have developed this NRMP without great partnerships, generous funding, and the expertise of a skilled consultant team. A key partner driving the creation of this plan has been the volunteer-led JRPS Invasive Plant Task Force (IPTF). The IPTF has been instrumental in raising awareness about the threat invasive plants pose to the park’s natural resources, assisting in the first invasive plant baseline study in 2015, and laying the groundwork for the park’s current management efforts. A grant from the Virginia Department of Forestry—made possible by the 2022 Federal Inflation Reduction Act—enabled JRPS and Friends of the James River Park (FOJRP) to pursue the development of this plan. The Department of Parks, Recreation, and Community Facilities, which oversees all Richmond parks including JRPS, partnered closely with FOJRP to secure resources and advance the support of the city’s most visited green space. Biohabitats, selected through a competitive process, brought scientific expertise, ecological insight, and thoughtful facilitation to every phase of the project—resulting in a plan that reflects the complexity and care the park deserves. Without the steadfast partnership of FOJRP under the leadership of Executive Director, Josh Stutz, this project would not have been possible.

Two voices in the Richmond community were especially strong in advancing an NRMP for the James River Park System. Madge Bemiss, representing the IPTF, and Tricia Pearsall -- civic volunteers who spearheaded efforts to stem the aggressive expansion of invasive plants, enhanced recreational experiences, and contributed for many years, to boards and park groups who have ensured the park thrives -- were vocal in their advocacy for a natural resource management plan. Madge and Em Robertson dedicated many hours to guiding the NRMP from start to finish, developing presentations to engage the public and key stakeholders. Along with Madge and Em, Bill Shanabruch, Andrew Alli, Penelope Davenport, Josh Stutz, and Giles Garrison made up the NRMP project leadership team who worked closely with Biohabitats to ensure this plan is thorough and actionable.

The NRMP is rooted in the values JRPS staff and volunteers practice every day: stewardship of the river, protection of native species, care for the land, and a belief that people and nature both belong in this space. The park provides drinking water for our city, cools our neighborhoods, and connects about 2 million visitors to JRPS every year, more than any State Park in the Commonwealth. JRPS is a national generator of tourism and forms the beating hearts of Richmond’s outdoor recreation community. But its ecological health cannot be taken for granted, and we recognize that recreational uses must be balanced with safeguards to the environment.

This plan gives us a shared set of tools and priorities to strike that balance, and to ensure that JRPS remains resilient, biodiverse, and welcoming for future generations to enjoy. Just as importantly, this plan builds on over a decade of hard, thoughtful, on-the-ground work. The IPTF laid the groundwork long before this planning process began. Their tireless efforts over 10+ years—monitoring plant communities, piloting new removal strategies, creating a strong community of trained volunteers, and sharing deep ecological knowledge—have supported the creation of the JRPS Invasive Species Management (ISM) team and helped make JRPS a model for collaborative restoration. Special thanks to Madge Bemiss, Laura Greenleaf, Anne Wright, Catherine Farmer, Bill Shanabruch of IPTF. Thanks also to the current ISM team, including Cat McGuigan, Gera Williams, Megan Lowe, and Laura Greenleaf, for initiating a campaign of awareness, building a robust volunteer network, and for doing the arduous work that gives us a fighting chance of restoring James River Park System.

Reader, if you are inspired, please join us in becoming a park steward. Find out more at jamesriverpark.org.

Giles Garrison

Programs and Operations Manager

City of Richmond Department of Parks, Recreation and Community Facilities



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CHAPTER 1

INTRODUCTION



INTRODUCTION

The James River Park System (JRPS) is a 600-acre hub for passive and nature-based recreation along the James River in the heart of Richmond, Virginia. The park offers a unique blend of natural areas, historic sites, and river access that is serviced by over 20 miles of trails providing scenic river and city views. The park is also recognized regionally for its high-quality adventure recreation opportunities, including Class IV rapids and two climbing sites, which draw many visitors to the park.

With the park's unique urban context and popularity come many challenges related to balancing user experiences with resource management goals. Ecological stressors that strain the normal functioning of natural systems can be managed before they evolve into ecological threats that can lead to irreversible damage. For long, linear parks such as James River Park, **habitat fragmentation** is an overarching ecological stressor that is inherent to the system (see box below). To maintain high quality natural areas in this context, significant management investments must be made to defend core habitats from adjacent stressors and threats.

To defend these core habitats, this plan focuses primarily on recreational use and the prevalence of non-native and **invasive plants**, with consideration of additional factors such as special management for sensitive areas and overbrowse by white-tailed deer.

HABITAT FRAGMENTATION

Habitat management and restoration requires understanding that ecosystems are not closed systems and that flows of energy and materials are constantly exchanged among areas of differing land cover and land use. In general, natural areas within urban contexts are remnants of larger intact systems that were fragmented by legacy of anthropogenic disturbance. Smaller, fragmented pieces or patches are more vulnerable to degradation. Larger patches are more resilient to **ecological stressors** because they are buffered by their size. In larger patches, core interior habitats can persist despite more disturbance-prone or lower quality edge conditions, but as patches get smaller, those edge conditions can encroach on the core interior habitat and threaten the quality of the patch. These threats can be in the form of native and non-native flora and fauna that can penetrate further into the patch and suppress or exclude more sensitive or specialized flora and fauna. JRPS is a linear park (a lot of edge) surrounded by urban land uses (adjacent patches with lower quality habitat), which makes it vulnerable.

Plan Overview

This plan provides specific guidance for park staff and land managers.

Chapter 2 describes how baseline conditions were assessed at the Vegetation Management Area (VMA) level. The assessment evaluated resource quality, ecologically sensitive areas, level of invasion, and recreational use as well as observing some effects of white-tailed deer and operational activities.

Chapter 3 establishes three management categories based on the assessment data: Resource Conservation, Managed Use, and Recreation Hubs, and explains how management guidelines vary among the categories.

Chapter 4 describes the resource recovery strategy, a stepwise process of specific management actions required to manage stressors and threats, facilitate recovery, and monitor and maintain natural resources in good condition.

Chapter 5 zooms into the park section level to provide detailed mapping of the management categories and individual VMAs and a summary of focus areas for each assessed park section.

The **appendices** provide more detailed management guidance for each Park Section, monitoring protocols, and resource recovery strategies.

Plan Goals and Objectives

The intent of this plan is to provide a framework for managing stressors and threats, while recovering the natural areas within the James River Park system, ensuring that future generations will have access to these same or better resources and the social and ecological benefits that come with them. The planning framework was developed in alignment with the intentions of the Falls of the James State Scenic River, the Chesapeake Bay Protection Areas (CBPAs), and Recorded Conservation Easements.

The specific plan goals and objectives include:

Goal 1: Manage stressors and threats to natural areas of the park

Objectives:

- A. Develop management framework to prioritize management activities
- B. Establish and implement stressor/threat specific Best Management Practices (BMPs)

Goal 2: Continuously improve the park's ecosystem functionality

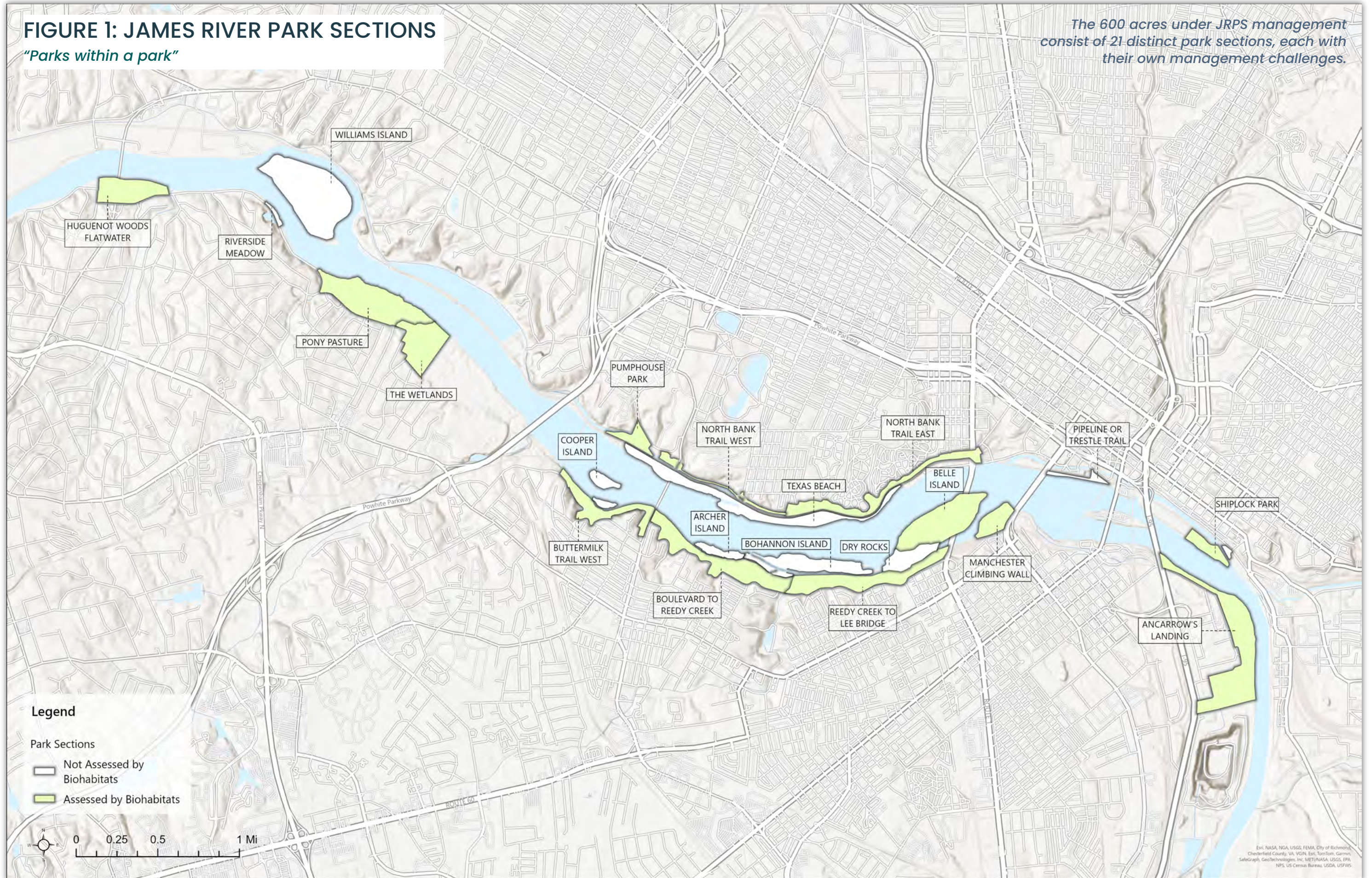
Objectives:

- A. Recover physical conditions that support natural communities
- B. Preserve and/or reestablish representative and diverse natural communities to the highest level practical
- C. Preserve and enhance the structural diversity of natural communities
- D. Expand connectivity among natural areas within the park and surrounding landscape
- E. Establish and implement a monitoring and **adaptive management** framework

FIGURE 1: JAMES RIVER PARK SECTIONS

"Parks within a park"

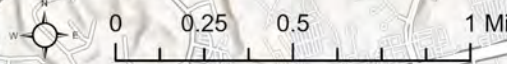
The 600 acres under JRPS management consist of 21 distinct park sections, each with their own management challenges.



Legend

Park Sections

- Not Assessed by Biohabitats
- Assessed by Biohabitats



Esri, NASA, NOAA, USGS, FEMA, City of Richmond, Charlottesville County, VA, VGNR, Esri, Swanton, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

CHAPTER 2

BASELINE ASSESSMENT & CONTEXT

A baseline condition assessment of the park's natural areas was conducted to document existing conditions and establish an understanding of the spatial patterns associated with resource quality, ecologically sensitive areas, level of invasion, and recreational use/intensity. The spatial patterning is important in delineating areas where ecological stressors intersect with high quality or sensitive resources. Ecological stressors are factors that strain the normal functioning of natural systems, communities, or species and can lead to diminished ecological health and resiliency over time. Ecological stressors often evolve into threats which have more immediate and direct impacts to the ecological health of natural systems that can lead to irreversible ecological damage.

BASELINE ASSESSMENT

Baseline conditions were assessed at the **Vegetation Management Area (VMA)** level. VMAs are subdivisions of park sections that are similar in composition and condition and consist of roughly 5 contiguous acres generally bounded by a distinct change in condition or physical feature – e.g., trail, creek, slope. Baseline conditions are summarized at the park section scale based on an area weighted average of VMAs within each respective park section and presented on the parkwide mapping in **Figures 2, 3, and 4**. Differences in resource quality and level of invasion that occur at the VMA scale are presented in the Park Section Summaries in **Chapter 4**. Collectively, these data are intended to guide the implementation of the **resource management framework**. The following sections further define the assessment framework and stressor context.

Resource Quality

Resource quality is a characterization of the condition of natural plant communities as an indicator of type and diversity of wildlife they support and the physical condition of the landscape. Resource quality was defined by the natural community type, overall vegetative community ratings, and native vegetation diversity, which were evaluated during the baseline ecological assessment. Resource quality is also an indicator of the level of stressors and threats acting on a specific VMA. Measures of resource quality through time can be used to track overall stressor levels and response to management activities.

LEGACY LAND USE IN THE MID-ATLANTIC UNITED STATES

In the mid-Atlantic, industrial exploitation and agricultural land clearing peaked in the mid-1800s leaving much of the landscape denuded of natural forests and significant amounts of fertile soil washed into waterways. As a result, contemporary mature forests are comprised of relatively even age stands that are 80-110 years old. Consequently, many contemporary forests are less resilient to disturbance and more susceptible to stressors.

Using the data from the initial ecological assessment, each VMA was given a cumulative rating representing its overall resource quality. Those ratings were averaged for each park section using a weighted method that accounted for the area of each VMA. This overall resource quality rating by park section is shown in **Figure 2**.

In this map, the relative resource quality was assigned a rating of 1 to 4 using a natural breaks methodology. VMAs with lowest ratings (1) correspond to the lowest relative resource quality. These resource quality ratings (1, 2, 3, 4) are part of the alpha-numeric coding system used in the resource management framework.

Ecologically Sensitive Areas

Ecologically sensitive areas include steep slopes, erodible soils, **floodplains** and riparian areas, **streams and waterways, wetlands,** and **natural heritage areas**. For the purposes of this plan, areas within 100 feet of the border of any of these features are also considered sensitive. Sensitive areas are overlaid with resource quality at a park section level in **Figure 2**.

The number of overlapping features was used to define the most sensitive areas. It should be noted that natural associations and physical proximity among streams, wetlands, waterways, and their associated floodplains and riparian areas, skews the weighting toward areas with concentrated water resources higher by default in this analysis.

Steep Slopes & Erodible Soils

A steep slope in this analysis is any slope greater than 15%. Erosion risk associated with slope increases as the slope increases with severe limitations on slopes greater than 25%. Steep slopes are more susceptible to erosion following **land disturbance**, which makes them more challenging to revegetate and stabilize. Steep slopes can also limit access and make park management and restoration activities more challenging.

In addition to slope, the physical properties of the soil and slope length contribute to soil erodibility by water. The **soil erodibility index (k-value)** represents a soil's susceptibility to water erosion with erodible soils being characterized as soils with K-values >0.35. For the purposes of this plan, moderately to severely erodible soils were mapped as sensitive areas, and were given a 100 ft sensitivity **buffer** like all other sensitive features. Moderately erodible soils were considered to be those with a K-value between 0.25 and 0.35.

Floodplains & Riparian Areas

A **floodplain** is an area adjacent to a river or stream that is subject to being inundated by flood waters. The frequency of flooding, which is described by the **annual exceedance probability (AEP)**, significantly influences the site's ecology and the risk to infrastructure. For example, an AEP 1% delineates a "100-year floodplain", which is significant from an infrastructure risk and regulatory perspective; however, on the contemporary landscape, other anthropogenic factors are likely to disturb the landscape on a more frequent basis making the 1% AEP flood less ecologically significant. An AEP of 4%, which corresponds to a 25-year flood, may align more closely with a disturbance regime with greater influence on the site morphology and ecological communities. For the purposes of this plan, the 1% AEP is used for best practices related to park operations in a regulatory and risk context, while existing vegetative communities and evidence of flood disturbance may inform resource recovery and management strategies.

Riparian areas are vegetated zones adjacent to streams, rivers, and other waterways that function to filter pollutants, reduce erosion and provide habitat. Site topography, land cover, vegetation type, and distance from the waterbody all contribute to the efficacy of a riparian area. For the purposes of this plan, riparian areas were identified as areas within 100 feet of any waterway to be consistent with definitions in the City's Chesapeake Bay Preservation Act. It is important to note that a 100-foot buffer is a round number and the full extent of riparian communities and functions may extend beyond that limit, especially along the James River Mainstem. Therefore the 100-foot buffer should be considered a minimum and it may be prudent to use field indicators, like changes in vegetation or soil, to delineate riparian areas or adopt a wider buffer to guide planning and design.

Streams & Waterways

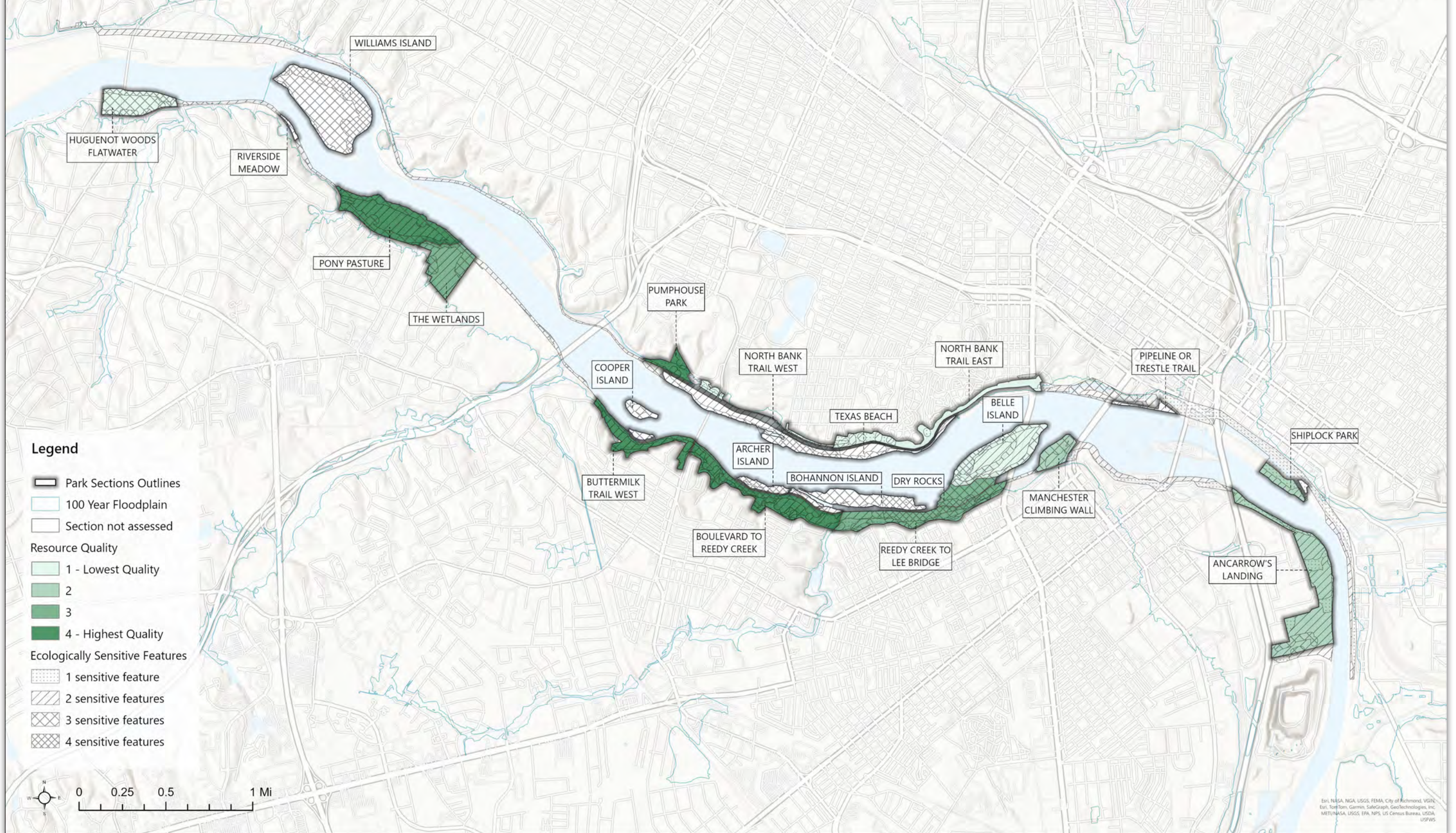
Streams and waterways are natural channels that convey year-round (perennial), seasonal (intermittent) and rain dependent (ephemeral) flow from the landscape. These include all sizes of rivers, creeks, streams, and gullies that created a linked network that filter and process nutrients from the landscape, protect against floods, and sustain aquatic ecosystems. In this plan, streams and waterways include areas waterward of the top of bank excluding the upland islands in the James River. Note that areas subject to seasonal flows, such as Dry Rocks, are technically part of the stream and waterway network.

Wetlands

Wetlands are important transitional areas that are inundated or saturated with ground or surface water for part of the year. Wetlands are established with plant communities adapted for life in saturated soil conditions and provide important water quality and habitat functions. Wetlands defined in this plan are based on published data (National Wetland Inventory (NWI) mapping) and limited field observations and may not meet the regulatory definition of wetlands. More formal wetland investigations may be necessary to support planning and design.

FIGURE 2: RESOURCE QUALITY & ECOLOGICALLY SENSITIVE AREAS

Baseline Assessment



Buffers

Buffers are areas surrounding sensitive areas that are important to preserving and enhancing ecological functions. For the purpose of this plan, buffers are 100 feet from the edge of the resource.

Natural Heritage Areas

Natural heritage areas are designated areas supporting habitat for species of conservation need. This includes both flora and fauna. For this plan, heritage areas are based on data provided by Virginia Department of Conservation and Recreation's Natural Heritage Program. These areas are not geographically specific element occurrences. Coordination with DCR on where specific elements occur when planning projects and maintenance activities is important to the preservation of these vulnerable species.

Level of Invasion

Level of invasion is a measure of the severity of non-native and invasive (NNI) cover within three strata - Ground Plane (0-3' height), Mid Plane (3-20' height) and Canopy (>20' height). For this plan, highly invaded areas may represent either severe levels of invasion in a single strata or invasion in multiple strata. High levels of invasion inhibit the growth and regeneration of natural communities and consequently threaten resource quality. The level of invasion by park section is presented in **Figure 3** with more detail on the level of invasion within each park section presented in **Chapter 4**. The overall invasion level by park section was calculated using the same method that was used for the resource quality calculation (a weighted average of the VMA invasion ratings for each section). The level of invasion was divided into 4 categories using a natural breaks methodology, and the numeric results were assigned letter ratings of A, B, C, or D. Letter ratings designated "A" represent areas with the highest levels of invasion, and "D" represents areas with the lowest levels. These levels of invasion ratings (A, B, C, D) are combined with the overall resource quality rating (1, 2, 3, 4) to create the alpha-numeric coding system used in the resource management framework.

Recreational Use/Intensity

Recreational use/intensity represents the spatial arrangement of access points, amenities/facilities, trails, and focal points within the park. The level of recreational use/intensity is associated with stressors of trampling and soil compaction, non-point source pollution, and litter. Additionally, recreational use can facilitate the spread of NNI species. **Figure 4** provides an overview of the recreational use intensity at James River Park.

Recreational use/intensity was not rated, but the spatial arrangement of features within a park section was evaluated visually to delineate areas that are likely to experience stressors related to high use intensity. The use intensity stressor is assumed to be the highest at access points and areas with the highest density of features.

Access Points

Access points are the primary points of entry in the park and include parking areas and formal trailheads. Ease of access directly correlates with the park use intensity, so ample parking near park amenities and focal areas will become activity hubs that can threaten adjacent ecologically sensitive areas.

Amenities/Facilities

Park amenities and facilities include restrooms, seating, pavilions, overlook structures, and other constructed features that exist for the enjoyment and convenience of park users. Provisioning for amenities and facilities can increase park use intensity that may spill over into adjacent areas and conflict with resource management objectives. However, park facilities can also be located and designed in ways that minimize the negative impacts associated with heavy use intensity.



Park visitors enjoying a focal point at Belle Isle. Image credit: Bill Draper

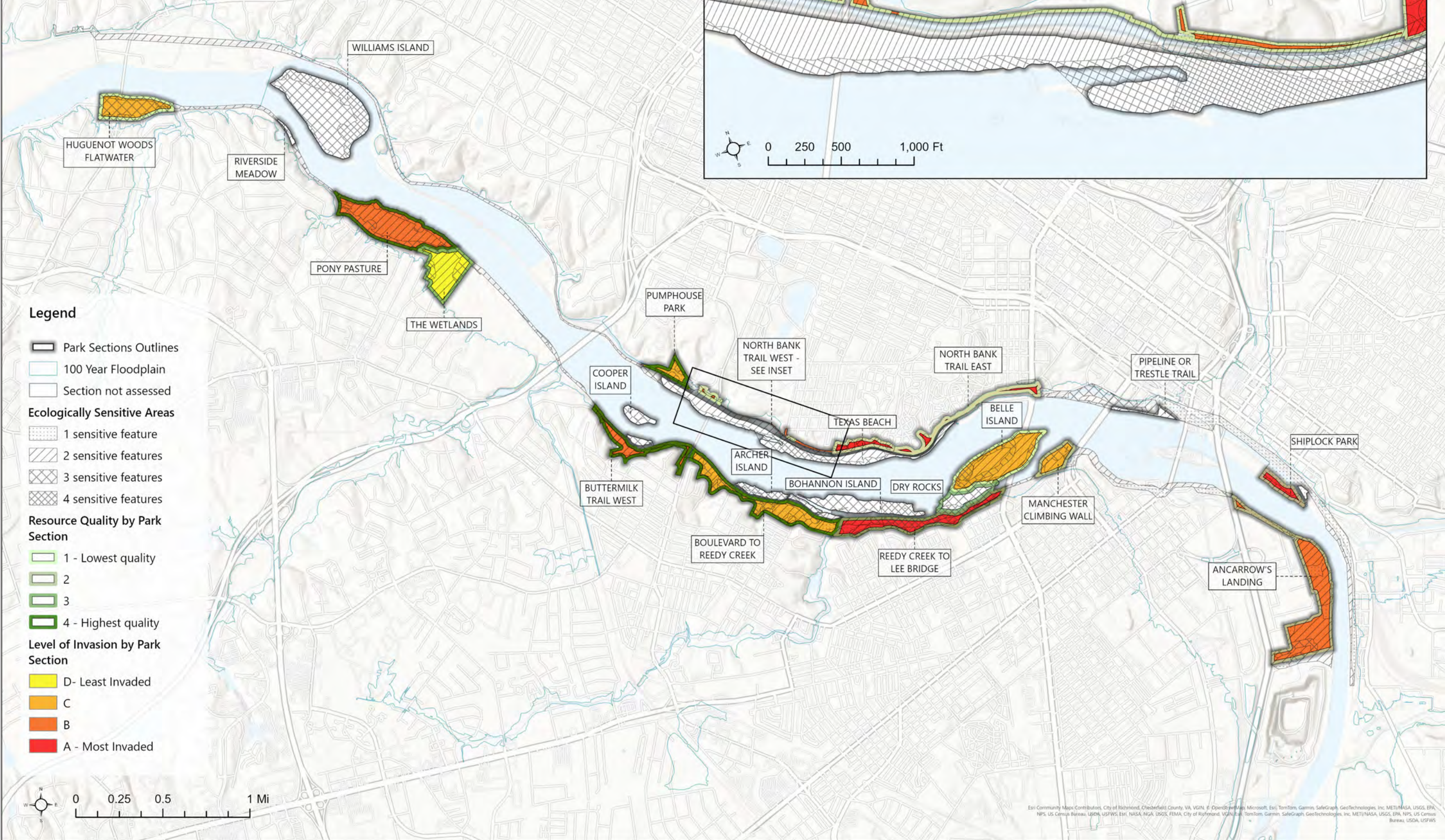
Focal points

Focal points include vistas, rock outcrops, park amenities and facilities, or areas that offer user experiences (e.g., swimming). Each focal point offers an experience that is tied to its uniqueness and use intensity.

Some focal points may be common but offer a unique experience because of a low use intensity (e.g., remote swimming hole or vista to watch a sunset). Other focal points offer unique experiences and attract high use intensity (e.g., Climbing Wall).

FIGURE 3: LEVEL OF INVASION, RESOURCE QUALITY & SENSITIVE AREAS

Baseline Assessment



Legend

- Park Sections Outlines
- 100 Year Floodplain
- Section not assessed
- Ecologically Sensitive Areas**
- 1 sensitive feature
- 2 sensitive features
- 3 sensitive features
- 4 sensitive features
- Resource Quality by Park Section**
- 1 - Lowest quality
- 2
- 3
- 4 - Highest quality
- Level of Invasion by Park Section**
- D- Least Invaded
- C
- B
- A - Most Invaded

Esri Community Maps Contributors, City of Richmond, Chesterfield County, VA, VGIN, F, OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USFWS, ERI, NASA, NGA, USGS, FEMA, City of Richmond, VGIN, F, OpenStreetMap, Microsoft, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USFWS

TRAIL TYPES

Class A trails are highly to fully developed (USFS Class 4 & 5) trails that provide ready access from parking and access points to key park amenities and focal points and are wide enough for utility vehicles used for rescue and maintenance. These trails are generally improved surfaces that are kept free of obstacles including downed wood and overhanging vegetation in both the trail tread and shoulder areas. This trail experience should be highly curated and clearly queue users to areas that are in or out of bounds. Where Class B and C trails spur off, the trail section (width, surface, etc.) should clearly change and present a more primitive experience and control use intensity. Class A trails should be aligned to avoid ecologically sensitive areas.

Class B trails are developed (USFS Class 3) trunk trails that are wide enough for two pedestrians to pass and intended for conveyance of foot and bicycle traffic through the major areas of the park. These trails are generally naturally treaded with some improvements in wet areas, steep grades, and other problem areas and should be kept free of obstacles including downed wood and overhanging vegetation. This trail experience is intended to be primitive and provide pedestrian access to other sections of the park and connect the more remote focal areas and vistas of the park. Class B trails have moderate use intensity and may occasionally traverse ecologically sensitive areas with mitigation and best management practices.

Class C trails are minimally to moderately developed (USFS Class 1 and 2) natural treaded single track trails that are intended to provide access to or through ecologically sensitive areas. Social trails were also classified as C trails. These trails are maintained in a natural state and may contain minor and intermittent obstacles such as downed logs, seasonally wet areas, and overhanging vegetation to create a remote experience.

Trails

The James River Park System has an extensive trail network ranging from fully developed accessible trails to primitive social trails. **Social trails** are unofficial trails created by park users often to access focal points, gain entry, or as shortcuts. To facilitate discussion, the trails within JRP were categorized based on the USFS trail system. They were reclassified as Class A, B, or C based on their use intensity and function. The level of trail development is generally related to use intensity, with Class A trails receiving more foot traffic than classes B or C.

See page 17 for trail type descriptions.

Trail maintenance and improvements are mainly focused on preventing reroutes or widening. The trail experience is intended to be primitive and provide limited access to interior areas. Class C trails are the type most compatible for use in ecologically sensitive areas.

For representative photos and further descriptions of trail classes based on the USFS system refer to Trail fundamentals and trail management objectives (USFS 2016).

Several well-established **water trails** exist on the James River within JRPS. These trails are heavily used and require park infrastructure, such as parking and boat launches, to support them. While these trails are generally outside the scope of this plan, boat launches, portage sites, and places along the river where people can stop to rest or picnic would fall under the plan resource management framework under recreational use/intensity as access points, focal points, and trails.

Other Stressors & Threats

In addition to the primary stressors and threats associated with level of invasion and recreational use intensity, JRPS is subject to several other stressors and threats associated with its urban context and heavy use.

White-tailed Deer Pressure

White-tailed deer thrive in urban and suburban areas where forested landscapes are fragmented and offer abundant edge habitat.

In addition to habitat, white-tailed deer have few natural predators on these landscapes and hunting is often prohibited, so deer populations can grow unchecked. As deer populations grow, so do their needs, and they apply more pressure to forested landscapes as they consume more of the available understory seedlings and shrubs and rub their antlers on young trees. Heavy deer pressure can prevent the natural regeneration of forests, diminish habitat quality by impacting forest structure, open areas to invasive species, and hinder restoration efforts.

Evidence of white-tailed deer pressure was observed throughout JRPS and is likely contributing to the level of invasion stressor and impacting resource quality.

Operational

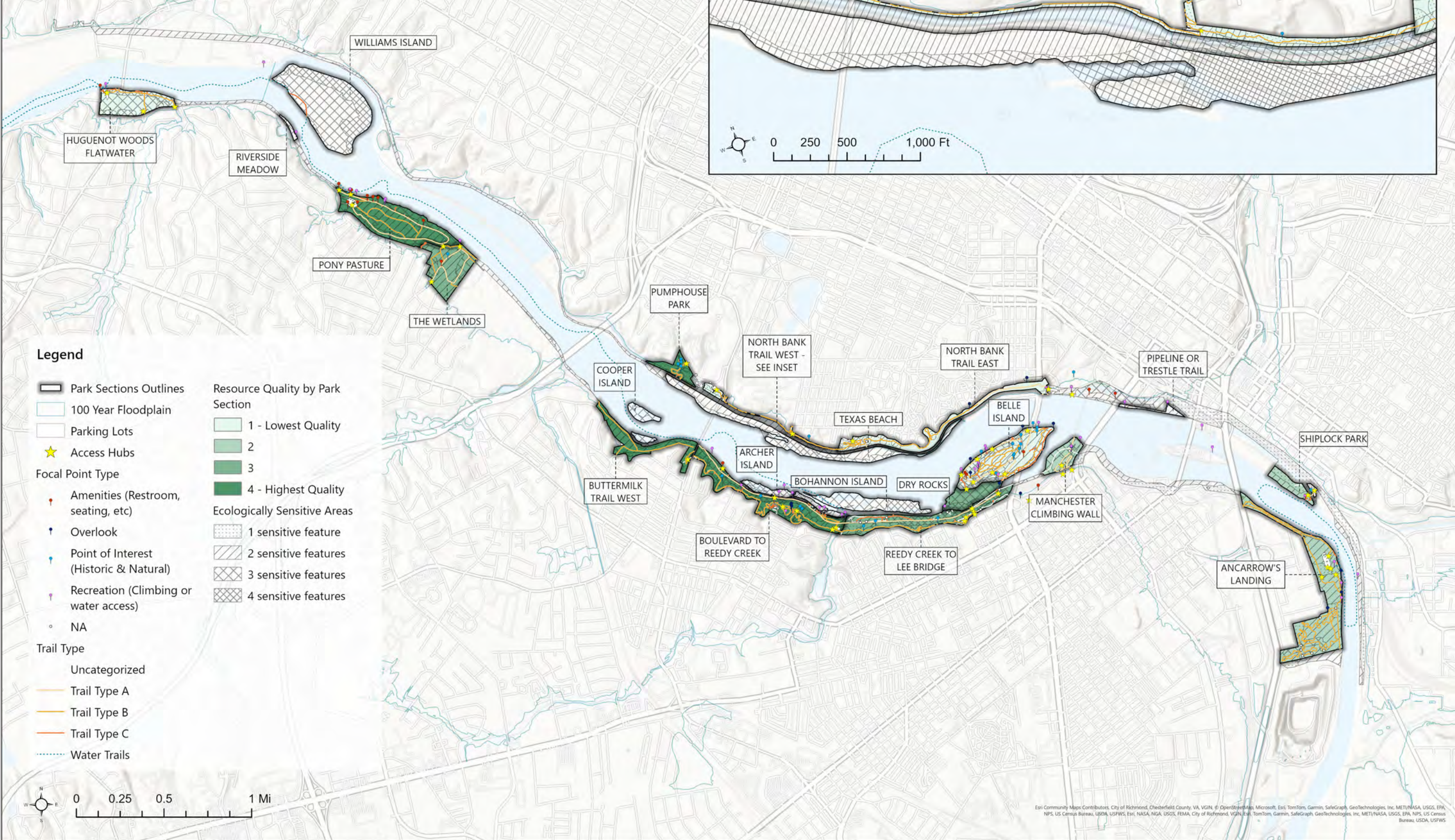
Park operational activities are necessary to maintain a clean, safe, and accessible park with diverse recreational opportunities for all park users. In addition, these operational activities like maintaining trails, removing trash, providing amenities and facilities can alleviate other stressors in support of the resource management objectives; however, the process of performing certain operational activities or developing opportunities can lead to the spread of NNI, compact soils, remove vegetation, and exacerbate erosion, all of which are in conflict with resource management goals. While the breadth of park operational activities is beyond the scope of this plan, excessive mowing, woody debris removal, and certain erosion control strategies were highlighted as stressors of concern.

Supplemental Data & Context

Field data from the 2024 assessments supporting the baseline assessment and context was provided as an addendum to the final plan. Additional context is provided in the Floristic Inventory of the James River Park System, Richmond, Virginia (Nakahata, et. al. 2020), the James River Park System Natural Community Investigation (Thompson, J. A. 2019), and the Invasive Plant Management Plan -2015 Annual Report (VHB 2015).

FIGURE 4: RECREATIONAL USE/INTENSITY, RESOURCE QUALITY & SENSITIVE AREAS

Baseline Assessment



Legend

- Park Sections Outlines
- 100 Year Floodplain
- Parking Lots
- Access Hubs
- Focal Point Type**
 - Amenities (Restroom, seating, etc)
 - Overlook
 - Point of Interest (Historic & Natural)
 - Recreation (Climbing or water access)
 - NA
- Trail Type**
 - Uncategorized
 - Trail Type A
 - Trail Type B
 - Trail Type C
 - Water Trails
- Resource Quality by Park Section**
 - 1 - Lowest Quality
 - 2
 - 3
 - 4 - Highest Quality
- Ecologically Sensitive Areas**
 - 1 sensitive feature
 - 2 sensitive features
 - 3 sensitive features
 - 4 sensitive features

CHAPTER 3

PARKWIDE RESOURCES MANAGEMENT FRAMEWORK



The baseline conditions assessment was used to delineate **three management categories – Resource Conservation, Managed Use, and Recreation Hub** – that form the parkwide resource management framework. The intent of this framework is to provide park managers with a set of standard management principles and practices for each management category that aligns with the contemporary and potential resource quality and the compatible recreational use/intensity of specific areas within the park. Figure 5 shows the delineation of each park section into the three framework categories.

Complementary to the parkwide framework, each vegetation management area within a park section was assigned an alpha-numeric code defining its contemporary resource quality and level of invasion, which can be used to prioritize implementation of the appropriate resource recovery strategy (see Chapter 3).

MANAGEMENT CATEGORY DESCRIPTIONS

Resource Conservation

Resource Conservation areas are those with the highest quality resources and the highest potential for recovery. These areas were selected based on their characteristics in the baseline field assessment and their spatial relationships (e.g., proximity) to areas of high recreational use. Resource Conservation is the most restrictive zone in terms of access and requires the greatest level of management input to support its recovery.

Recreational Use/Intensity

Recreational Use/Intensity should be strictly managed to support public use and enjoyment in a manner that preserves the exceptional natural character of resource conservation areas, and provides for experiences that are dependent on the natural character (e.g., solitude). All recreational development should follow low-impact guidelines, with particular attention to techniques to control invasive species and erosion.

Resource Quality targets

Resource Conservation areas consist of areas with the highest existing overall resource quality rating of 4 or those areas capable of attaining the highest overall resource quality rating (e.g., rating of 3). Continual improvement of resource quality should be a focus of management inputs and monitoring efforts.

Level of Invasion targets

Resource Conservation areas should be the priority for NNI control and should target overall level of invasion rating of D (minimal NNI cover (<10%) across all strata) so that biodiverse native plant communities can be recovered.

Managed Use

Managed Use areas are those where risk or evidence of degradation exists due to use intensity, but where natural community structure is generally intact and capable of supporting recovery to a more functional level. Managed Use areas are less access-restricted than Resource Conservation areas, and management focuses on containing the threats presented by heavy recreational use and recovering adjacent and impacted resources.

Recreational Use/Intensity

Recreational Use/Intensity should be managed to provide opportunities for nature-based recreational opportunities (hiking, biking, swimming, paddling, climbing) that are dependent on the park's natural character.

Resource Quality targets

Managed Use areas consist of areas of high to moderate existing overall resource quality ratings (ratings of 4 and 3, respectively) or those areas capable of attaining high resource quality ratings (e.g., 2 or better). Maintaining resource quality should be a focus of management with a long-term goal of continual improvement.

Level of Invasion targets

Managed Use areas are the second tier of priority for NNI control and should target level of invasion ratings of C or better (minimal NNI cover (<20%) across all strata) to sustain and support the recovery of relic native plant communities with good diversity.

Recreation Hub

Recreation Hubs are areas of the park with high recreational use intensity and impacted resources where degradation and ongoing stressors may not allow for the recovery of a fully functioning natural system. Recreation Hubs are the least restrictive management category in terms of access, and conservation objectives and management focus on managing threats from recreation use and preserving intact resource quality with a long-term goal of recovery.

Recreational Use/Intensity

Recreation Hubs should be managed to provide for the full range of recreational opportunities and programming with supporting facilities and amenities. Experiences should be inclusive and provide exposure to the park's natural character in a controlled manner without fully immersing users in it.

Resource Quality targets

Recreation Hubs consist of areas where the resource quality is limited by the recreational use intensity. Maintaining overall resource quality should be a focus of management with a long-term goal of continual improvement of focus areas.

Level of Invasion targets

Recreation Hubs are the lowest tier of priority for NNI control and should be managed for continual improvement with moderate levels of NNI cover (<40%) across all strata so that relic native plant communities can be sustained and trend toward recovery.

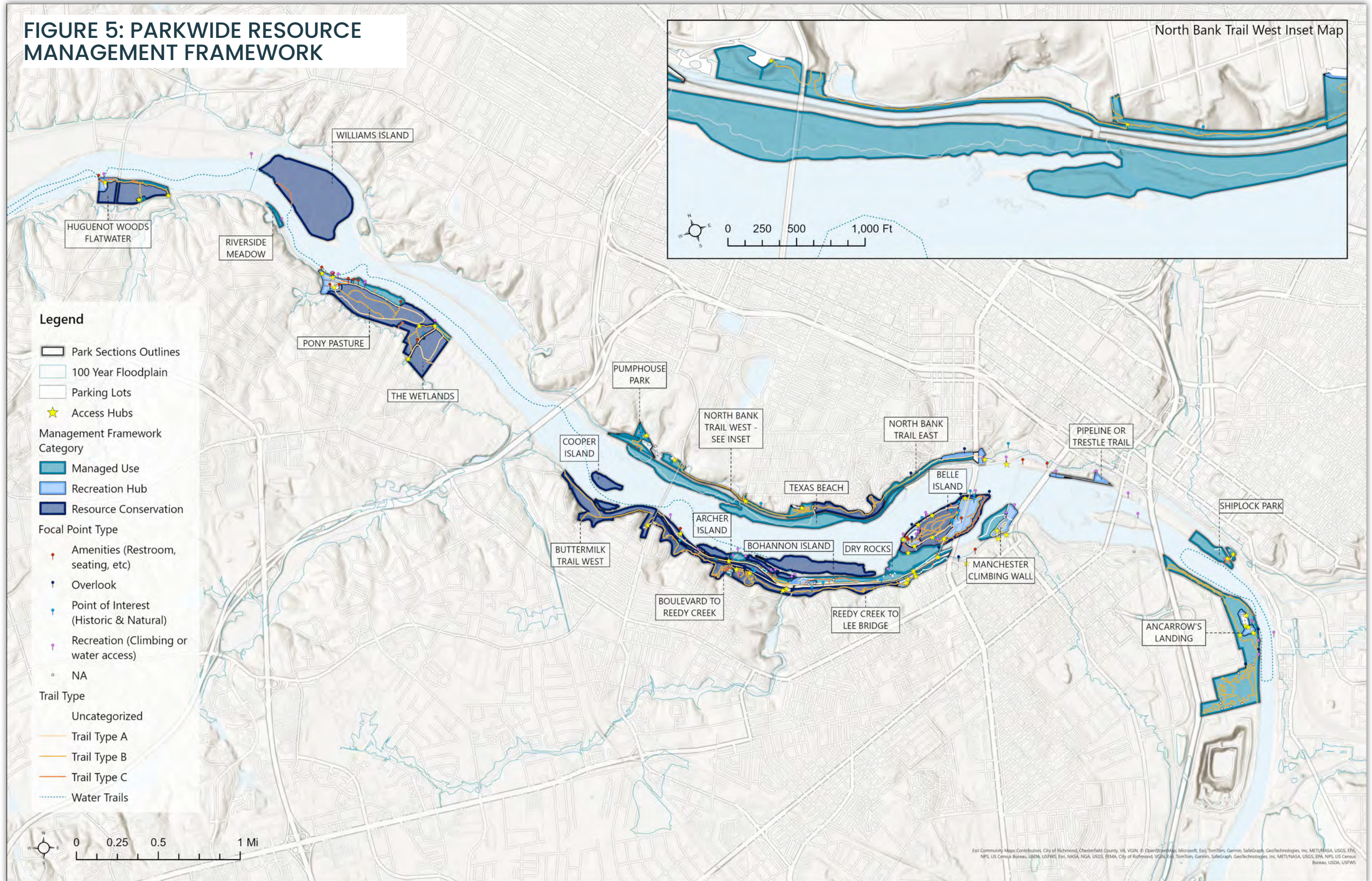
Adapting and Adding to the Framework

The parkwide resource management framework is intended to be adaptive to the management needs of the park as it grows and evolves. Consequently, it is recommended that the standard management principles and practices for each management category as well as the designation of management categories presented in **Figure 5** is re-evaluated every 5 years.

Changes in designations can be the result of planned capital projects, changes in recreational use/intensity, resource management success, or other demonstrated needs. Proposed changes in designations should be supported by an assessment of resource quality, ecologically sensitive areas, level of invasion, recreational use intensity and other stressors and threats similar to the baseline assessment to ensure the change in designation is aligned with the intent of the plan.

Similarly, the framework is adaptable to areas that are brought into park management. Designation of resource management category within the framework should be informed by a baseline assessment – See **Chapter 3** Monitor and Maintain for guidance on monitoring that can be used for baseline assessment.

FIGURE 5: PARKWIDE RESOURCE MANAGEMENT FRAMEWORK



CHAPTER 4

RESOURCE RECOVERY STRATEGY

The resource recovery strategy is a stepwise process that seeks to 1) manage or mitigate ecological threats; 2) facilitate ecological recovery; and 3) monitor and maintain the ecological recovery trajectory. The intent of the strategy is to first manage stressors and threats (Goal 1) and then continuously improve the park's ecosystem functionality (Goal 2).

PLANNING AND IMPLEMENTATION

Implementation of the resource recovery strategy is systematic and involves planning and prioritization processes at the parkwide, park section, and VMA scales. The Parkwide Resource Management Framework Categories and the alpha-numeric code representing the resource quality and level of NNI invasion ratings for each VMA are the basis for determining the management priority and actions at each scale.

Parkwide Scale

Managing ecological threats in support of goal 1 is the priority for parkwide management actions at the parkwide scale. The focus of parkwide management actions is 1) developing and operationalizing Best Management Practices (BMPs) to be applied under the Parkwide Resource Management Framework Categories and 2) monitoring and maintaining VMAs with the highest resource quality ratings (3 & 4).

Implementation of management actions at the

parkwide scale is a continuous improvement process. As such, not everything needs to be tackled at once. Operational BMPs can be piloted at the park section, VMA, or project scale prior to adopting parkwide. Monitoring and maintaining VMAs is targeted with focus on the greatest threats to the areas of highest resource quality. The intent is to allocate a fixed amount of targeted efforts at the parkwide scale to prevent or slow the rate of degradation in high quality VMAs that are outside of actively managed park sections.

In addition to targeted parkwide management actions, the priorities for park section management are set at the parkwide scale. Factors to consider in prioritizing park sections include:

- Overall resource quality and level of invasion
- Building on momentum (e.g., dedicated volunteers, demonstrated success, user interest)

- Capacity of park staff and allies to undertake management actions

Of the factors to consider, the one that probably carries the most weight is the capacity of park staff and allies. Park section management is systematic and intensive with an end goal of resource recovery, so it may only be possible to be active in a limited number of park sections in a given year.

Consequently, in the first years of implementing the plan, it may be advisable to target only 2 to 3 park sections for intensive management, while allowing the others to fall within the more limited parkwide management regime. Park section priorities for resource recovery should be evaluated at least every 5 years and be informed by parkwide monitoring.

Park Section Scale

Management at the park section scale is systematic and intensive with an end goal of resource recovery. This end goal is achieved on a VMA basis, where a VMA with the highest quality resources (ratings of 3 and 4) and lowest levels of invasion (ratings of C and D) is prioritized to become a building block or core from which management activities and the recovery process begins. Work then radiates out from this core to adjacent VMAs in a systematic approach.

The typical progression of work is to manage stressors and threats, generally level of invasion, in the core. Once the management objective is met for the core VMA, the management of stressors and threats progresses to adjacent VMAs. As stressors and threats are managed in those adjacent VMAs, recovery in the core can be facilitated, if necessary. Work continues to radiate out in a similar fashion and transition from managing stressors and threats to facilitating recovery until the entire park section meets its recovery objective.

Note: Facilitating recovery may not be necessary if the core maintains its resource quality and demonstrates capacity for natural regeneration.

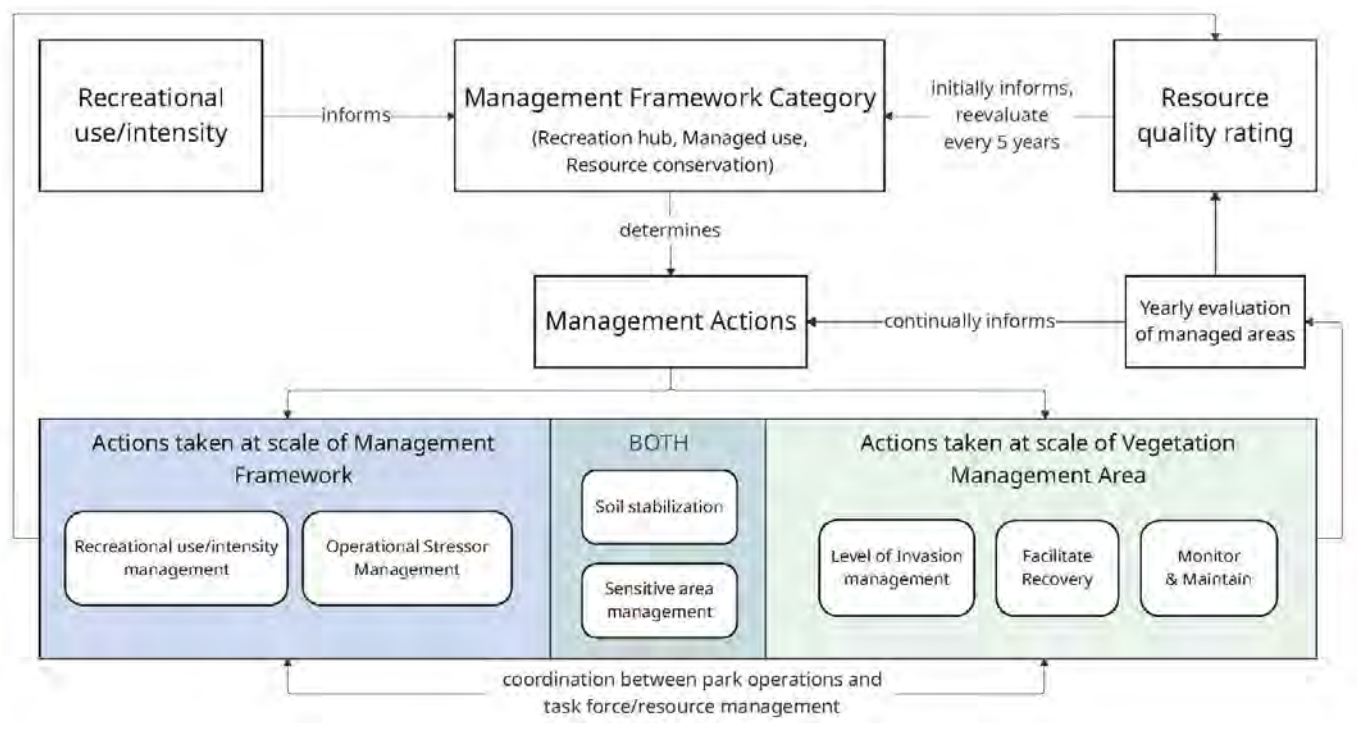
All park sections that are or have been actively managed should be monitored and maintained annually. This information informs the parkwide management priorities, provides opportunities to learn and adapt programs and strategies, and helps protect the significant investment of time and resources that went into the recovery.

Vegetation Management Area Scale

The VMA scale is where management actions are applied in support of the park section management objective. It is important for work at the VMA scale to be adaptive to site conditions and needs since the level of invasion, targeted species and other factors will vary across the VMA. Consequently, it may be advisable to have a workplan for each target VMA that outlines the overall objective and specific management actions to be taken in support of the management objective.

All VMAs that are or have been actively managed should be monitored and maintained annually.

FIGURE 6: RESOURCE MANAGEMENT FRAMEWORK & RECOVERY STRATEGY IMPLEMENTATION



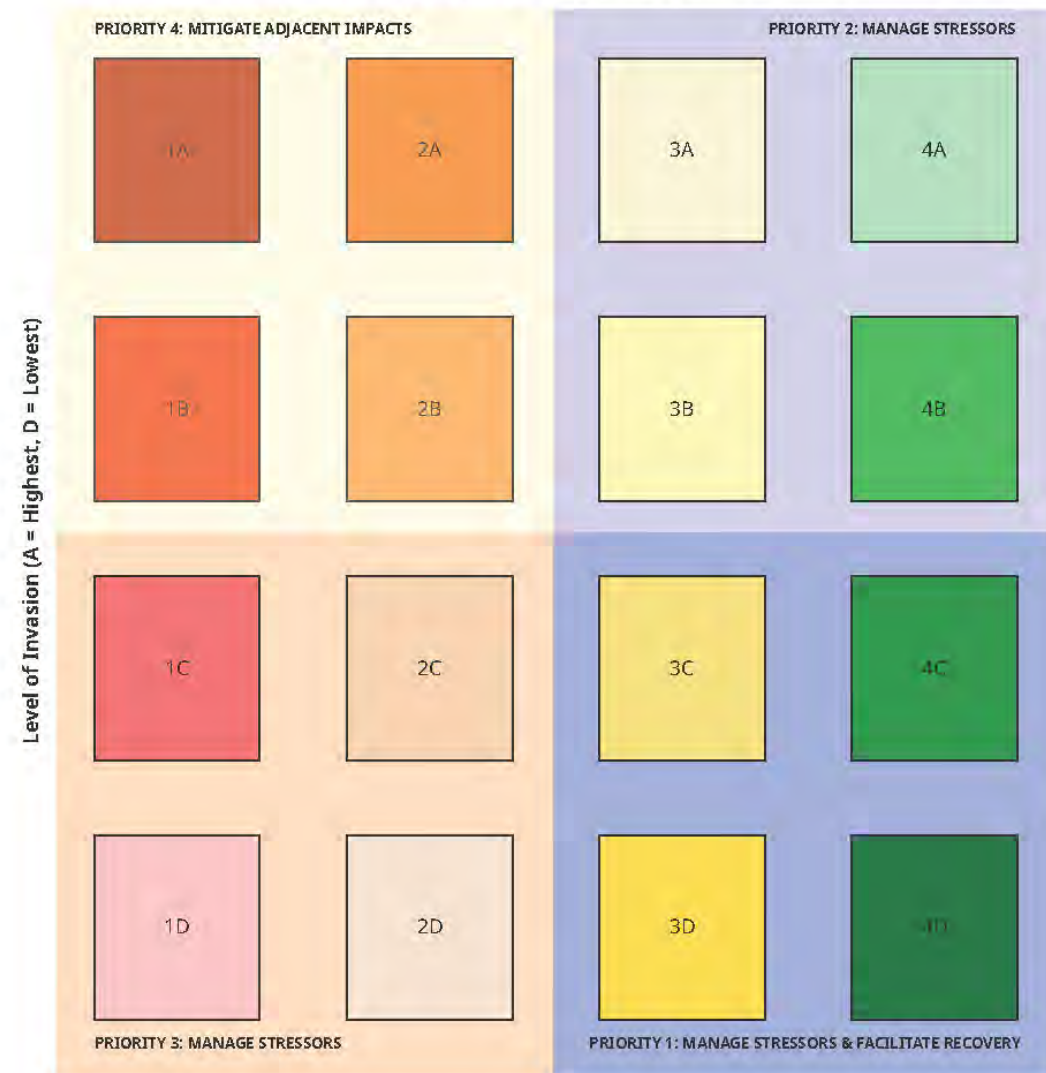
RECOVERY OBJECTIVE

Recovery objective is a specific and measurable outcome related to resource quality to be completed in a prescribed time period. Recovery objectives should ultimately be set at park section and VMA scales:

Park section: The recovery objective should focus on a long-term trajectory toward the highest level of resource recovery attainable (e.g., Attaining a resource quality rating of 3 or more for all VMAs within 10 years). Park Sections objectives should be re-evaluated every 5 years.

VMA scale: The recovery objective should focus on the short-term and what is practical to achieve in 1-2 years in support of the park section objective (e.g., reducing level of invasion by 1 category rating in 2 management units adjacent to the core in one year). VMA objectives should be re-evaluated annually.

FIGURE 7: VMA PRIORITIZATION RATING & RESOURCE RECOVERY MATRIX



MONITORING AND ADAPTING

Monitoring and adaptive management are a means of ensuring the ongoing recovery of the park by using the monitoring results to inform future actions.

A simple assessment form that characterizes the Recreational Use/Intensity, Resource Quality (forest and meadow/non-forest), Level of Invasion, and other stressors (Deer Browse, Soil Condition, and Adjacency) and a primer outlining the use and interpretation of the form is provided in [Appendix A](#).

Similar to the parkwide management framework, the Resource Recovery Strategy is intended to be adaptable to the ongoing and emerging resource management needs of the park (see [Figures 6 & 7](#)). The Resource Recovery Strategy is informed by monitoring and implemented at different scales. Adapting the strategies, specifically the management actions, should occur on an annual basis at the VMA level as needed.

Adaptations may include increasing the frequency and intensity of management actions or changing management actions to improve success in support of the VMA recovery objective(s). All adaptations to the management actions should be in support of the park section recovery objective. Park section objectives and parkwide priorities for recovery should be evaluated every 5 years.

When adding park sections to the resource recovery strategy they should be subdivided into vegetation management areas with similar characteristics and assessed using the rapid assessment. After assessing they can be integrated into the parkwide scale management program. If supported by the resource quality, momentum and capacity of park staff and allies, new areas can be designated a priority for more intensive park section management when it is acquired or during the 5-year re-evaluation of priorities.

MANAGEMENT ACTION GUIDANCE

Management actions are the direct interventions to be undertaken by parks staff, their allies, and/or contractors in support of recovery objectives. Management actions generally fall within the following categories aligned with their primary purpose:

Managing Stressors & Threats is the foundation of ecological recovery and the recovery process initiates only when all threats are adequately managed within the vegetation management area and the adjacent management areas.

Facilitating Recovery involves specific management actions directed toward accelerating natural recovery or correcting deficiencies noted in the rapid assessment of the VMA.

Monitoring and Maintaining ensures the ongoing recovery of the park by using monitoring results to inform future actions.

The following sections provide recommendations and guidance for the development and implementation of park specific best practices and management actions for each recovery category. [Table 1](#) summarizes the direct and indirect outcomes of practices, actions, supplemental guidance, and supporting information related to the management practices and actions is provided in [Appendix B](#).

Manage Stressors & Threats

Managing Recreational Use/Intensity

The threats posed by recreational use/intensity will largely be managed through the implementation of the parkwide resource management framework. Strategies for managing recreational use/intensity should be implemented on a parkwide scale and focus on strategically controlling access to Resource Conservation areas while adapting access in other areas to align with the designated park parkwide resource management framework categories and provide access to a range of recreational opportunities offered in the park.

Controlling Access: Controlling access is an important strategy for minimizing anthropogenic disturbances to natural areas. This is critically important around parking areas and when transitioning between areas of differing resource management framework categories (e.g., Recreation Hub to Managed Use).

Provisioning Amenities/Facilities: The level of amenities and facilities should be commensurate with the recreational use and intensity of a given area. In Recreation Hub areas, facilities should be obvious, easily accessible and incorporated into the overall circulation plan for the access point.

Provisioning for new amenities or facilities should be limited to existing Recreation Hub areas to alleviate pressure on adjacent park sections and only considered for Resource Conservation or Managed Use areas as a means of mitigating problems that are directly impacting the park section's trajectory toward the target recovery level.

TABLE 1: MANAGEMENT ACTIONS MATRIX

Management Actions	Resource Quality Indicators						Stressor Categories				
	Diversity	Structure		Forest			Level of Invasion	Recreational Use / Intensity	Deer Browse	Soil Condition	Adjacency
		Meadow / Non-Forest	Complexity	Canopy Closure	Vertical Layering	Age Class Diversity					
	Cover										
Managing Stressors & Threats											
Managing Recreational Use/Intensity											
Managing Level of Invasion											
Managing Sensitive Areas											
Managing Operational Stressors											
Managing White-tailed Deer											
Facilitating Recovery											
Enhancing & Managing Forest											
Resetting Ecological Trajectories											
Recovering Soils											
Monitoring and Maintaining											

Key: Outcomes
Direct Indirect

Managing Trails: Overall trail density should be managed to the minimum necessary to promote circulation, provide access to recreational resources, and enhance user experience that is compatible with the designated resource management framework category.

Trails may be added, eliminated, rerouted or upgraded to support recovery objectives. New trails and reroutes should be integrated into the natural landscape and contours and consider protection of the soil, water, vegetation, visual quality, user safety, and long-term maintenance. Trail heads should be clearly labeled with signage indicating entrance into ecologically sensitive areas.

Managing focal points: Understanding the context of focal points is critical to their management. In general, access to the significant natural and historic features or viewsheds of the park should be preserved for the enjoyment of all users. Lesser or redundant focal points should be considered for closure in the context of the resource management framework.

Communicating Intent: Communicating the intent of management actions and the role of park users in resource conservation as part of a focused outreach plan is a critical component of managing recreational use/intensity.

Managing Level of Invasion

Managing level of invasion seeks to protect the largest tracts of the highest quality habitats (4) with the lowest level of invasion (D) and set the foundation for facilitating recovery. Managing level of invasion involves two complementary strategies:

Defend the VMAs with the highest quality habitats, those with a resource quality rating of 3 or greater. The defend strategy consists of less intensive targeted efforts that focus on slowing or preventing resource degradation or loss (e.g., cutting vines off trees) at the park wide scale.

Advance management efforts systematically from the VMAs with highest resource quality and lowest levels of invasion toward the VMAs with higher levels of invasion (from D to A) and lower resource quality (4 to 1). The advance strategy is a more intensive effort focused on reducing or eliminating the overall level of invasion within a VMA and adjacent VMAs that is implemented at the park section level.

Managing level of invasion is prioritized on a parkwide scale where high quality VMAs are targeted for the defend strategy and priority park sections are targeted for the advance strategy and development of a park section work plan. On a parkwide scale, the defend strategy also facilitates the advance strategy over time as the defend actions can establish a controlled area from which the advance strategy can be launched.

Managing Sensitive Areas

Implementing best practices: Sensitive areas layer onto the resource management framework. In general activities and disturbance should be limited in sensitive areas and their buffers to minimize resource degradation. When disturbance is necessary, best practices should be used to minimize and mitigate impacts. Any proposed improvements within sensitive areas shall be in accordance with all federal, state and local laws and regulations including the City’s Chesapeake Bay Preservation Act, Erosion and Sediment Control Ordinance, the Stormwater Management Act, and the Parks recorded conservation easement.

Restricting Access to Vulnerable Areas: Restricting park operations and management activities and/or public access to certain areas can support resource management, conservation, and recovery objectives. Access restrictions can be permanent or temporary. Permanent restrictions would limit access to areas that are highly vulnerable to disturbance year-round and temporary restrictions would be aligned to the times of year when species of concern are most vulnerable (e.g., nesting and brooding seasons) and/or when weather conditions are generally not favorable (e.g., when soils are seasonally too wet and vulnerable to compaction).

Protecting Trees: During project planning, considering the extent of impact to tree roots and branches is equally or more important than protecting the tree trunk alone. To minimize the impact of construction and other land disturbing activities on tree resources, including their root systems, standard tree protection practices should be applied in accordance with International Society of Arboriculture guidelines.

Managing Operational Stressors

The implementation of operational best management practices (BMPs) are a means of managing the stressors induced by park operations. While necessary, many routine maintenance activities can be vectors for the spread of NNI, compact soils, remove vegetation, disturb sensitive areas, and cause erosion that can hinder progress toward resource recovery goals. Some recommended BMPs include:

Coordinating Projects: When engaging in land disturbing activities, coordination is critical to protect resources and ensure consistency with management objectives across departments. Formalizing a process for coordinating land disturbing activities could involve weekly coordination meetings to review planned work, a review process with a simple review and signoff form by key parties, or an ad hoc pre-disturbance meetings or some combination of the three.

Mowing Responsibly: Mowing is a vegetation management practice that can support objectives related to user experience and ecological recovery when implemented in a controlled manner. Specifically, mowing can maintain vegetation height to make areas compatible with recreational uses, disrupt ecological succession to support meadow development, suppress NNI, and establish a sense of place and cues for park users. Mowing out of context can also threaten ecological recovery by facilitating the spread of NNI, destroying habitat, or disrupting desirable succession.

Managing Coarse Woody Debris: Coarse wood in natural environments provides beneficial wildlife habitat, promotes soil health and recovery, and redirects surface flows. Consequently, presence of coarse wood is an important component of ecological health and is compatible with resource management objectives. In some cases excessive amounts of coarse wood can be unsightly or become hazardous (e.g., fuel sources for wildfires) and for these reasons it needs to be managed.

Overall, coarse wood should generally be removed from trails in accordance with the strategies and guidance for the designated trail classification and resource management framework category. Coarse wood falling outside of trails may remain unless it presents a hazard or nuisance.

Controlling Erosion: Implementation of an erosion control plan is a critical component of any planned earth disturbing activity and should be performed in compliance with the City's Erosion and Sediment Control Ordinance. Erosion is also a concern anywhere flow concentrates on the landscape. This often occurs where water flows along trails, in stream channels, or where soils are compacted due to high recreational use intensity. The overall strategy for managing erosion on the landscape is to provide surface protection (vegetation, matting, straw, leaf duff, etc.) and disrupt flow paths; however, it is important to explore the causes before treating the symptoms. For example, heavy flow eroding a trail on a slope may be justification for closing or rerouting the trail rather than trying to defend it.

Stabilizing Soil: Following land disturbances, including NNI control activities, soils are susceptible to erosion and vulnerable to invasion in high-risk areas. BMPs for soil stabilization should include temporary and permanent vegetation and provisioning for temporary surface protections while vegetation establishes (e.g., straw or wood mulch, erosion control blankets, logs or other natural materials to redirect flow paths).

Limiting Pesticide Use: Use of pesticides may be necessary in support of park management and resource management objectives, but their use may harm beneficial insects and other wildlife. The use of pesticides should be limited, justified, and targeted in accordance with a pest management plan. When pesticide application is necessary, systemic pesticides (e.g., neonicotinoids) should generally be avoided when possible because they have a long residence time in plant tissues, including nectar and pollen that beneficial insects rely on. Use of non-systemic pesticides is more targeted but should consider timing of applications to minimize harm to beneficial insects.



Folks participating in a park cleanup event. Image credit: Bill Draper

Engaging Park Users and Volunteers

Outreach and volunteer engagement will be critical components of plan implementation. Specifically, outreach is necessary for park managers to better understand park use that is contributing to problem areas (e.g., why is a social trail there) and educate public on the strategies being implemented and why. Volunteer engagement provides two benefits. First, it helps with outreach, and second, it can increase your capacity to implement certain plan recommendations related to NNI control, resource recovery, and even outreach.

Due to the importance of outreach and volunteer support in the implementation of the plan, it may be beneficial to designate or hire a full or part-time outreach/volunteer coordinator to free up other staff time for other activities.

Managing White-tailed Deer

Managing the white-tailed deer stressor will become increasingly important as sections of the park progress toward recovery. Since JRPS is an open system where deer can freely move in and out, an overall deer management strategy will be an ongoing effort. A strategy for managing deer that includes a deer census, interim measures to support resource recovery, and long-term herd management should be developed.

Facilitating Recovery

Enhancing and Managing Forest

Enhancing and managing forests can correct impairments in species, age class diversity, or structure. Forest enhancements should be site specific and may require the direction of a licensed forester. The primary strategies for enhancing and managing forests are thinning or removal of less desirable trees to increase species and age class opportunities and supplemental plantings to improve diversity and structure. Interim strategies such as deer enclosure pods use fencing to reduce deer pressure in discrete areas to facilitate natural regeneration process in support of recovery objectives while a broader management strategy is underway.

Resetting Ecological Trajectories

Resetting ecological trajectories is a non-selective strategy that involves removing all or most of the existing vegetative cover to reset the successional state of a VMA. This strategy is best applied in VMAs with overall resource quality ratings of 1 or 2 where there is limited potential for natural recovery and a low risk of long-term damage or loss of the resource. Resetting trajectories may involve managing towards the original cover type (e.g., forest to forest) or another more compatible cover type (e.g., forest to meadow).

Recovering Soil

Soils can be damaged by trampling, compaction, and loss of organic material. This is common in high use intensity areas and along trails and access points. Standard best practices for soil recovery include deep tilling into the subsoil for decompaction with implements like a chisel plow and shallow tilling of surface soils with more conventional tillers to loosen and amend them with organic material. These practices are very disruptive, best applied at larger scales, and not applicable to steep slopes or areas under tree canopy due to impacts to critical root zones. Less intrusive means of decompacting and amending soils are necessary in these areas.

Monitoring & Maintaining

Monitoring and adaptive management are means of ensuring the ongoing recovery of the park by using the monitoring results to inform future actions. A simple assessment form that characterizes the Recreational Use/Intensity, Resource Quality (forest and meadow/non-forest), Level of Invasion, and other stressors (Deer Browse, Soil Condition, and Adjacency) is provided in [Appendix B](#) along with a primer on completing the form and interpreting data. The intent of the assessments is to provide a snapshot of the status with enough data to inform management actions and priorities in accordance with the Natural Resource Management Plan (NRMP).

This evaluation should be undertaken annually within all park sections under active management to track the status and effectiveness of management actions and on a parkwide basis every 5 years at a minimum. However, it is also advisable to assess highly vulnerable management units (e.g., management units of high resource quality and high levels of invasion or adjacent to higher levels of invasion) annually and implement targeted management to minimize the risk of resource degradation or loss.

Each active VMA should show continual improvement for the parameters that are actively managed in accordance with the recovery objectives and the targets established by the resource management framework category (see [Chapter 3](#)). Should a VMA not track toward its target, the following action thresholds have been set.

- Overall resource quality rating or any individual stressor rating (e.g., level of invasion, recreational use/intensity) degrades by one category (e.g., functioning at risk to compromised) in a monitoring year.
- Any individual indicator or stressor rating (e.g., diversity, cover, complexity) shows a degrading trend from baseline for two or more consecutive assessment years (e.g., rating slides from functioning at risk to compromised).
- Overall resource quality rating and individual stressor ratings (e.g., level of invasion, recreational use/intensity) show no improvement after 5 years of management.

If an action threshold is exceeded, the underperforming indicator or stressor categories can be related to management actions having a direct outcome on the stressor or indicator to help determine what remedial actions may be needed to correct the trajectory.

IMPLEMENTATION COST CONSIDERATIONS

The cost of implementing the recommendations provided in the plan will vary depending on the existing staff and volunteer capacity to implement the recommended work and the pace at which you proceed. The following considerations are offered to help with the budget planning process.

Invasive Plant Management

The cost of invasive plant management involves both advancing the front against existing and new invasions and maintaining controlled areas. As the more acreage is managed, more staff capacity needs to be allocated to the maintenance at the cost of continuing to advance the front. Based on information provided in surveys and conversations, we estimate the current staff has the capacity to maintain approximately 130 acres based on the following assumptions:

- o Crew size = 2-3 people
- o Availability = 2.5 days/week
- o Season = 26 weeks (6 months)
- o Productive Crew Days = 65 days/year

Figures 8-10 demonstrate how staff capacity to advance the front diminishes after only two years. The basis of these graphs assumes 50 acres is currently managed and staff production for maintenance activities averages 2 ac/day (25 days or 38.5% of staff time). The balance of the staff time (40 days) is allocated toward advancing the front at an average production rate of 1 ac/day (40 acres). As a result, we recommend increasing capacity to implement the plan within the next two years and re-evaluating every two years as illustrated in the following graphs.

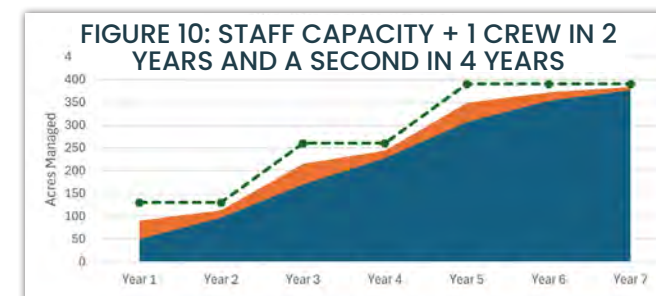
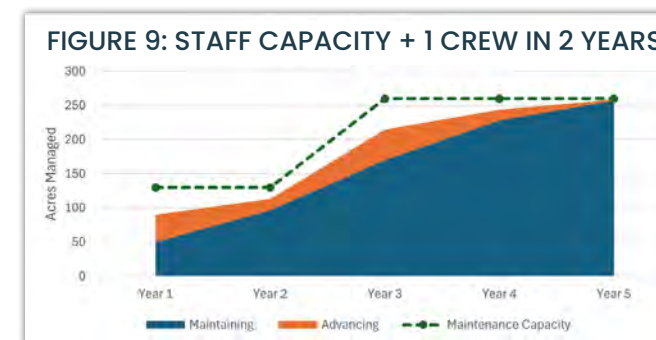
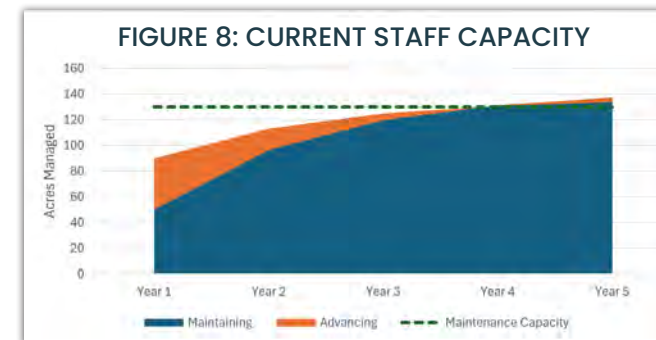
Increasing capacity can be undertaken by hiring new permanent or seasonal staff, expanding volunteer programs to support implementation, and augmenting with contractor support. It should be noted that an ongoing level of support will be necessary to maintain the managed natural areas within JRPS.

Table 2 provides some general planning level estimates (+/-25%) to assist in decision making.

Level of Invasion	Treatment Capacity (Acres/day)	Crew Day Rate ¹	Treatment Cost/Acre
1	0.25	\$2,600	\$10,400
2	0.5	\$2,600	\$5,200
3	1	\$2,600	\$2,600
4	2	\$2,600	\$1,300
Average	0.9375		\$4,875

1. Day rates include basic tools materials and incidental. Machinery is excluded.

For comparison, contractor support for 65 days to match current staff capacity could cost \$438,750/year.



Facilitating recovery

The costs of facilitating recovery will vary depending on the specific objectives of each project. General planning costs for some strategies are provided in [Table 3](#).

Activity	Unit cost for planning	Notes
Forest enhancement	\$20,000/ac.	Planting, fencing and survival warranty.
Reforestation/Afforestation	\$37,000 - \$60,000/Ac	3 gal trees with deer protection and warranty
Meadow establishment	\$5,750 - \$8,050/ac.	Prep and seed, establishment warranty.
Soil Recovery	\$12-\$21/SY	Includes matting, straw mulch, compost and temp seed. Higher range include permanent seed and/or hardwood mulch.

Monitoring and adaptive management

Overall monitoring and adaptive management cost will consist of an annual assessment and the overall operational costs of implementing the plan. The annual assessment cost should assume that one park section can be assessed per day, which may result in a couple of weeks of staff time depending on how many units are under active management. For remediation of problem areas and NNI maintenance the cost guidance provided in the previous sections is applicable.

IMPLEMENTATION TIMELINE & GUIDING PRINCIPLES

Implementation of the Natural Resources Management Plan is an ongoing and adaptive process that is responsive to the existing and emerging stressors and threats to park resources and focuses on continual improvement. To facilitate planning, a proposed implementation timeline is presented in **Table 4**. This timeline illustrates the stepwise implementation of the various categories of the management framework and is organized by the following phases:

Piloting

Selecting a set of attainable projects to implement on small scales (VMA or smaller) to demonstrate proof of concept and work out details of your best practices. Each pilot project should target a specific management action in the framework to scale up in the next phase.

Adapting, Adopting, & Building Capacity

This is about taking what was learned in the piloting phase, adopting best practices and tools, and scaling up. This is also the time to focus on building capacity through hiring staff and volunteer engagement.

Advancing

The advancing phase is when most of your best practices are in place and demonstrating success and the team has the capacity to move from the initial park sections to the next round, while reserving capacity to monitor and maintain completed work.

Maturing

At the maturing phase, management efforts are pivoting to the less intensive work of monitoring and maintaining.

It should be noted that the years referenced in the proposed timeline are provided for guidance, and the intent of the timeline is to provide a means of visualizing the implementation schedule.

The overall goal of the plan is continuous improvement and the plan actions should be undertaken in timeframes that support that goal. As a result, not all management actions need to start and advance simultaneously on day 1. It is recommended that some core supporting actions within each of the management categories (e.g., managing recreation use intensity, managing level of invasion) are initiated with pilot projects within each 5-year planning cycle, such that the actions can be scaled up and you can demonstrate progress toward your goal at each 5-year milestone.

Due to the scope and scale of implementing an ambitious NRMP, the following guiding principles should also be considered in planning and executing the plan:

1. **Prioritize battles you can win**
 - Focus on a limited number of park sections
 - Consider your capacity and always prioritize maintaining ground over gaining ground
2. **Advance with purpose**
 - Work in a logical sequence and outward from a managed area
 - Only advance to an adjacent management unit when threats are managed in the current unit
3. **Managing threats will lead to recovery**
 - Celebrate when threats in a management unit are managed – it’s a win, even if that is all you can do. Natural processes will take over even if you don’t have funding capacity to facilitate recovery.
4. **Monitoring and adaptive management are critical**
 - Monitor annually to track the trajectory and effectiveness of your hard work
 - Adapt regularly if things are not progressing.

TABLE 4: IMPLEMENTATION TIMELINE

Year	Piloting		Adapting, Adopting, & Building Capacity			Advancing				Maturing			
	1	2	3	4	5	6	7	8	9	10	11-15	15-20	20+
Adopt Parkwide Management Framework													
Assess and Prioritize													
Manage Stressors and Threats													
Facilitate Recovery													
Monitoring & Maintaining													



CHAPTER 5

PARK SECTION SUMMARIES

The following park section summaries are intended to complement the parkwide resource management framework with supplemental focus areas for each park section. The park section summaries also include more detailed park section maps that display the alpha-numeric coding representing the resource quality and level of invasion for each VMA. As discussed in the resource recovery strategy, this coding is intended to guide implementation and track recovery.

Due to time limitations and access constraints in the scope of this study, some park sections were not assessed and lack detailed mapping. It is recommended that the Resource Quality and Level of Invasion assessments are completed, so that these sections can be integrated into the management framework. The provided Resource Monitoring & Adaptive Management Rapid Assessment Form provided in Appendix B can be used for this purpose.

FIGURE 11: PONY PASTURE (PP)

NNI TREATMENT PRIORITIZATION BY VEGETATION MANAGEMENT AREA

Natural Community Type(s): Piedmont/Mountain Floodplain Forest

Management Categories: Recreation Hub, Managed Use, Resource Conservation

Legend

▭ Park Sections Outlines

▭ 100 Year Floodplain

--- 2 ft contour interval

--- 10 ft contour interval

▭ Parking Lots

★ Access Hubs

Vegetation Management Area Rating

1A 3A

1B 3B

1C 3C

1D 3D

2A 4A

2B 4B

2C 4C

2D 4D

▭ Uncategorized

Management Framework Category

▭ Managed Use

▭ Recreation Hub

▭ Resource Conservation

Focal Point Type

• Amenities (Restroom, seating, etc)

• Overlook

• Point of Interest (Historic & Natural)

• Recreation (Climbing or water access)

• Other

Trail Type

▭ Uncategorized

▭ Trail Type A

▭ Trail Type B

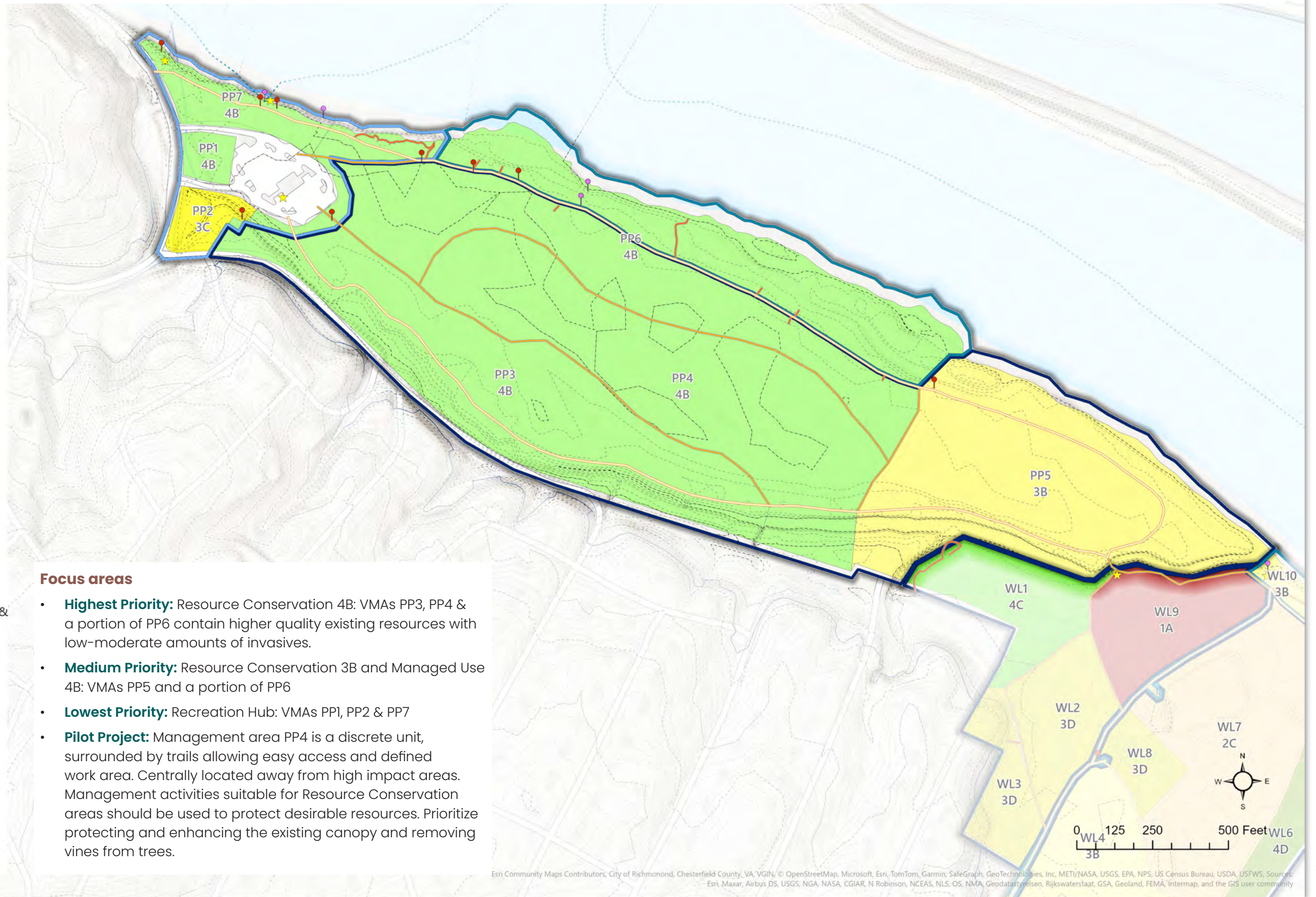
▭ Trail Type C

▭ Water Trails

▭ Trails Outside Assessed Areas

Focus areas

- **Highest Priority:** Resource Conservation 4B: VMAs PP3, PP4 & a portion of PP6 contain higher quality existing resources with low-moderate amounts of invasives.
- **Medium Priority:** Resource Conservation 3B and Managed Use 4B: VMAs PP5 and a portion of PP6
- **Lowest Priority:** Recreation Hub: VMAs PP1, PP2 & PP7
- **Pilot Project:** Management area PP4 is a discrete unit, surrounded by trails allowing easy access and defined work area. Centrally located away from high impact areas. Management activities suitable for Resource Conservation areas should be used to protect desirable resources. Prioritize protecting and enhancing the existing canopy and removing vines from trees.



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FIGURE 12: THE WETLANDS (WL)

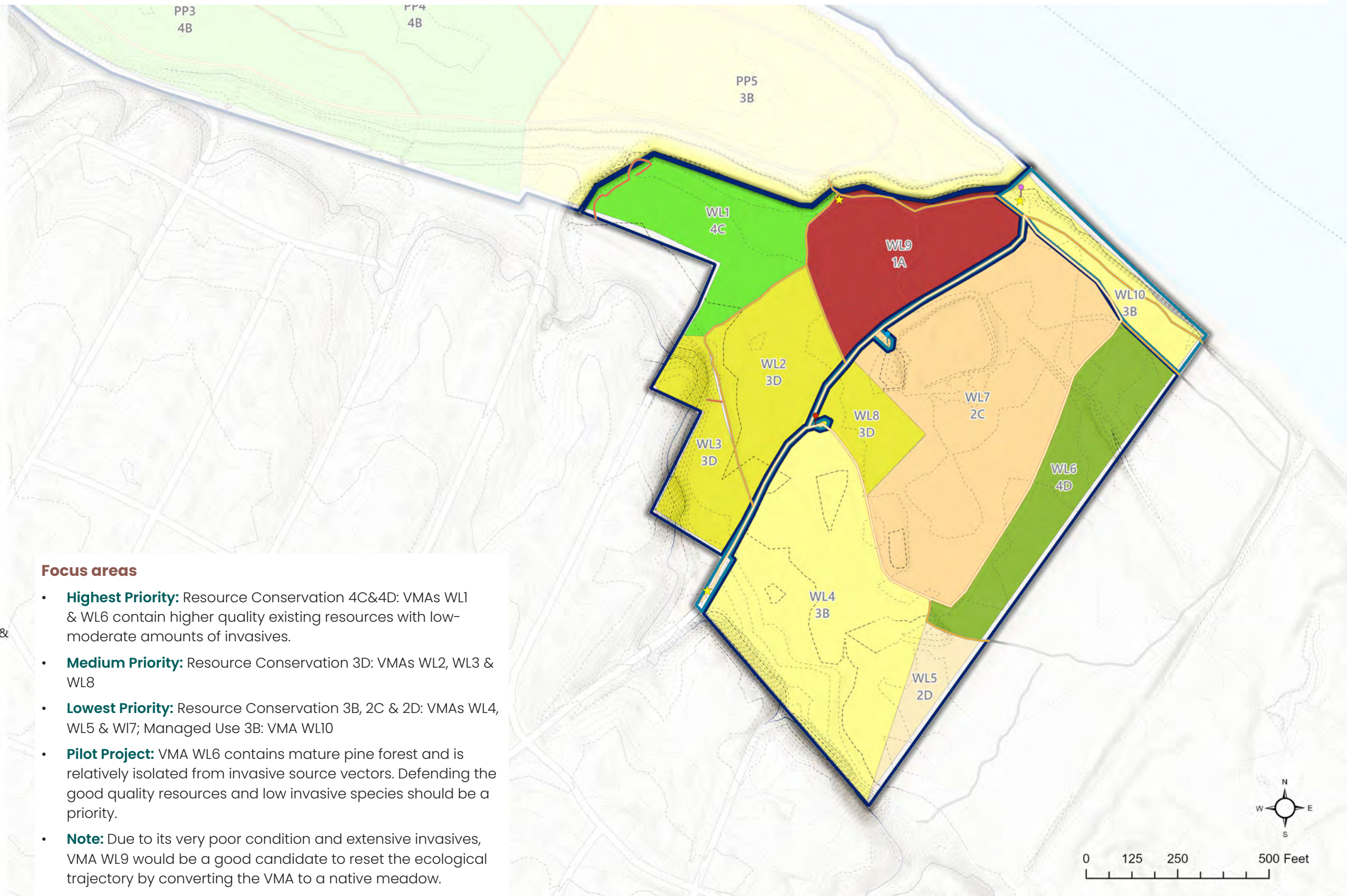
NNI TREATMENT PRIORITIZATION BY VEGETATION MANAGEMENT AREA

Natural Community Type(s): Piedmont/Mountain Floodplain Forest, Coastal Plain/Piedmont Floodplain Swamp

Management Categories: Managed Use, Resource Conservation

Legend

- Park Sections Outlines
- 100 Year Floodplain
- 2 ft contour interval
- 10 ft contour interval
- Parking Lots
- Access Hubs
- Vegetation Management Area Rating**
- 1A
- 1B
- 1C
- 1D
- 2A
- 2B
- 2C
- 2D
- 3A
- 3B
- 3C
- 3D
- 4A
- 4B
- 4C
- 4D
- Uncategorized
- Management Framework Category**
- Managed Use
- Recreation Hub
- Resource Conservation
- Focal Point Type**
- Amenities (Restroom, seating, etc)
- Overlook
- Point of Interest (Historic & Natural)
- Recreation (Climbing or water access)
- Other
- Trail Type**
- Uncategorized
- Trail Type A
- Trail Type B
- Trail Type C
- Water Trails
- Trails Outside Assessed Areas



Focus areas

- **Highest Priority:** Resource Conservation 4C&4D: VMAs WL1 & WL6 contain higher quality existing resources with low-moderate amounts of invasives.
- **Medium Priority:** Resource Conservation 3D: VMAs WL2, WL3 & WL8
- **Lowest Priority:** Resource Conservation 3B, 2C & 2D: VMAs WL4, WL5 & WL7; Managed Use 3B: VMA WL10
- **Pilot Project:** VMA WL6 contains mature pine forest and is relatively isolated from invasive source vectors. Defending the good quality resources and low invasive species should be a priority.
- **Note:** Due to its very poor condition and extensive invasives, VMA WL9 would be a good candidate to reset the ecological trajectory by converting the VMA to a native meadow.

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FIGURE 13: HUGUENOT FLATWATER PARK (HWF)

NNI TREATMENT PRIORITIZATION BY VEGETATION MANAGEMENT AREA

Natural Community Type(s): Piedmont/Mountain Floodplain Forest,

Management Categories: Managed Use, Resource Conservation

Legend

▭ Park Sections Outlines

▭ 100 Year Floodplain

⋯ 2 ft contour interval

⋯ 10 ft contour interval

▭ Parking Lots

★ Access Hubs

Vegetation Management Area Rating

■ 1A ■ 3A

■ 1B ■ 3B

■ 1C ■ 3C

■ 1D ■ 3D

■ 2A ■ 4A

■ 2B ■ 4B

■ 2C ■ 4C

■ 2D ■ 4D

▭ Uncategorized

Management Framework Category

▭ Managed Use

▭ Recreation Hub

▭ Resource Conservation

Focal Point Type

● Amenities (Restroom, seating, etc)

● Overlook

● Point of Interest (Historic & Natural)

● Recreation (Climbing or water access)

○ Other

Trail Type

▭ Uncategorized

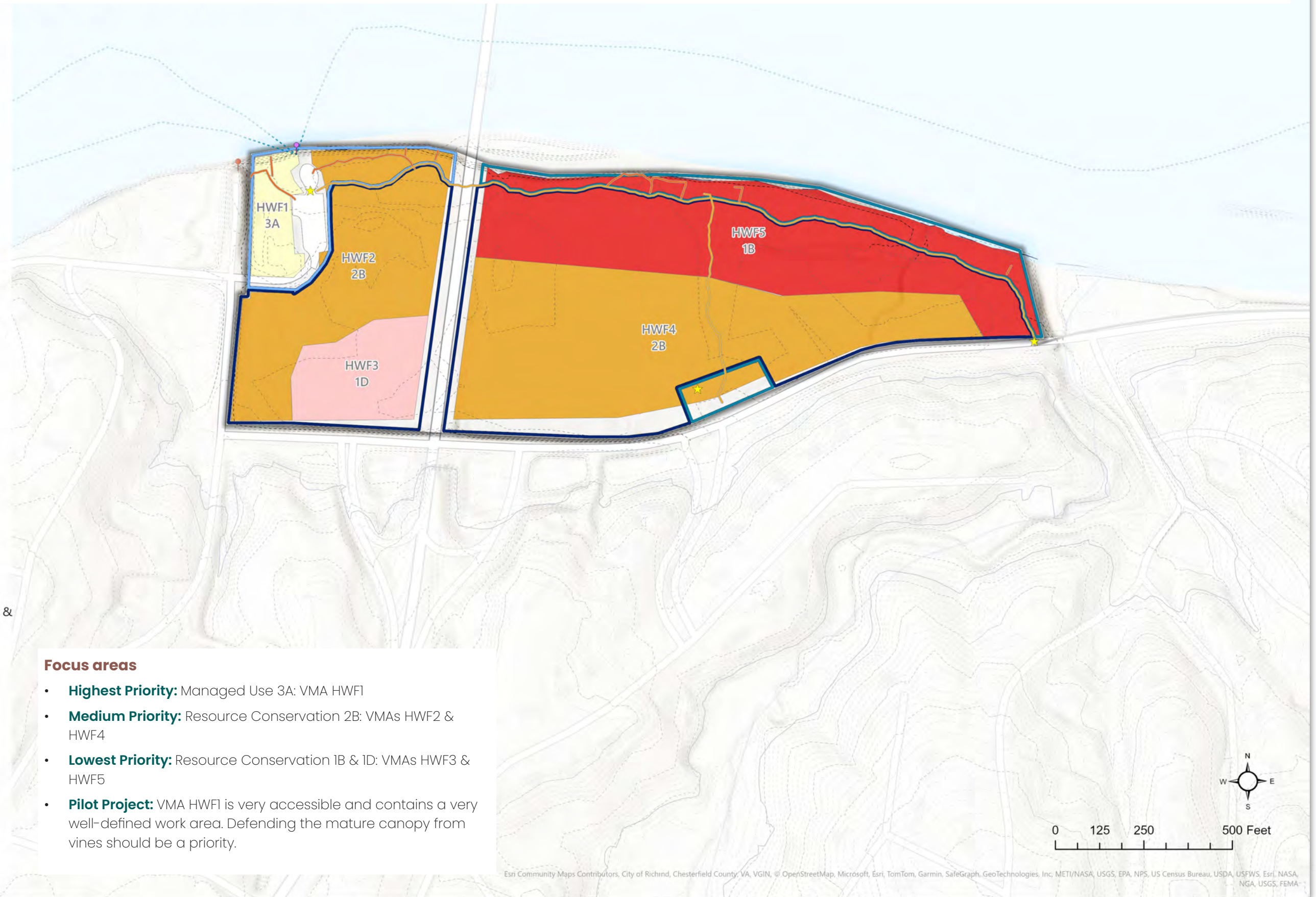
▭ Trail Type A

▭ Trail Type B

▭ Trail Type C

⋯ Water Trails

▭ Trails Outside Assessed Areas



Focus areas

- **Highest Priority:** Managed Use 3A: VMA HWF1
- **Medium Priority:** Resource Conservation 2B: VMAs HWF2 & HWF4
- **Lowest Priority:** Resource Conservation 1B & 1D: VMAs HWF3 & HWF5
- **Pilot Project:** VMA HWF1 is very accessible and contains a very well-defined work area. Defending the mature canopy from vines should be a priority.

0 125 250 500 Feet



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FIGURE 14: BUTTERMILK TRAIL WEST (BTW)

NNI TREATMENT PRIORITIZATION BY VEGETATION MANAGEMENT AREA

Natural Community Type(s): Piedmont/Mountain Floodplain Forest, Mesic Mixed Hardwood Forest

Management Categories: Resource Conservation



FIGURE 15: BOULEVARD TO REEDY CREEK (BRC)

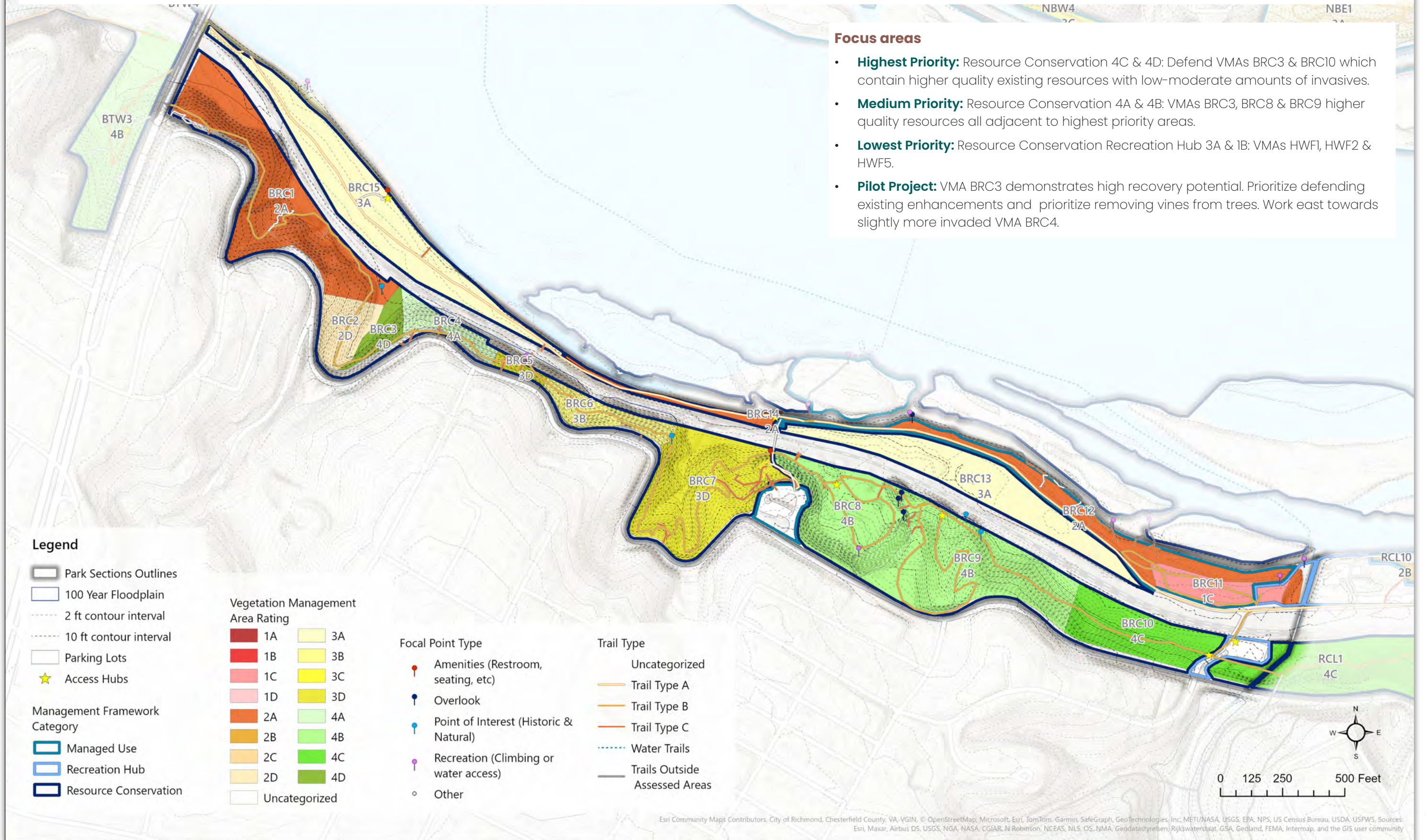
NNI TREATMENT PRIORITIZATION BY VEGETATION MANAGEMENT AREA

Natural Community Type(s): Piedmont/Mountain Floodplain Forest, Mesic Mixed Hardwood Forest

Management Categories: Recreation Hub, Managed Use, Resource Conservation

Focus areas

- **Highest Priority:** Resource Conservation 4C & 4D: Defend VMAs BRC3 & BRC10 which contain higher quality existing resources with low-moderate amounts of invasives.
- **Medium Priority:** Resource Conservation 4A & 4B: VMAs BRC3, BRC8 & BRC9 higher quality resources all adjacent to highest priority areas.
- **Lowest Priority:** Resource Conservation Recreation Hub 3A & 1B: VMAs HWF1, HWF2 & HWF5.
- **Pilot Project:** VMA BRC3 demonstrates high recovery potential. Prioritize defending existing enhancements and prioritize removing vines from trees. Work east towards slightly more invaded VMA BRC4.



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FIGURE 16: REEDY CREEK TO LEE BRIDGE (RCL)

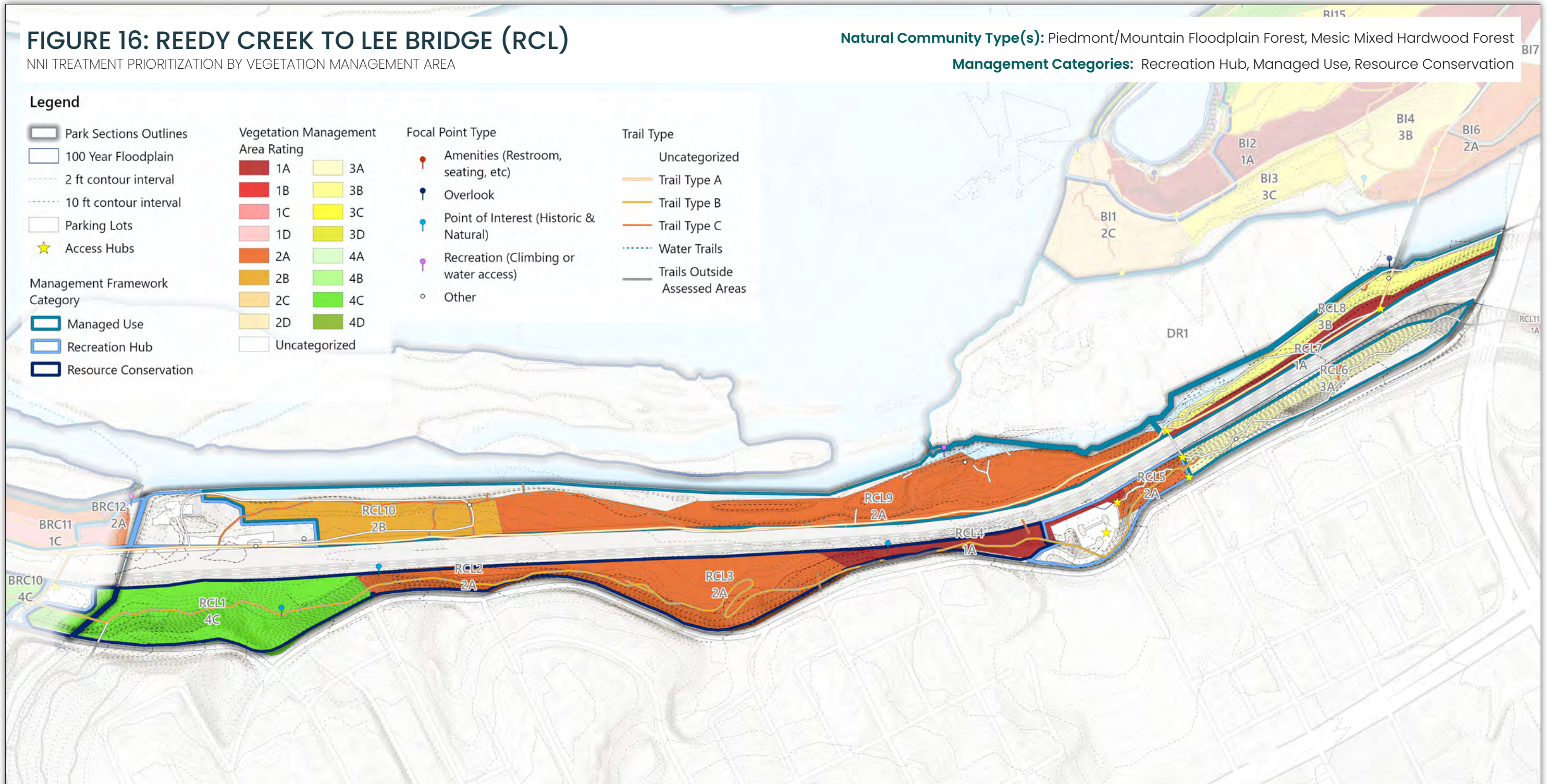
NNI TREATMENT PRIORITIZATION BY VEGETATION MANAGEMENT AREA

Natural Community Type(s): Piedmont/Mountain Floodplain Forest, Mesic Mixed Hardwood Forest

Management Categories: Recreation Hub, Managed Use, Resource Conservation

Legend

	Vegetation Management Area Rating	Focal Point Type	Trail Type
Management Framework Category			



Focus areas

- **Highest Priority:** Resource Conservation 4C: VMA RCL1; Managed Use 3A & 3B: VMAs RCL6 & RCL8
- **Medium Priority:** Resource Conservation 2A & 2B: VMAs RCL2 & RCL3; Managed Use 2A & 2B: VMAs RCL9 & RCL10
- **Lowest Priority:** Managed Use 1A: VMA RCL7; Recreation Hub 1A: VMA RCL5
- **Pilot Project:** VMA RCL1 is a discrete unit with a well-defined work area bound on one side by roadway, one side by stream and one side by railway, bisected by a trail allowing easy access. Management activities suitable for Resource Conservation areas should be used to protect desirable resources. Prioritize protecting and enhancing the existing canopy and removing vines from trees – defend strategy. Work should occur from west to east towards the more invaded RCL2.

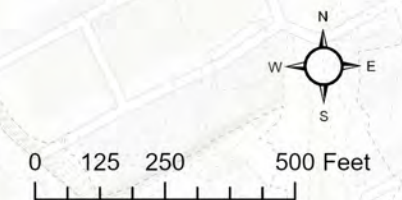


FIGURE 17: BELLE ISLE (BI)

NNI TREATMENT PRIORITIZATION BY VEGETATION MANAGEMENT AREA

Natural Community Type(s): Piedmont/Mountain Floodplain Forest, Mesic Mixed Hardwood Forest, Acidic Oak-Hickory Forest

Management Categories: Recreation Hub, Managed Use, Resource Conservation

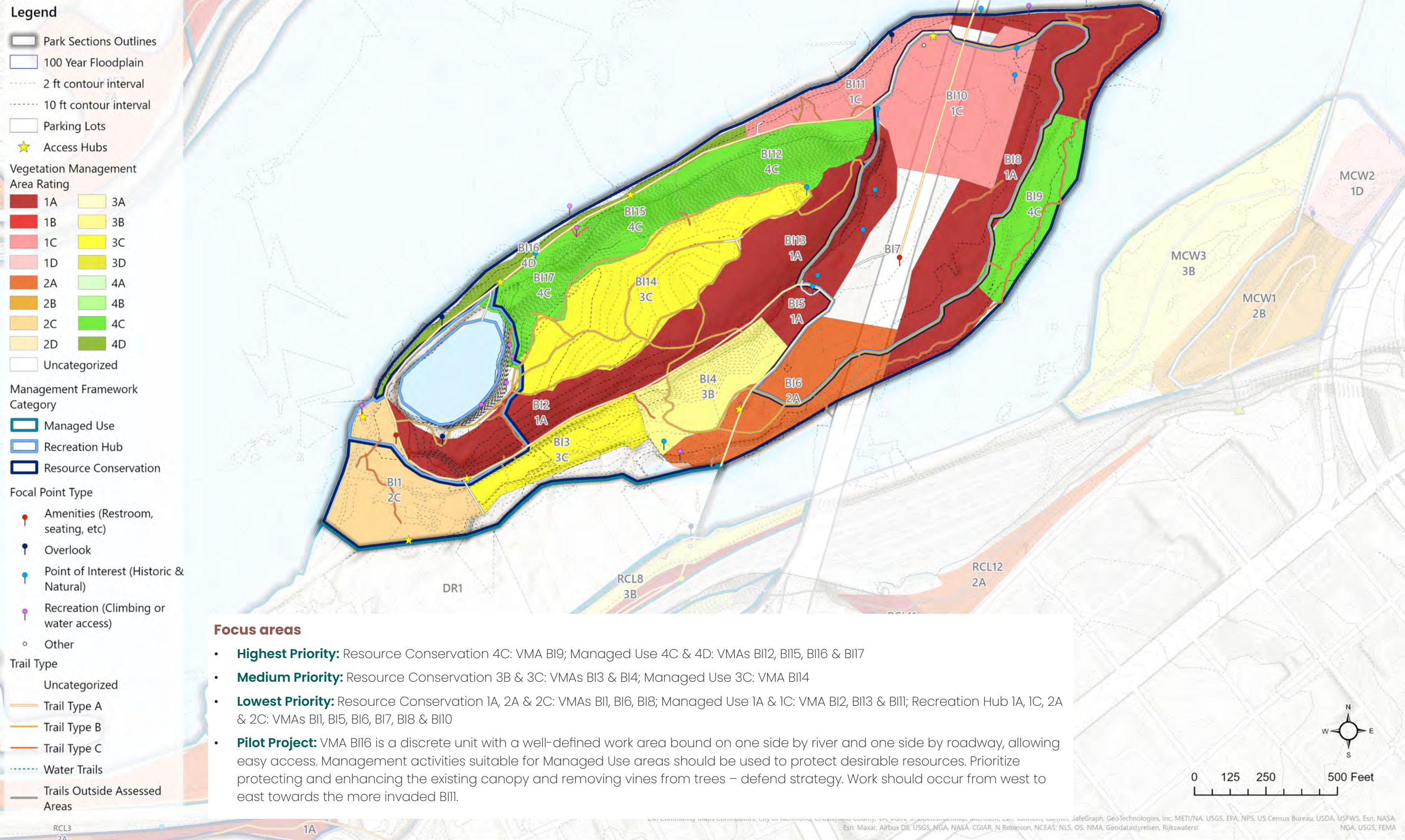
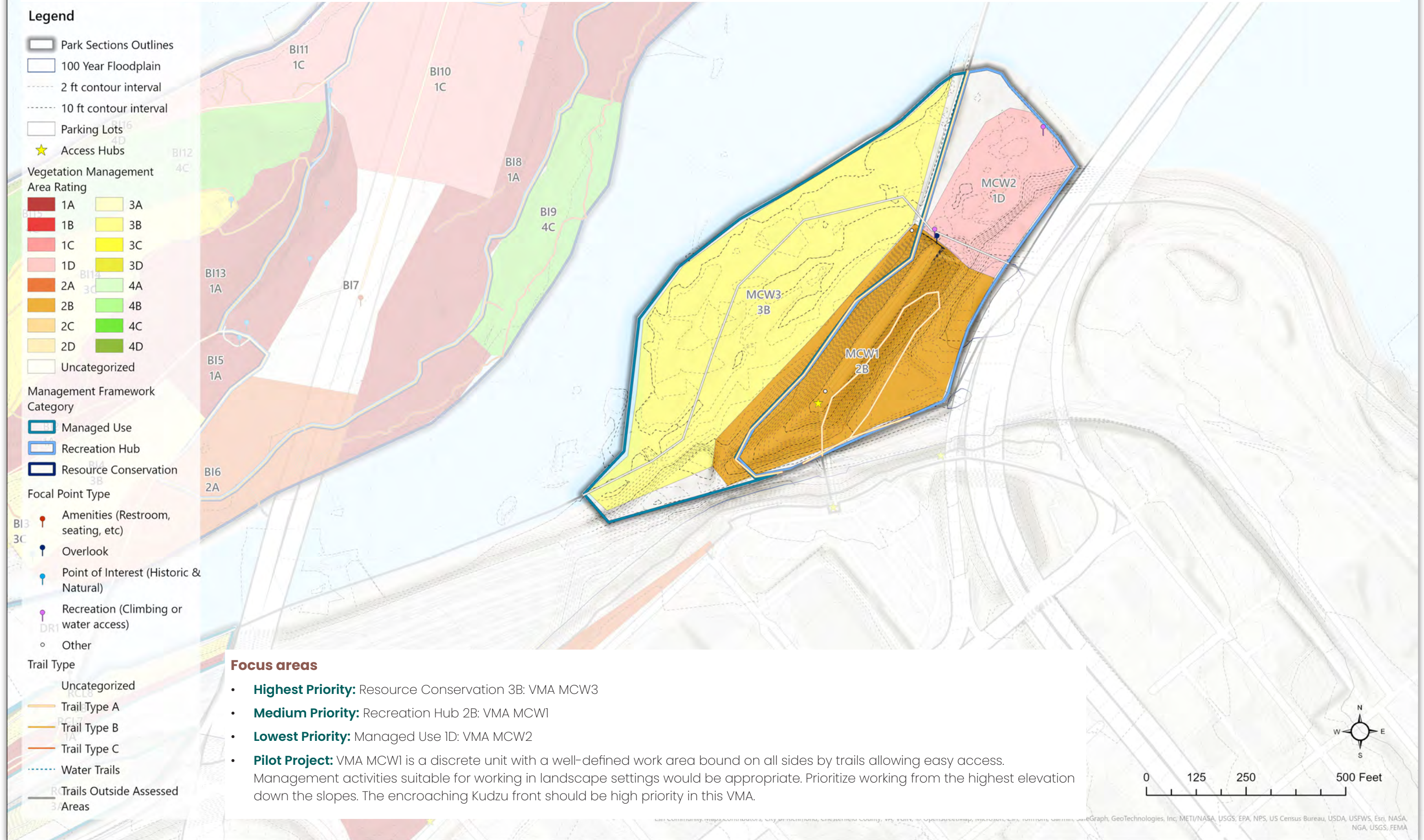


FIGURE 18: MANCHESTER CLIMBING WALL (MCW)

NNI TREATMENT PRIORITIZATION BY VEGETATION MANAGEMENT AREA

Natural Community Type(s): Piedmont/Mountain Floodplain Forest

Management Categories: Recreation Hub, Managed Use



Focus areas

- **Highest Priority:** Resource Conservation 3B: VMA MCW3
- **Medium Priority:** Recreation Hub 2B: VMA MCW1
- **Lowest Priority:** Managed Use 1D: VMA MCW2
- **Pilot Project:** VMA MCW1 is a discrete unit with a well-defined work area bound on all sides by trails allowing easy access. Management activities suitable for working in landscape settings would be appropriate. Prioritize working from the highest elevation down the slopes. The encroaching Kudzu front should be high priority in this VMA.



FIGURE 19: ANCARROW'S LANDING (AL) & CHAPEL ISLAND (CI)

NNI TREATMENT PRIORITIZATION BY VEGETATION MANAGEMENT AREA

Natural Community Type(s): Piedmont/Mountain Floodplain Forest

Management Categories: Recreation Hub, Managed Use

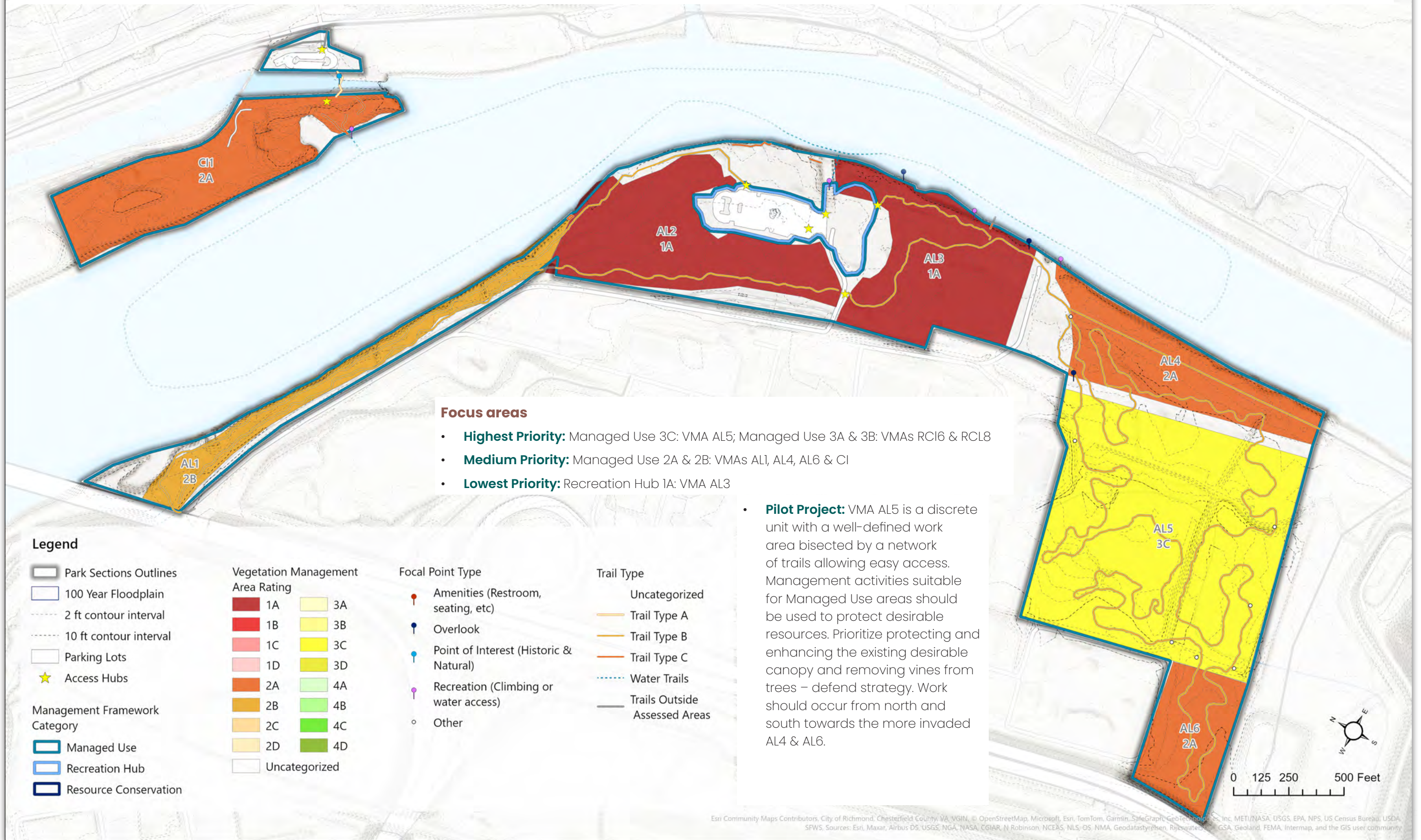


FIGURE 20: PUMPHOUSE PARK (PPK)

NNI TREATMENT PRIORITIZATION BY VEGETATION MANAGEMENT AREA

Natural Community Type(s): Piedmont/Mountain Floodplain Forest, Acidic Oak Hickory Forest

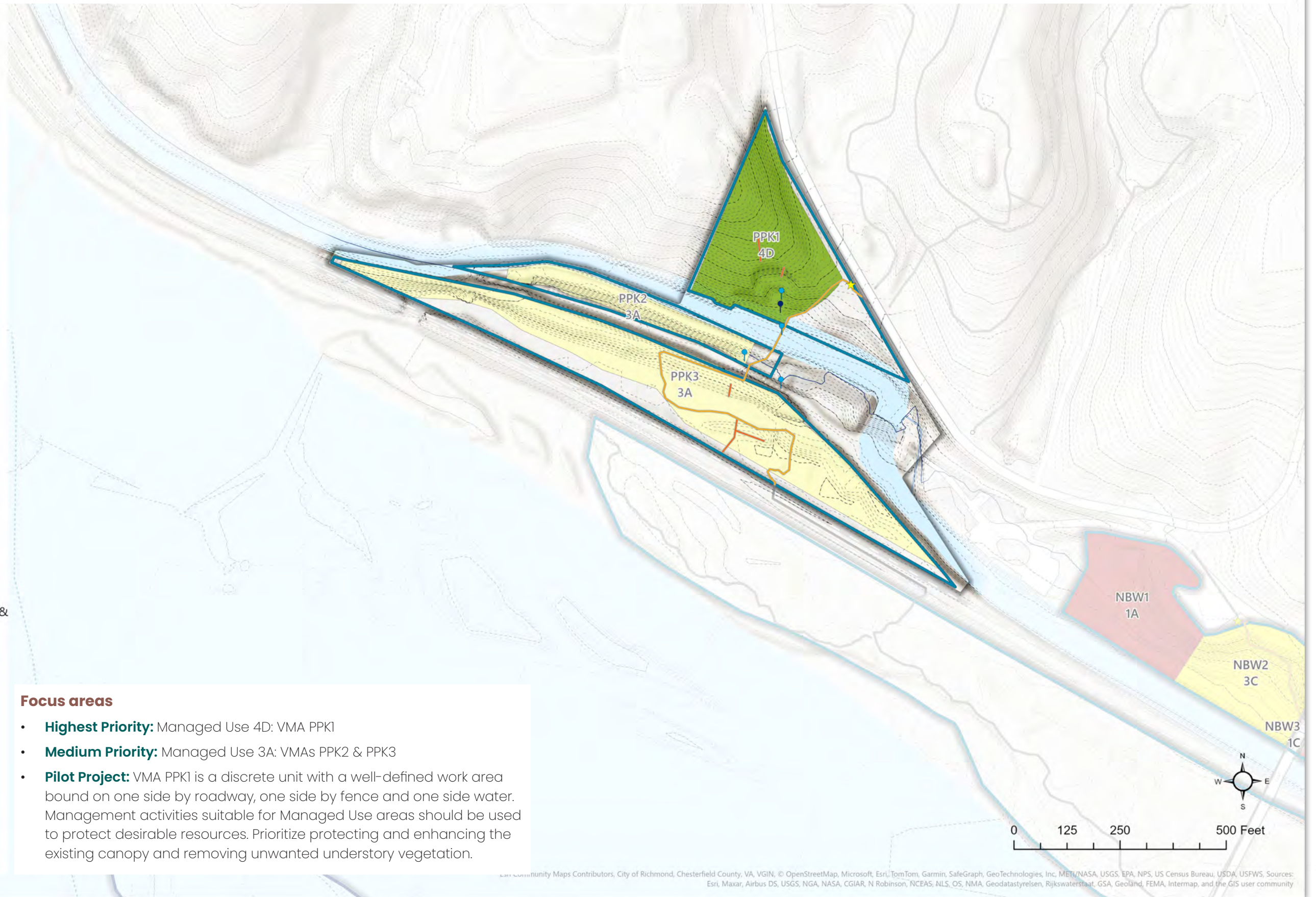
Management Categories: Managed Use

Legend

- Park Sections Outlines
- 100 Year Floodplain
- 2 ft contour interval
- 10 ft contour interval
- Parking Lots
- Access Hubs
- Vegetation Management Area Rating**
- 1A
- 1B
- 1C
- 1D
- 2A
- 2B
- 2C
- 2D
- 3A
- 3B
- 3C
- 3D
- 4A
- 4B
- 4C
- 4D
- Uncategorized
- Management Framework Category**
- Managed Use
- Recreation Hub
- Resource Conservation
- Focal Point Type**
- Amenities (Restroom, seating, etc)
- Overlook
- Point of Interest (Historic & Natural)
- Recreation (Climbing or water access)
- Other
- Trail Type**
- Uncategorized
- Trail Type A
- Trail Type B
- Trail Type C
- Water Trails
- Trails Outside Assessed Areas

Focus areas

- **Highest Priority:** Managed Use 4D: VMA PPK1
- **Medium Priority:** Managed Use 3A: VMAs PPK2 & PPK3
- **Pilot Project:** VMA PPK1 is a discrete unit with a well-defined work area bound on one side by roadway, one side by fence and one side water. Management activities suitable for Managed Use areas should be used to protect desirable resources. Prioritize protecting and enhancing the existing canopy and removing unwanted understory vegetation.



BTW4

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FIGURE 21: NORTH BANK TRAIL EAST (NBE)

NNI TREATMENT PRIORITIZATION BY VEGETATION MANAGEMENT AREA

Natural Community Type(s): Piedmont/Mountain Floodplain Forest, Acidic Oak Hickory Forest

Management Categories: Recreation Hub, Managed Use, Resource Conservation

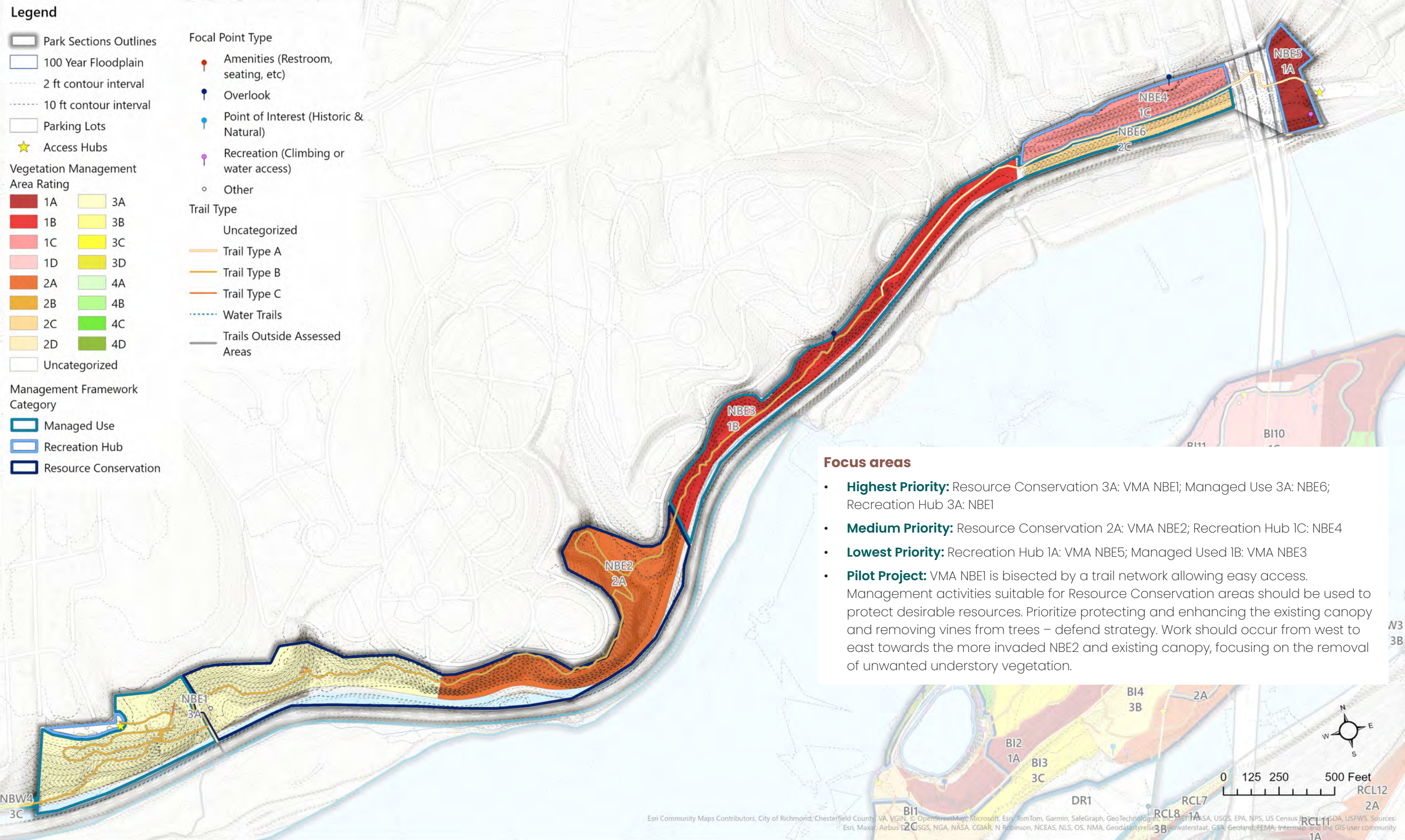
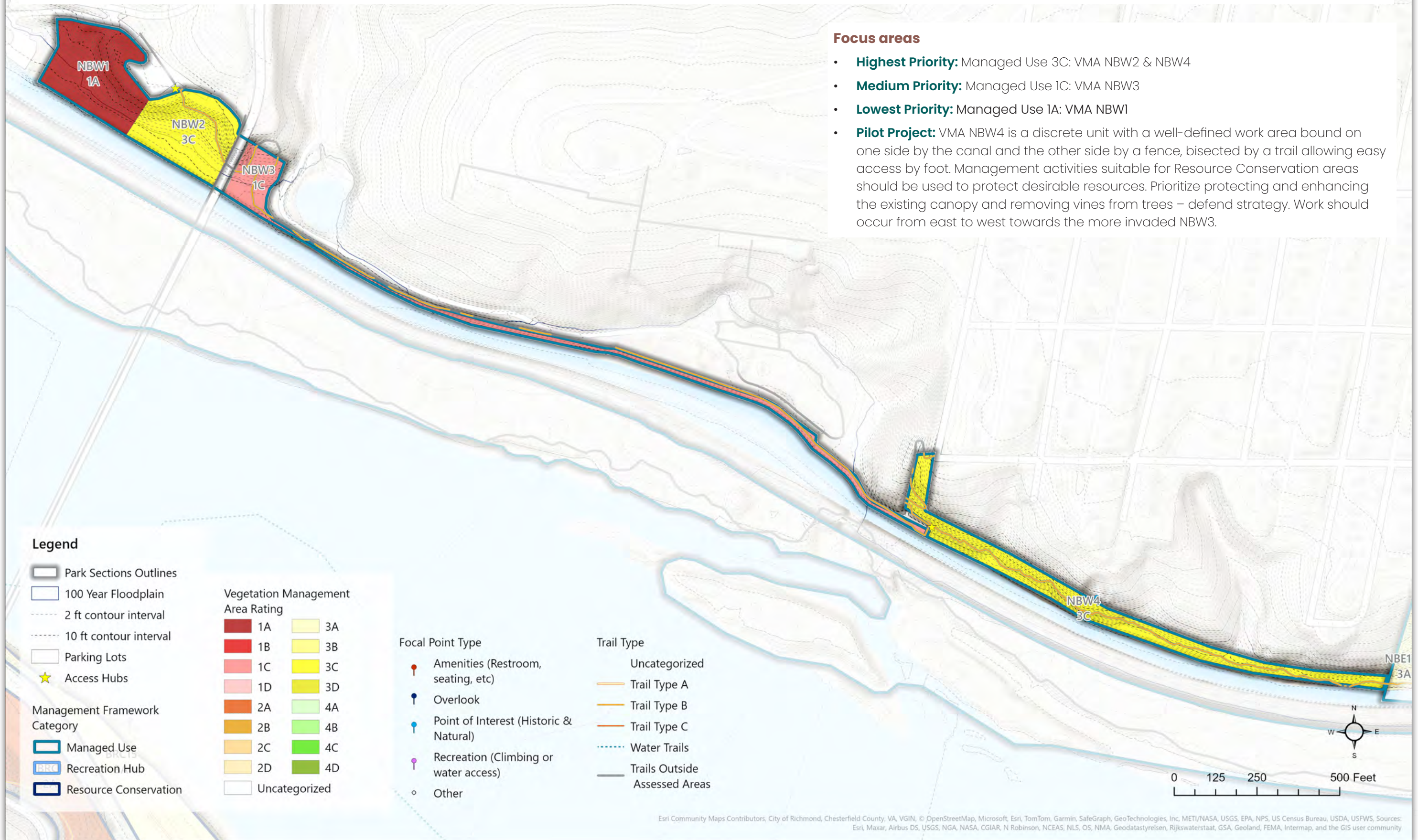


FIGURE 22: NORTH BANK TRAIL WEST (NBW)

NNI TREATMENT PRIORITIZATION BY VEGETATION MANAGEMENT AREA

Natural Community Type(s): Piedmont/Mountain Floodplain Forest

Management Categories: Managed Use



Focus areas

- **Highest Priority:** Managed Use 3C: VMA NBW2 & NBW4
- **Medium Priority:** Managed Use 1C: VMA NBW3
- **Lowest Priority:** Managed Use 1A: VMA NBW1
- **Pilot Project:** VMA NBW4 is a discrete unit with a well-defined work area bound on one side by the canal and the other side by a fence, bisected by a trail allowing easy access by foot. Management activities suitable for Resource Conservation areas should be used to protect desirable resources. Prioritize protecting and enhancing the existing canopy and removing vines from trees – defend strategy. Work should occur from east to west towards the more invaded NBW3.

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REMAINING PARK SECTIONS

UNASSESSED BY BIOHABITATS

Texas Beach

Natural Community Type(s): Piedmont/Mountain Floodplain Forest

Management Categories: Managed Use, Resource Conservation

Focus areas: Complete rapid assessment, establish VMAs, and integrated into the parkwide scale management program.

Pipeline or Trestle Trail

Natural Community Type(s): Piedmont/Mountain Floodplain Forest

Management Categories: Recreation Hub, Managed Use

Focus areas: Complete rapid assessment, establish VMAs, and integrated into the parkwide scale management program.

Bohannon Island

Natural Community Type(s): Piedmont/Mountain Floodplain Forest

Management Categories: Resource Conservation
Focus areas: Complete rapid assessment, establish VMAs, and integrated into the parkwide scale management program.

Archer Island

Natural Community Type(s): Piedmont/Mountain Floodplain Forest

Management Categories: Managed Use, Resource Conservation

Focus areas: Complete rapid assessment, establish VMAs, and integrated into the parkwide scale management program.

Cooper Island

Natural Community Type(s): Piedmont/Mountain Floodplain Forest

Management Categories: Resource Conservation

Focus areas: Complete rapid assessment, establish VMAs, and integrated into the parkwide scale management program.

Williams Island

Natural Community Type(s): Piedmont/Mountain Floodplain Forest

Management Categories: Resource Conservation

Focus areas: Complete rapid assessment, establish VMAs, and integrated into the parkwide scale management program.

Riverside Meadow

Natural Community Type(s): Piedmont/Mountain Floodplain Forest

Management Categories: Managed Use, Resource Conservation

Focus areas: Complete rapid assessment, establish VMAs, and integrated into the parkwide scale management program.

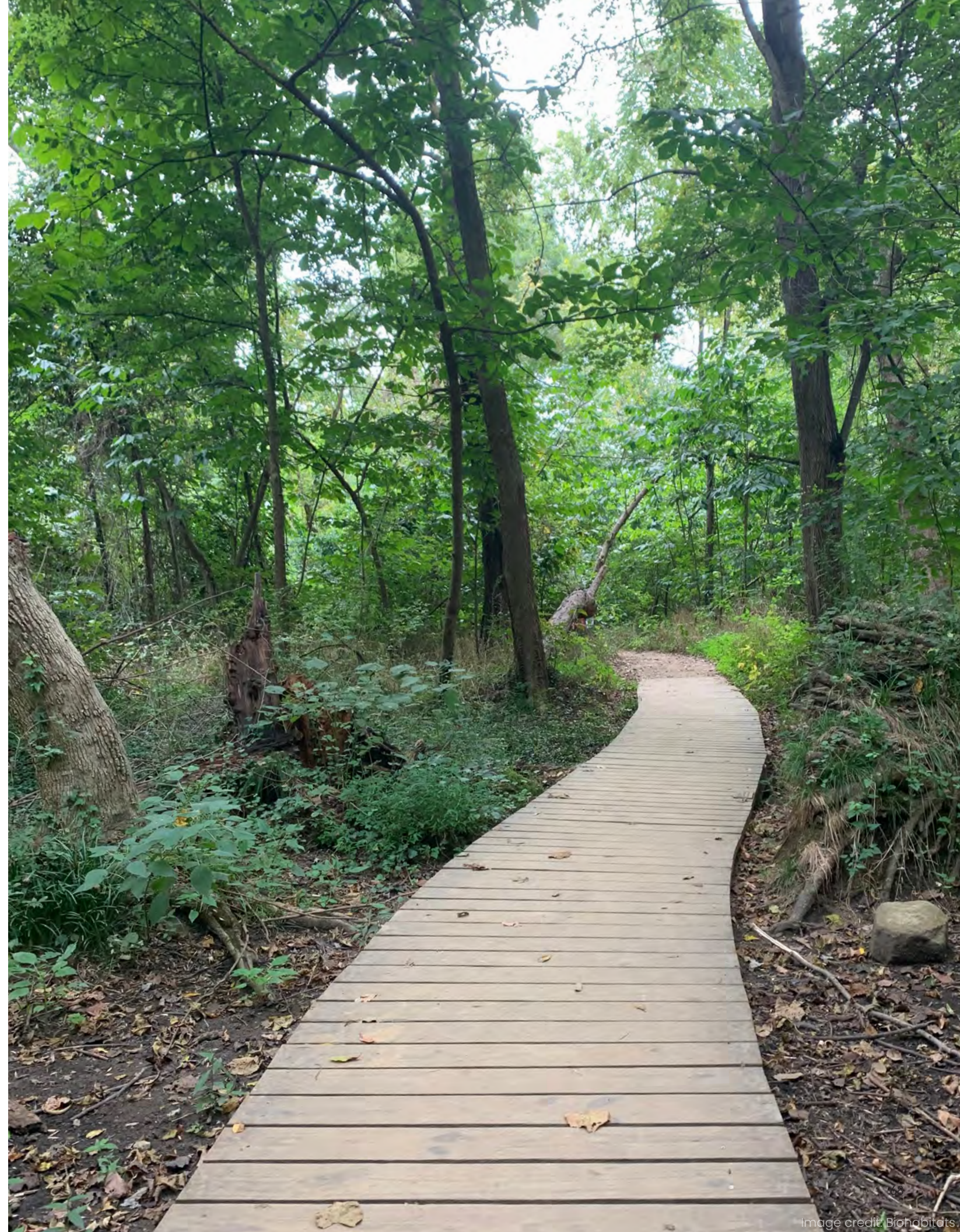
Dry Rocks

Natural Community Type(s): N/A

Management Categories: Managed Use

Focus areas:

- Implement strategies to manage recreational use/intensity in accordance with Managed Use objectives.
- Consider time-of-year restrictions or other means of protecting sensitive resources at critical times in this highly accessible park section.



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GLOSSARY

Adaptive management

A structured approach to natural resource management used to address uncertainty by testing management strategies, evaluating their outcomes, and adjusting management.

Annual exceedance probability (AEP)

Descriptor of flooding frequency in an area. For example, an AEP of 1% delineates a 100-year floodplain.

Buffers

Buffers are areas surrounding sensitive areas that are important to preserve and enhance ecological functions. For this plan, all buffers are 100 feet from the edge of the resource.

Ecological recovery

The process by which ecosystems regain structure, function, and species composition after disturbance or degradation.

Ecological Stressor

Ecological stressors are factors that strain the normal functioning of natural systems, communities, or species and can lead to diminished ecological health and resiliency over time.

Ecological Threat

Ecological stressors often evolve into threats which have more immediate and direct impacts to the ecological health of natural systems that can lead to irreversible ecological damage.

Ecologically sensitive areas

Ecologically sensitive areas include steep slopes, erodible soils, floodplains and riparian areas, streams and waterways, wetlands, and natural heritage areas. For the purposes of this plan, areas within 100 feet of the border of any of these types of features are also considered sensitive.

Edge effect

The ecological changes and species interactions that occur at the boundary between different habitat types, often increasing biodiversity but also vulnerability to invasive species.

Ecosystem function

The natural processes and interactions (e.g., nutrient cycling, energy flow, pollination) that sustain ecosystems and the services they provide.

Floodplain

An area adjacent to a river or stream that is subject to being inundated by flood waters.

Fragmentation

The breaking up of continuous habitat into smaller, isolated patches, often due to human activity, which can reduce biodiversity and ecosystem resilience.

Invasive plants

Non-native plant species that spread rapidly and outcompete native vegetation, often disrupting ecosystem balance and reducing habitat quality.

Land disturbing activities

Any planned projects or routine maintenance projects that involve soil disturbance or clearing of vegetation (removal of above ground stems and roots).

Level of invasion

Level of invasion is a measure of the severity of non-native and invasive (NNI) cover within three strata - Ground Plane (0-3' height), Mid Plane (3-20' height) and Canopy (>20' height). For this plan, highly invaded areas may represent either severe levels of invasion in a single strata or invasion in multiple strata.

Natural Heritage Areas

Designated areas supporting habitat for species of conservation need. This includes both flora and fauna. For this plan heritage areas are based on data provided by Virginia Department of Conservation and Recreation's Natural Heritage Program.

Non-native plants

Plant species introduced to an area where they do not naturally occur; not all are invasive, but they may affect native ecosystems.

Passive recreation

Low-impact leisure activities that do not require intensive infrastructure or disturb natural resources, such as walking, birdwatching, or photography.

Recreational use/intensity

Recreational use/intensity represents the spatial arrangement of access points, amenities/facilities, trails, and focal points within the park. The level of recreational use/intensity is associated with stressors of trampling and soil compaction, non-point source pollution, and litter.

Relic plant community

A remnant of a previously widespread plant community that persists in a limited area, often indicating historical ecological conditions.

Resource Management Framework

The framework, described in Chapter 3, used to delineate park sections into three broad management categories: Managed use, Recreation Hub, and Resource Conservation.

Resource Management Framework Category: Managed Use

Managed Use areas are those where evidence of degradation or risk of degradation exists due to use intensity, but where natural community structure is generally intact and capable of supporting recovery to a more functional level.

Resource Management Framework Category: Recreation Hub

Recreation Hubs are areas of the park with high recreational use intensity and impacted resources where degradation and ongoing stressors may not allow for the recovery of a fully functioning natural system.

Resource Management Framework Category: Resource Conservation

Resource Conservation areas are those with the highest quality resources and the highest potential for recovery.

Resource quality

Resource quality was defined by the natural community type, overall vegetative community ratings, and native vegetation diversity, which were evaluated during the baseline ecological assessment.

Social trails

Unplanned, informal paths created by repeated foot traffic outside of designated trails, often causing vegetation damage and soil erosion.

Soil erodibility (k-value)

Represents a soil's susceptibility to water erosion with erodible soils being characterized as soils with K-values >0.35. For the purposes of this plan, moderately to severely erodible soils were mapped as sensitive areas, and were given a 100 ft sensitivity buffer like all other sensitive features. Moderately erodible soils were considered to be those with a K-value between 0.25 and 0.35.

Streams and waterways

Streams and waterways are natural channels that convey year-round (perennial), seasonal (intermittent) and rain dependent (ephemeral) flow from the landscape.

Trails – Class A

Class A trails are highly to fully developed (USFS Class 4 & 5) trails that provide ready access from parking and access points to key park amenities and focal points and are wide enough for utility vehicles for rescue and maintenance.

Trails – Class B

Class B trails are developed (USFS Class 3) trunk trails that are wide enough for two pedestrians to pass and intended for conveyance of foot and bicycle traffic through the major areas of the park.

Trails – Class C

Class C trails are minimally to moderately developed (USFS Class 1 and 2) natural treaded single track trails that are intended to provide access to or through ecologically sensitive areas. Social trails were also classified as C trails.

Use intensity

The degree and frequency of human or animal use in an area, which influences ecosystem condition and management needs.

Vegetation Management Areas (VMA)

Subdivisions of park sections that are similar in vegetative composition and condition and bounded by a distinct change in condition or physical feature – e.g., trail, creek, slope.

Vegetation strata

The vertical layers of plant growth in a habitat (e.g., canopy, understory, groundcover), which provide diverse habitats for wildlife.

VMA Prioritization framework

System of alphanumeric rating given to each vegetation management area based on its level of NNI invasion (from A Highest to D Lowest) and its overall resource quality (1 lowest and 4 highest). This can be used to guide prioritization of management efforts within each park section and is replicable using the assessment form.

Wetlands

Wetlands are important transitional areas that are inundated or saturated with ground or surface water for part of the year.

APPENDIX A

MONITORING & ADAPTIVE MANAGEMENT RAPID ASSESSMENT MATERIALS



RESOURCE MONITORING & ADAPTIVE MANAGEMENT RAPID ASSESSMENT PRIMER

The following rapid assessments can be performed to qualitatively assess a Vegetation Management Area (VMA) or provide semi-quantitative results on a fixed plot basis (e.g., a minimum of two tenth acre plots per VMA or one plot per 4 acres). The intent of the assessments is to provide a snapshot of the status with enough data to inform management actions and priorities in accordance with the Natural Resource Management Plan (NRMP). This evaluation should be undertaken annually within all park sections under active management to track the status and effectiveness of management actions and on a parkwide basis every 5 years at a minimum. However, it is also advisable to assess highly vulnerable VMAs (e.g., VMAs of high resource quality and high levels of invasion or adjacent to higher levels of invasion) annually and implement targeted management to minimize the risk of resource degradation or loss.

Due to the qualitative nature of the data collection, field calibration is recommended prior to each monitoring season to ensure consistency in results. Field calibration may integrate one or more of the following approaches:

1. Start slow and grow – Start with one crew of potential team leaders. This crew performs assessments together for a few days or VMAs to get in sync with ratings and then splits up

to lead their own crews. Recalibration can occur throughout the monitoring season as needed.

2. Calibration day – A crew lead plans and leads a calibration day with all crew members to rate a few VMAs and build consensus on ratings. It is important to visit VMAs of varying conditions using this method. This is a good strategy for engaging volunteers, but should be paired with a quality control program.
3. Quality Control Checks – A crew lead randomly selects VMAs, performs an independent evaluation and compares it with the field crew’s ratings. Any discrepancies are discussed with the field crew and additional calibration is initiated if necessary. This is an important step to add if volunteer groups or large numbers of staff are undertaking the assessments.

In interpreting the assessment ratings, the indicator categories (Resource Quality) describe the overall condition of a VMA in the context of its stressors and threats within the VMA. The stressor categories (Level of Invasion, Recreational Use / Intensity and Other Stressors) qualify the severity of stressor / threat posed by each category within a VMA. The stressor categories define the management actions while the Resource Quality sets the priority for management and informs the recovery strategy. The table below can help inform the selection of management actions.

Management Actions	Resource Quality Indicators					Stressor Categories				
	Diversity	Structure			Level of Invasion	Recreational Use / Intensity	Deer Browse	Soil Condition	Adjacency	
		Meadow / Non-Forest	Forest							
Cover	Complexity	Canopy Closure	Vertical Layering	Age Class Diversity						
Managing Stressors & Threats										
Managing Recreational Use/Intensity										
Managing Level of Invasion										
Managing Sensitive Areas										
Managing Operational Stressors										
Managing White-tailed Deer										
Facilitating Recovery										
Enhancing & Managing Forest										
Resetting Ecological Trajectories										
Recovering Soils										
Monitoring and Maintaining										

Key: Outcomes
Direct Indirect

INDICATOR ASSESSMENT

Resource Quality

Resource Quality consists of a composite of vegetative community diversity and structure, which are metrics to represent the VMA’s relative ecological function or value. High resource quality ratings are generally correlated to lower stressor ratings and vice versa, so stressor assessments, like level of invasion, can be used to determine which management actions to take to improve the resource quality ratings.

Diversity

Context and management

Overall: Diversity is an indicator of resource quality that is generally correlated with stressor and threat levels – higher diversity is indicative of lower stress levels and vice versa. Forest with poor diversity is at the highest risk for pest and disease like emerald ash borer or beech leaf disease that can decimate forest canopies and open them up to invasion. Primary stressors influencing diversity at all levels are level of invasion (competitive exclusion by NNI) and deer browse.

Ground Plane: Ground plane strata is likely the first layer to respond to stressors; therefore, VMAs with low Ground Plane diversity and higher Mid-plane and Canopy diversity may indicate a system that is in decline despite a functioning, or functioning at risk, overall rating. In these cases strategies like fenced pod planting and targeted NNI control can be used to facilitate regeneration.

Mid-plane: Low Mid-plane diversity can result from poor regeneration due to heavy invasion at the ground plane or deer browse. If low diversity is paired with higher structure (e.g., paw paw stands) it may indicate competitive exclusion by deer resistant species, which may require forest management – thinning.

Canopy: Low Canopy diversity is usually indicative of long-term degradation or past land use. Active degradation can be the results of pest and disease, level of invasion and prolonged deer pressure. Improving canopy diversity is a long-term strategy that must start at the ground level and may require forest management or supplemental planting. Management actions that maintain canopy diversity are a high priority.

RESOURCE QUALITY					
Diversity					
<i>The vegetative community diversity is the number of species present. In this metric, this is measured by strata Ground plane (0-3 ft in height), Mid-Plane (3-20 ft height) and Canopy (>20 ft height). Rate the number of readily observable native species present in each strata that is present based on the categories below.</i>					
Strata		Functioning	Functioning at risk	Compromised	Not functioning
Ground Plane	# Species	>12	8-12	3-7	<3
	Rating	4	3	2	1
Mid-Plane	# Species	>6	4-6	2-3	<2
	Rating	4	3	2	1
Canopy	# Species	>6	4-6	2-3	<2
	Rating	4	3	2	1
Overall Diversity Rating:	<i>Add the rating for each strata present and divide by the total number of strata present and rate overall diversity.</i>				
		Functioning >3.5	Functioning at risk 3.5-2.6	Compromised 2.5-1.6	Not functioning <1.6
		4	3	2	1

Image drawn from assessment form included in this appendix.

Structure – Meadow/Non-Forest

Context and management

Overall Structure Rating: Structure is an indicator of resource quality that is generally correlated with stressor and threat levels – higher structure ratings are indicative of lower stressor levels and vice versa. VMAs with low structure ratings host fewer species and tend to be less resilient to drought and other stressors. Low overall structure ratings may be a candidate for a less selective management strategies since these VMAs are both highly vulnerable and of relatively low quality.

Vegetative Cover: Low Vegetative Cover is likely the result of poor or compacted soils (see Other Stressors – Recreational use and Soil condition assessments below). If the rapid assessments of Recreational use and Soil condition do not identify the primary stressor, additional testing may be required prior to engaging in remedial actions. Additional testing could include using a soil penetrometer to measure soil compaction or collecting soil samples to be tested for agricultural properties (e.g., pH, phosphorus, potassium, calcium, magnesium, and % of organic matter (OM)).

Other factors like soil contamination may be a concern depending on the sites history. Soil recovery strategies like tilling and decompaction are often necessary prior to supplemental seeding and planting. Soil amendments recommended by the soil testing lab may also be beneficial.

Complexity: Low Complexity can result from natural succession when aggressive colonizers or NNI are present. These low complexity ratings will likely be paired with low diversity ratings and/ high levels of invasion. Adjusting management strategies to mimic a natural disturbance regime such as rotational mowing or prescribed fire program can interrupt succession and improve complexity.

Note: For new or establishing meadow/non-forest areas, diversity and structure ratings may be lower. Meadow/non-forest establishment/ re-establishment typically takes three years (sleep, creep, leap) to reach the potential diversity and complexity. Other factors that could impact establishment are droughts and extreme weather. Consequently, low scores may not be indicative of a management change if best practices for meadow/non-forest establishment

Structure – Meadow / Non-Forest				
<i>Structure is a measure of the habitat complexity of a Vegetation Management Area (VMA) or plot. In this metric, the structure is determined by overall cover and complexity metrics. Rate each metric based on the description that best characterizes the VMA or plot. Complete only for Meadow / Non-Forest cover types.</i>				
Vegetative Cover	<i>Vegetation cover is an estimate of the aerial cover or how much of the ground is covered by vegetation when viewed from above.</i>			
	Intact. >80% aerial cover at ground plane	Generally intact; 50-79% aerial cover at ground plane	Relatively intact; 30-49% aerial cover at ground plane	Sparse or absent in places; <30% aerial cover at ground plane
	4	3	2	1
Complexity	<i>Complexity characterizes the diversity of cover types (e.g., height, texture) from wildlife perspectives. Complexity is rated based on the vegetation cover present.</i>			
	Good structure including native warm season grasses and forbs, may include shrubs and trees	Generally good structure with a mosaic of grass-dominant areas interspersed with shrubs, trees and thickets	Structure lopsided with monocultural stands of few species;	Structure poor with large areas covered by monocultures and NNIs;
	4	3	2	1
Overall Structure Rating:	<i>Add the vegetative cover and complexity ratings and rate overall structure.</i>			
	Functioning >6	Functioning at risk 6-5	Compromised 4-3	Not functioning <3
	4	3	2	1

Image drawn from assessment form included in this appendix.

(e.g., mowing program to minimize competition from cover crops and aggressive colonizers) are being followed and level of invasion and other stressors are low.

Structure – Forest

Context and management

Overall Forest Structure Rating: Structure is an indicator of resource quality that is generally correlated with stressor and threat levels – higher structure ratings are indicative of lower stressor levels and vice versa. Compromised and not functional forest structures are less resilient to disturbance from pests and disease, storms and recreational use intensity.

Canopy closure: Declines in canopy closure can be indicative of pest and disease, canopy trees

aging out, disturbance, level of invasion, etc. In a healthy forest, openings in the canopy can spur vigorous growth of the understory/mid-plane, so lower canopy ratings may be offset by higher vertical layering in the overall structure rating.

Vertical layering: Deer pressure and competitive exclusion by NNI are likely stressors influencing vertical layering. Low vertical layering ratings may be an early indicator of a declining canopy condition due to limited natural regeneration to replace fallen, diseased, or damaged trees. Managing deer and NNI stressors should be a focus, but targeted NNI control and fenced pod planting can be used as an interim step to recover vertical layering. If vertical layering is functioning or functioning at risk but the diversity is lower (e.g., paw paw stands) it may indicate

RESOURCE QUALITY (Cont.)				
Structure - Forest				
<i>Structure is a measure of the habitat complexity of a VMA or plot. In this metric, the structure is determined by the canopy closure, vertical layering, and age class diversity. Rate each metric based on the description that best characterizes the VMA or plot. Complete only for Forest cover types.</i>				
Canopy Closure	<i>Canopy closure is a measure of how much of the sky is obscured by tree branches and leaves. In this metric the % canopy cover is visually estimated.</i>			
	Intact canopy with good age class diversity; >80% cover	Generally intact canopy; 50-79% cover	Canopy relatively intact; 30-49% cover	Canopy sparse or absent in places; <30% cover
	4	3	2	1
Vertical Layering	<i>Vertical layering is the presence of Canopy (>20'), understory (3-20'), shrub (0-3'), herbaceous, woody regeneration (native species<3') in a forest. Note the vertical layers that are present and rate.</i>			
	All 5 layers present and vigorous with prolific regeneration.	Multiple layers (4-5) present; one or more layers may be sparse, suppressed, or less vigorous.	Two or more layers are absent or very sparse; regeneration low	forest layers generally absent consisting of predominately canopy and herbaceous layers. No obvious regeneration.
	4	3	2	1
Age Class Diversity:	<i>Age class diversity is represented by a wide range of tree sizes in the canopy (>20') layer. Tree sizes are generally characterized as young (4-12" DBH), mature (12-24" DBH), Old (>24" DBH). Note the size classes that are present and rate.</i>			
	High. All age classes are present and distribution is relatively even.	Moderate. All age classes are present but distribution is skewed toward a dominant class. Some classes may be present by sparse.	Low age class diversity. One or more age classes is absent or present in only minor amounts.	Poor age class diversity. Only one age class is represented.
	4	3	2	1
Overall Forest Structure Rating:	<i>Add the canopy closure, vertical layering, and age class diversity ratings and rate the overall structure.</i>			
	Functioning >10	Functioning at risk 10-8	Compromised 7-5	Not functioning <5
	4	3	2	1

Image drawn from assessment form included in this appendix.

competitive exclusion by deer resistant species, which may require forest management - thinning.

Note: Natural community type may be a consideration in vertical layering as some community types (e.g., Acidic Oak - Hickory Forests) may have more sparse herbaceous layers by nature. In these cases ratings can be adjusted by one category using best professional judgement.

Age class diversity: Eastern forests have inherently low age class diversity due to a legacy of land clearing activities. Landuse legacy, deer pressure and competitive exclusion by NNI are likely stressors influencing age class diversity. Forest management including selective thinning and supplemental plantings are part of a resource recovery strategy for age class diversity.

Resource Quality Rating:	Add the diversity rating to the overall forest structure rating and rate the resource quality.			
	Functioning >6	Functioning at risk 6-5	Compromised 4-3	Not functioning <3
	4	3	2	1

Image drawn from assessment form included in this appendix.

STRESSOR ASSESSMENTS

Level of Invasion

Context and management

Overall: Overall level of invasion is a primary stressor affecting resource quality that acts primarily through the competitive exclusion of desirable vegetation and natural regeneration, specifically when allelopathic NNI are present (e.g., garlic mustard, amur honeysuckle, Japanese knotweed, tree-of-heaven). Preventing degradation is a goal of management, so different strategies may apply based on the threat posed in each strata.

Ground Plane: Ground plane is the foundation of the forest. High levels of invasion may exclude natural regeneration and lead to declines in other strata. High levels of invasion at the ground plane combined with low structural diversity ratings present significant risk of decline and are a priority for management.

Mid-plane: Mid-plane invasion is typically in the form of shrubs and young trees that can occupy forest gaps which slows or prevents natural regeneration. High levels of invasion in the mid and ground planes coupled with low resource

quality are good candidates for non-selective treatments (brush hogging and spraying).

Canopy: Presence of NNI in the canopy strata is likely indicative of high levels of invasion overall. NNI growing on canopy trees are a priority for management since the loss of canopy can take decades to replace. VMAs with high resource quality with NNI present in the canopy or threatening the canopy should be targeted for treatment. Depending on the VMAs overall priority, this may only be a targeted treatment involving the cutting and treating of vines invading the canopy.

Management Priorities include:

1. Target areas at highest risk – e.g., canopy
2. Maintain areas of low invasion, specifically where resource quality is high
3. Advance in accordance with the parkwide management framework and park section priorities

LEVEL OF INVASION				
<i>Level of invasion qualifies the threat posed by non-native invasive (NNI) plants. The assessment is stratified by Ground plane (0-3 ft in height), Mid-plane (3-20 ft height) and Canopy (>20 ft height). Rate each strata present in the VMA or plot based on the description that best characterizes the level of invasion in the VMA or plot.</i>				
Strata	Overall NNI presence is <10% with little to no cover of species with high invasiveness rank. NNI not suppressing native plant communities	NNI present in minor amounts (<20% aerial cover) with little to no cover of species with high invasiveness rank; NNI not suppressing native plant communities	NNI present in moderate amounts (20-40% aerial cover) or NNI cover is dominated by species with high invasiveness rank; NNI are competing with native plants	NNI abundant (>40% aerial cover) or NNI cover is dominated by species with high invasiveness rank; Dense monocultures present; native plants communities suppressed or absent
Ground Plane (0-3 ft. height)	4	3	2	1
Mid-plane (3-20 ft height)	4	3	2	1
Canopy (>20 ft height)	4	3	2	1
Overall level of invasion Rating:	<i>Determine the overall level of invasion rating by adding the ratings for each strata present and dividing by the total number of strata present.</i>			
	Functioning >3.5	Functioning at risk 3.5-2.6	Compromised 2.5-1.6	Not functioning <1.6
	D	C	B	A

Image drawn from assessment form included in this appendix.

RECREATION USE/INTENSITY				
<i>Recreation Use / Intensity qualifies how park use is acting as a stressor to resource quality. Rate the level of recreational use based on the description that best characterizes the VMA or plot.</i>				
Stressor	Functioning	Functioning at risk	Compromised	Not functioning
Recreational Use	Little or no social trail, trail enlargement and/or refuse present. Vegetation and resources adjacent to trail showing no signs of degradation. No visible signs of erosion; landforms appear natural.	Social trail, trail enlargement and/or refuse are present in minor amounts. Vegetation and resources adjacent to trail showing limited evidence of degradation. Minor, isolated signs of erosion.	Social trail, trail enlargement and/or refuse present in moderate amounts. Vegetation and resources adjacent to trail showing evidence of degradation. Erosion is obvious and may be somewhat widespread.	Social trail, trail enlargement and/or refuse causing obvious impacts to resources. erosion widespread and may be severe

Image drawn from assessment form included in this appendix.

OTHER STRESSORS				
<i>Other stressors are factors that may be limiting Resource Quality. Qualifying the level of other stressors can inform the restoration strategy. Rate each stressor below based on the description that best characterize the VMA or plot.</i>				
Stressor	Functioning	Functioning at risk	Compromised	Not functioning
Deer Browse	Not Browsed: Native vegetation present between 6" to 6' above ground; no visible damage	Lightly Browsed: Native vegetation present between 6" to 6' above ground; browse visible on less than 50% of branches / plants	Moderately Browsed: Native vegetation present between 6" to 6' above ground; browse visible on more than 50% of branches / plant	Heavily Browsed: Native vegetation present more than 6" above ground; plants severely hedged
Soil Condition	Undisturbed- Natural state, no compaction or excessive erosion, trash or human impact not present, thick cover of leaf litter or organics.	Low Disturbance- Very little human disturbance, small or few areas of minor compaction / erosion / bare soil (mostly associated with formal trails, social trails uncommon), some litter / organics, minimal trash	Moderately disturbed- Human disturbance / impact present, moderate or several areas of moderate compaction / erosion / bare soil, most vegetation growth not impacted.	Highly Disturbed- Large areas of compaction, bare soil, impervious material, trash / contaminants, extensive or several areas of severe erosion, minimal leaf litter / organics, vegetation growth limited.
Adjacency <i>Applicable to resource quality of 3 or 4</i>	Adjacent VMAs with equal or better resource quality and level of invasion and/or adjacent land covers not managed by park are natural and of similar condition	One or more adjacent VMAs are of equal or better resource quality level with level of invasion generally within one unit (e.g., 3C with 3B adjacent) or adjacent land covers not managed by park are not natural (e.g., residential) but appear to be of similar condition to the VMA	Adjacent VMAs of lesser quality and higher level of invasion generally within one unit (e.g., 3C with 2B adjacent) or adjacent land covers not managed by the park appear to be of lesser quality posing a threat to the VMA	Adjacent VMAs of lesser quality and higher level of invasion generally by more than one unit (e.g., 4C with 2B adjacent) or adjacent land covers not managed by the park appear to be of lesser quality posing a significant threat to the VMA

Image drawn from assessment form included in this appendix.

Recreational Use/Intensity

Context and management

Recreational Use / Intensity (RU/I) is a primary and secondary stressor to resource quality. As a primary stressor, trampling along trails and at focal points, development of social trail networks, and associated soil erosion directly contribute to resource degradation. The extent of degradation is directly correlated with use and the density of RU/I features. As secondary stressor, RU/I is a vector for the spread of NNI which is also directly correlated with use and the density of RU/I features. In addition, RU/I is used to designate or assess compatibility with a management category in the parkwide management framework. Management of RU/I stressors is detailed in the NRMP.

Other Stressors

Context and Management

Managing all stressors and threats is critical to developing a successful recovery strategy. The stressors outlined below were identified as other parkwide stressors that may limit resource quality ratings. Qualifying the status of these stressors in the context of the resource quality rating will inform the extent to which these factors need to be integrated in a successful restoration strategy or adaptive management.

Deer Browse: Deer browse should be evaluated with structure ratings. If structure ratings are low, evidence of deer browse may not be as apparent and could skew findings. Strategies for deer browse include fenced pod plantings to create patches of increased diversity and structure to maintain and recover resource quality. These patches can evolve into cores from which to build or implement the recovery strategy. The long-term strategy is to develop and implement a White-Tailed Deer Management program as outlined in the NRMP.

Soil conditions: The soil conditions assessment is complementary RU/I assessment and focuses on the impacts to soil, specifically compaction, that could limit vegetation establishment or which plant communities are supported. Soil conditions can inform the designation of a management category in the parkwide management framework and strategies to recover damaged soils where practical as discussed in the NRMP.

Adjacency: The adjacency assessment is a risk evaluation to establish management priorities. VMAs that are compromised or not functioning for adjacency are at a greater risk for degradation. Regular/annual monitoring and maintenance to defend edges from invasion is recommended for at risk VMAs.

OVERALL MANAGEMENT CATEGORY

Resource Quality Rating and Level of Invasion Rating combine to define the management category. Overall management categories establish the park wide and section priorities in accordance with the overall management framework of the NRMP.

FIGURE A-1: VMA PRIORITIZATION FRAMEWORK

Level of Invasion	Resource quality			
	Lowest 1	2	3	Highest 4
A (Highest)	1A	2A	3A	4A
B	1B	2B	3B	4B
C	1C	2C	3C	4C
D (Lowest)	1D	2D	3D	4D

References

Elements of the rapid assessment were adapted from the *Baltimore County Forest Conservation Technical Manual – Forest Structure Analysis and the Fairfax County Department of Public Works and Environmental Services’ Community Inventory Quality Criteria*.

Resource Monitoring & Adaptive Management

Rapid Assessment Form

Vegetation Management Area / Plot #: _____ Notes: _____

Surveyor(s): _____

Date: _____

RESOURCE QUALITY				
Diversity				
<i>The vegetative community diversity is the number of species present. In this metric, this is measured by strata Ground plane (0-3 ft in height), Mid-Plane (3-20 ft height) and Canopy (>20 ft height). Rate the number of readily observable native species present in each strata that is present based on the categories below.</i>				
Strata	Functioning	Functioning at risk	Compromised	Not functioning
Ground Plane	# Species >12	8-12	3-7	<3
	Rating 4	3	2	1
Mid-Plane	# Species >6	4-6	2-3	<2
	Rating 4	3	2	1
Canopy	# Species >6	4-6	2-3	<2
	Rating 4	3	2	1
Overall Diversity Rating:	<i>Add the rating for each strata present and divide by the total number of strata present and rate overall diversity.</i>			
	Functioning >3.5	Functioning at risk 3.5-2.6	Compromised 2.5-1.6	Not functioning <1.6
	4	3	2	1
Structure – Meadow / Non-Forest				
<i>Structure is a measure of the habitat complexity of a Vegetation Management Area (VMA) or plot. In this metric, the structure is determined by overall cover and complexity metrics. Rate each metric based on the description that best characterizes the VMA or plot. Complete only for Meadow / Non-Forest cover types.</i>				
Vegetative Cover	<i>Vegetation cover is an estimate of the aerial cover or how much of the ground is covered by vegetation when viewed from above.</i>			
	Intact. >80% aerial cover at ground plane	Generally intact; 50-79% aerial cover at ground plane	Relatively intact; 30-49% aerial cover at ground plane	Sparse or absent in places; <30% aerial cover at ground plane
	4	3	2	1
Complexity	<i>Complexity characterizes the diversity of cover types (e.g., height, texture) from wildlife perspectives. Complexity is rated based on the vegetation cover present.</i>			
	Good structure including native warm season grasses and forbs, may include shrubs and trees	Generally good structure with a mosaic of grass-dominant areas interspersed with shrubs, trees and thickets	Structure lopsided with monocultural stands of few species;	Structure poor with large areas covered by monocultures and NNIs;
	4	3	2	1
Overall Structure Rating:	<i>Add the vegetative cover and complexity ratings and rate overall structure.</i>			
	Functioning >6	Functioning at risk 6-5	Compromised 4-3	Not functioning <3
	4	3	2	1
Resource Quality Rating:	<i>Add the diversity rating to the overall structure rating and rate the resource quality.</i>			
	Functioning >6	Functioning at risk 6-5	Compromised 4-3	Not functioning <3
	4	3	2	1

RESOURCE QUALITY (Cont.)				
Structure - Forest				
<i>Structure is a measure of the habitat complexity of a VMA or plot. In this metric, the structure is determined by the canopy closure, vertical layering, and age class diversity. Rate each metric based on the description that best characterizes the VMA or plot. Complete only for Forest cover types.</i>				
Canopy Closure	<i>Canopy closure is a measure of how much of the sky is obscured by tree branches and leaves. In this metric the % canopy cover is visually estimated.</i>			
	Intact canopy with good age class diversity; >80% cover	Generally intact canopy; 50-79% cover	Canopy relatively intact; 30-49% cover	Canopy sparse or absent in places; <30% cover
	4	3	2	1
Vertical Layering	<i>Vertical layering is the presence of Canopy (>20'), understory (3-20'), shrub (0-3'), herbaceous, woody regeneration (native species<3') in a forest. Note the vertical layers that are present and rate.</i>			
	All 5 layers present and vigorous with prolific regeneration.	Multiple layers (4-5) present; one or more layers may be sparse, suppressed, or less vigorous.	Two or more layers are absent or very sparse; regeneration low	forest layers generally absent consisting of predominately canopy and herbaceous layers. No obvious regeneration.
	4	3	2	1
Age Class Diversity:	<i>Age class diversity is represented by a wide range of tree sizes in the canopy (>20') layer. Tree sizes are generally characterized as young (4-12" DBH), mature (12-24" DBH), Old (>24" DBH). Note the size classes that are present and rate.</i>			
	High. All age classes are present and distribution is relatively even.	Moderate. All age classes are present but distribution is skewed toward a dominant class. Some classes may be present by sparse.	Low age class diversity. One or more age classes is absent or present in only minor amounts.	Poor age class diversity. Only one age class is represented.
	4	3	2	1
Overall Forest Structure Rating:	<i>Add the canopy closure, vertical layering, and age class diversity ratings and rate the overall structure.</i>			
	Functioning >10	Functioning at risk 10-8	Compromised 7-5	Not functioning <5
	4	3	2	1
Resource Quality Rating:	<i>Add the diversity rating to the overall forest structure rating and rate the resource quality.</i>			
	Functioning >6	Functioning at risk 6-5	Compromised 4-3	Not functioning <3
	4	3	2	1

Resource Quality Comments: _____

LEVEL OF INVASION				
<i>Level of invasion qualifies the threat posed by non-native invasive (NNI) plants. The assessment is stratified by Ground plane (0-3 ft in height), Mid-plane (3-20 ft height) and Canopy (>20 ft height). Rate each strata present in the VMA or plot based on the description that best characterizes the level of invasion in the VMA or plot.</i>				
	Overall NNI presence is <10% with little to no cover of species with high invasiveness rank. NNI not suppressing native plant communities	NNI present in minor amounts (<20% aerial cover) with little to no cover of species with high invasiveness rank; NNI not suppressing native plant communities	NNI present in moderate amounts (20-40% aerial cover) or NNI cover is dominated by species with high invasiveness rank; NNI are competing with native plants	NNI abundant (>40% aerial cover) or NNI cover is dominated by species with high invasiveness rank; Dense monocultures present; native plants communities suppressed or absent
Strata				
Ground Plane (0-3 ft. height)	4	3	2	1
Mid-plane (3-20 ft height)	4	3	2	1
Canopy (>20 ft height)	4	3	2	1
Overall level of invasion Rating:	<i>Determine the overall level of invasion rating by adding the ratings for each strata present and dividing by the total number of strata present.</i>			
	Functioning >3.5	Functioning at risk 3.5-2.6	Compromised 2.5-1.6	Not functioning <1.6
	D	C	B	A

Level of Invasion Comments: _____

RECREATION USE/INTENSITY				
<i>Recreation Use / Intensity qualifies how park use is acting as a stressor to resource quality. Rate the level of recreational use based on the description that best characterizes the VMA or plot.</i>				
Stressor	Functioning	Functioning at risk	Compromised	Not functioning
Recreational Use	Little or no social trail, trail enlargement and/or refuse present. Vegetation and resources adjacent to trail showing no signs of degradation. No visible signs of erosion; landforms appear natural.	Social trail, trail enlargement and/or refuse are present in minor amounts. Vegetation and resources adjacent to trail showing limited evidence of degradation. Minor, isolated signs of erosion.	Social trail, trail enlargement and/or refuse present in moderate amounts. Vegetation and resources adjacent to trail showing evidence of degradation. Erosion is obvious and may be somewhat widespread.	Social trail, trail enlargement and/or refuse causing obvious impacts to resources. erosion widespread and may be severe

Recreation Use/Intensity Comments: _____

OTHER STRESSORS				
<i>Other stressors are factors that may be limiting Resource Quality. Qualifying the level of other stressors can inform the restoration strategy. Rate each stressor below based on the description that best characterizes the VMA or plot.</i>				
Stressor	Functioning	Functioning at risk	Compromised	Not functioning
Deer Browse	Not Browsed: Native vegetation present between 6" to 6' above ground; no visible damage	Lightly Browsed: Native vegetation present between 6" to 6' above ground; browse visible on less than 50% of branches / plants	Moderately Browsed: Native vegetation present between 6" to 6' above ground; browse visible on more than 50% of branches / plant	Heavily Browsed: Native vegetation present more than 6" above ground; plants severely hedged
Soil Condition	Undisturbed- Natural state, no compaction or excessive erosion, trash or human impact not present, thick cover of leaf litter or organics.	Low Disturbance- Very little human disturbance, small or few areas of minor compaction / erosion / bare soil (mostly associated with formal trails, social trails uncommon), some litter / organics, minimal trash	Moderately disturbed- Human disturbance / impact present, moderate or several areas of moderate compaction / erosion / bare soil, most vegetation growth not impacted.	Highly Disturbed- Large areas of compaction, bare soil, impervious material, trash / contaminants, extensive or several areas of severe erosion, minimal leaf litter / organics, vegetation growth limited.
Adjacency <i>Applicable to resource quality of 3 or 4</i>	Adjacent VMAs with equal or better resource quality and level of invasion and/or adjacent land covers not managed by park are natural and of similar condition	One or more adjacent VMAs are of equal or better resource quality level with level of invasion generally within one unit (e.g., 3C with 3B adjacent) or adjacent land covers not managed by park are not natural (e.g., residential) but appear to be of similar condition to the VMA	Adjacent VMAs of lesser quality and higher level of invasion generally within one unit (e.g., 3C with 2B adjacent) or adjacent land covers not managed by the park appear to be of lesser quality posing a threat to the VMA	Adjacent VMAs of lesser quality and higher level of invasion generally by more than one unit (e.g., 4C with 2B adjacent) or adjacent land covers not managed by the park appear to be of lesser quality posing a significant threat to the VMA

Other Stressor Comments: _____

APPENDIX B

RESOURCE RECOVERY STRATEGY SUPPLEMENTAL GUIDANCE



MANAGING STRESSORS & THREATS

Managing threats is a core component of the resource recovery strategy. Stressor and threat mitigation is the foundation of ecological recovery and the recovery process initiates only when all stressors and threats are adequately managed within the vegetation management area (VMA) and the adjacent VMAs. The primary threats to the James River Park systems are NNI infestations and stressors associated with recreational activities. The James River Park system will always face some inherent ecological stressors presented by recreational use/intensity, level of invasion, and urban context. Consistent management of these stressors will allow for varying degrees of ecosystem recovery, but these underlying stressors alongside deer density and **edge effects** will influence both the level of ecosystem recovery that is attainable and the level of management input needed.

The stressors and threats covered in this section include:

- Managing recreational use/intensity
- Managing level of invasion
- Managing sensitive areas
- Managing operational stressors
- Engaging Park Users and Volunteers
- Managing white-tailed deer

Managing Recreational Use/Intensity

The threats posed by recreational use/intensity will largely be managed through the implementation of the parkwide resource management framework. Strategies for managing recreational use/intensity should be implemented on a parkwide scale and focus on strategically controlling access to Resource Conservation areas while adapting access in other areas to align with the designated parkwide resource management framework categories and provide access to a range of recreational opportunities offered in the park.

It should be noted that the threat from recreational use/intensity may not be fully managed for Recreation Hub areas, so the highest level of recovery may not be attainable.

Controlling Access

Controlling access is an important strategy for minimizing anthropogenic disturbances to natural areas. This is critically important around parking areas and when transitioning between management zones (e.g., Recreation Hub to Managed Use). The primary strategies for controlling access include:

Managing social trail development -

Understanding the purpose and need of social trails and desire paths is key to managing circulation patterns. Formalizing some social trails from adjacent neighborhoods or street parking may be important to improve safety or alleviate other problem areas; however, development of parking for ease of access should only be considered when aligned with the designated resource management framework category. Redundancies in access should be eliminated and redundant trails should be closed using the trail management strategies outlined for the respective resource management framework category (see Managing Trails for further guidance).

Establishing clear cues- Creating clear and consistent cues to orient users and direct them from parking areas or access points to formal trail heads or other amenities and facilities is a strategy to focus anthropogenic stressors on areas that are managed to be compatible with

that use intensity. Strategies can include formal means like fences or more informal means like establishing “park-like” buffers zones that use strategically placed planting beds, signage, and densely vegetated (messy) transitions to direct park users.

Trail heads should be clearly labeled with signage indicating entrance into a Resource Conservation area.

Provisioning for Amenities/Facilities

The level of amenities and facilities should be commensurate with the recreational use and intensity of a given area. In Recreation Hub areas, facilities should be obvious, easily accessible and incorporated into the overall circulation plan for the access point. Provisioning for new amenities or facilities should be limited to existing Recreation Hub areas to alleviate pressure on adjacent park sections and only considered for Resource Conservation or Managed Use areas as a means of mitigating problems that are directly impacting the park section’s trajectory toward the target recovery level.

Managing Trails

Overall trail density should be managed to the minimum necessary to promote circulation, provide access to recreational resources, and enhance user experience that is compatible with the designated resource management framework category. Trails may be added, eliminated, rerouted or upgraded to support recovery objectives. New trails and reroutes should be integrated into the natural landscape and contours and consider protection of the soil, water, vegetation, visual quality, user safety, and long-term maintenance. Trail heads should be clearly labeled with signage indicating entrance into ecologically sensitive areas.

Trails within Resource Conservation areas - Trail density should be kept to a minimum and consist of predominantly Class C trails. Class B trails may be used as a means of connecting other park sections and providing access from established access points, but no new trails should be constructed in these areas unless necessary for access.

Trail maintenance should be kept to a minimum to promote the natural character of these areas and undertaken with hand tools and, when necessary, with handheld power tools. Downed logs and debris should be cleared to promote safe passage in accordance with the trail class objectives, and cleared woody debris should be redistributed on-site in a manner that does not detract from the experience and blends with the natural landscape. Woody debris can be used strategically to guide foot traffic onto designated routes and limit social trail development.

Trails within Managed Use areas – Trail density should be kept to a minimum and consist of predominantly Class B trails. Class C trails may be used as a means of connecting to focal points in more sensitive areas. In some managed use areas, where heavy recreational use is inevitable and social trail development is widespread, it may be appropriate to redesign trails in a way that can withstand heavy recreational use with minimal erosion. This may involve blocking off social trails, rerouting trails to reduce landscape stress, or in limited cases, making a Class C trail into a Class B trail to concentrate foot traffic. (A good example of this is the shoreline near Pony Pasture.)

Trail maintenance and construction in these areas should incorporate natural or nature like materials that are compatible with the natural character to reinforce problem areas. Maintenance activities should be accomplished with hand tools and, when necessary, with small equipment and handheld power tools. Downed logs and debris should be cleared to promote safe passage in accordance with the trail class objectives, and cleared woody debris should be redistributed in a manner that does not detract from the experience and blends with the natural landscape. Woody debris can be used strategically to guide foot traffic onto designated routes and limit social trail development.

Trails within Recreation Hub areas – Trail density should promote flow and access to key focal points and consist of predominantly Class A and B trails.

Trail maintenance and construction should be compatible with the natural character and consist of measures to reinforce trails, promote drainage and otherwise improve trails to withstand high use intensity. Maintenance activities should be accomplished with hand tools, handheld power tools and small equipment. Downed logs and debris should be cleared to promote safe passage in accordance with the trail class objectives, and cleared woody debris should be removed or redistributed in a manner that does not detract from the experience and blends with the natural landscape. Woody debris can be used strategically to guide foot traffic onto designated routes and limit social trail development.

Managing Focal points

Understanding the context of focal points is critical to their management. In general, access to the significant natural and historic features or viewsheds of the park should be preserved for the enjoyment of all users. The following strategies should be implemented based on management framework categories:

Focal points within Resource Conservation areas

– Existing focal points that are representative and unique should be managed and serviced by clearly marked trails and signage indicating entrance into an ecologically sensitive area; however, redundant points should be closed. Focal points should be developed to accommodate individual users and small groups (<5).

Focal points within Managed Use areas –

Existing focal points should be managed similarly to Resource Conservation areas; however, allowance for some redundant focal points may alleviate some use intensity impacts while also offering park users a sense of a more remote experiences despite the overall use intensity of the park section. Focal points should be

developed to accommodate small (<5) to moderate groups (<10) of park users at one time. Limited amenities such as log seating may be provided, dependent on context.

Focal points within Recreation Hub areas –

Representative natural and historic features or viewsheds of the park should be formalized and accessible and managed in a manner that is compatible with a high use intensity and accommodates use by larger groups (>10) of park users. Access to these focal points should include clearly marked trails, natural barriers, and signage to direct users to remain in the designated areas. Park amenities such as benches may also be provided. To offset the impacts of more formally developing key focal points some redundant focal points in sensitive areas should be closed.

Communicating Intent

Communicating the intent of management actions and the role of park users in resource conservation as part of a focused outreach plan is a critical component of managing recreational use/intensity.

Managing Level of Invasion

The overall strategy to systematically manage the NNI threat includes two complementary components that are prioritized at the parkwide scale and implemented at the VMA and park section scale:

1. **Defend** the VMAs with the highest quality habitats, those with a resource quality rating of 3 or greater, at the park wide scale and
2. **Advance** management efforts systematically at the park section level from VMAs with highest resource quality and lowest levels of invasion toward VMAs with higher levels of invasion (from D to A) and lower resource quality (4 to 1)

The defend component consists of less intensive targeted efforts that focus on slowing or preventing resource degradation or loss. The defend component is intended to be targeted and applied on a broad scale to control the primary threats to a VMA. Examples of defend actions may include annual maintenance of managed areas, targeted efforts to prevent NNI

The advance component is a more intensive effort focused on reducing or eliminating the overall level of invasion within a VMA and adjacent VMAs. The advance component is prioritized at the parkwide scale and implemented at the park section level. The advance strategy should generally radiate out from a controlled area to adjacent VMAs in a logical progression. The advance component is focused and should be undertaken at a park section level. Due to the intense level effort, the advance component is best to be initiated in only 2 to 3 park sections at time, depending on resource availability. Note that the defend component is complementary to the advance component and, overtime, the frequency and intensity of defend activities can increase to facilitate the advancing in other park sections.

The overall strategy to manage the NNI threat is to protect the largest tracts of the highest quality habitats (4) with the lowest level of invasion (D). Work should generally radiate out from a controlled area to adjacent VMAs in a logical progression (see **figure B-2**). The advance component is focused and should be undertaken at a park section level. Due to the intense level effort, the advance component is best to be initiated in only 2 to 3 park sections at time, depending on resource availability.

When implemented together on a parkwide scale, the defend component facilitates the advance component over time as the defend actions can establish a controlled area from which the advance strategy can be launched.

Guidance for prioritizing and implementing the overall strategy for managing level of invasion should consider the following:

Prioritize the largest tract of high resource quality – Work to protect and enhance rare, unique or beneficial species and associated communities first to minimize further loss of value.

Start in the area with the lowest level of invasion – The initial effort to reclaim an area from invasive vegetation is lower in areas with reduced presence of invasives at the outset. Therefore, less

FIGURE B-1: PRIORITY RANKING

Level of Invasion	Resource quality			
	1	2	3	4
A	18	12	8	4
B	16	11	7	3
C	14	10	6	2
D	13	9	5	1

from invading a specific strata (e.g., canopy), treating priority one species, etc. One strategy for implementing the defend strategy broadly is a fixed effort or “lightning” approach where a crew has a specific objective (e.g., canopy protection) and spends a set amount of time per VMA (e.g., 2 hours, a morning, a day) focused on attacking the obvious problems (e.g., focus on most invaded trees, best quality trees). The intent is not to be comprehensive, but to reduce the threat. The defend component should occur annually, but can occur more frequently depending on resource availability.

management effort is required to maintain these areas and focus can quickly shift to expanding to adjacent areas.

Target species with the highest invasiveness first

Highest Priority to Lowest Priority- Virginia ranks the invasiveness of all non-native and invasive species based upon their ability to spread and their impact upon native communities. Species which tend to spread or reproduce the fastest and can alter their surroundings through shading and physical or chemical suppression should be treated first. See the Virginia Department of Conservation and Recreation (VA DCR) Natural Heritage Program’s Virginia Invasive Plant Species List for current rankings of invasiveness by species - <https://www.dcr.virginia.gov/natural-heritage/invspdflist>.

Work from highest elevation to lowest elevation

-Through direct movement by gravitational force and indirect movement through soil or water flows, plant propagule materials generally flow from infested areas downslope. Start treatment activities from the highest point within treatment area and work down slope.

Work along vectors - Invasive vegetation is typically spread through propagule movement along roads, trails and water flow paths. Movement can then occur from those source points into un-infested areas. Treatment typically requires working along these vector paths to access treatment areas and therefore should be treated first to avoid continued spread during treatment activities.

Reinforce with native seed - In areas of low resource quality, native seedbanks may be depleted, which makes them susceptible to reinvasion. The use of cover crops and native seed mixes can effectively slow the rate of reinvasion by colonizing the cleared site with native vegetation that competes with non-natives. Note that even some native seed can be aggressive and displace desirable native plants, so it is important to consider your goals and objectives and the selected plants’ ecology and growth habit. More aggressive plants may be appropriate in Managed Use and Recreation Hubs and problem areas, while less aggressive plants may be selected for conservation areas.

If the state of the native seedbank or the soil condition is uncertain, applications of only cover crops may provide temporary cover while evaluating regeneration of the native seedbank or the capacity of soils to support more diverse vegetative communities. With this approach, some periodic maintenance (e.g., mowing or hand trimming) is needed to reduce competition between cover crops and the native seed.

Timing - Timing treatments to critical life stages of plant development can be critical to their control. For example, plants that spread readily by seed require control activities prior to their seeding periods. It is also important to time treatments around when sensitive wildlife are active (e.g., amphibian breeding seasons) to minimize accidental harm, especially in sensitive areas.

Selectivity- Selectivity of treatments describes how targeted or precise a treatment methodology is. Highly selective treatment methodologies precisely target individual plants or groups of plants while trying to protect the integrity of the surrounding resource and are generally more labor intensive to implement broadly (e.g., stem treatments, hand pulling). In contrast, low selectivity treatment methodologies are broadly applied and may result in incidental temporary harm to surrounding resources (e.g., broad foliar applications, brush hogging). Low selectivity methods are best applied to areas of lower quality or higher resilience.

Determining the best control methodology must first consider what desirable resources co-exist in the management area. The alpha-numeric coding system used in the resource management framework can be used to broadly frame compatible treatment methods; however, actual site conditions may be more nuanced and require deviations from the broad strategy. Consequently, the methods and selectivity of treatments may need to vary within VMAs to protect a sensitive feature. To ensure the highest level of resource protection, a pre-implementation reconnaissance should be held by the field crew or with the contractor to delineate areas where the broad strategy must be adapted to protect resources. Considerations for selecting treatment methods include:

Most Selective

- Intact native community
- Protected or unique community
- Rare, Threatened or Endangered species habitat
- Widespread occurrence of sensitive areas (streams, wetlands, etc.)
- Vectors few or limited
- Undesirable species few or non-aggressive
- Moderately Selective
- Moderately disturbed native community
- No or limited occurrence of sensitive areas
- Vectors moderately abundant and/or new
- Undesirable species moderately abundant or aggressive

Least Selective

- Native vegetation community not present or disturbed or undesirable (Right of way, Landscaped area around facilities)
- No sensitive areas present or adjacent
- Vectors abundant and/or well established
- Undesirable species abundant or aggressive
- Long term management area

Control Methods

The above guidance is intended to provide general direction on priorities and strategies in support of the overall recovery objectives. Specific tactics and control methods for managing level of invasion should draw from the site specific knowledge and experience of the Invasive Plant Task Force (IPTF) and align with standard teachings and practices provided by the following organizations:

- Blue Ridge Partnership for Regional Invasive Species Management (PRISM)
- University extension services (particularly Southeast and Mid-Atlantic region)
- North American Invasive Species Management Association (NAISMA) treatment guidelines

FIGURE B-2: BROAD FRAMEWORK FOR TREATMENT SELECTIVITY

Level of Invasion	Resource quality			
	1	2	3	4
A	Low			
B				
C				
D				High

Managing Sensitive Areas

Sensitive areas layer onto the resource management framework. In general, activities and disturbance should be limited in sensitive areas and their buffers to minimize resource degradation.

When disturbance is necessary, best practices should be used to minimize and mitigate impacts. Any proposed improvements within sensitive areas shall be in accordance with all federal, state and local laws and regulations including the City's Chesapeake Bay Preservation Act, Erosion and Sediment Control Ordinance, the Stormwater Management Act, and the Parks recorded conservation easement.

Specifically, **the following activities should be avoided in sensitive areas without demonstrated purpose and need** and activities within riparian areas or buffers may require an approved Water Quality Impact Assessment and or waivers for compliance with the City's Chesapeake Bay Preservation Act:

- Storing equipment/materials
- Land disturbance
- Use of motorized vehicles except as needed for emergency response, law enforcement, and necessary maintenance.
- New building, structure, equipment, improvement, or facility, including any road, boat ramp, boat landing, dock or parking area of any kind
- Removal, destruction, cutting, or clearing of trees except: (1) to prevent the imminent loss of life or to remove a significant threat to life or property; (2) to create emergency firebreaks; (3) to control disease; (4) to remove or control invasive or non-native species.

Specific strategies for consideration in managing sensitive areas include:

Restricting Access to vulnerable areas

Restricting park operations and management activities and/or public access to certain areas can support resource management, conservation, and recovery objectives. Access

restrictions can be permanent or temporary. Permanent restrictions would limit access to areas that are highly vulnerable to disturbance year-round and temporary restrictions would be aligned to the times of year when species of concern are most vulnerable (e.g., nesting and breeding seasons) and/or when weather conditions are generally not favorable (e.g., when soils are seasonally too wet and vulnerable to compaction).

Temporary/time-of-year restrictions can be highly variable depending on the conservation objective, but some general considerations include:

- Timing larger scale land disturbing activities (weeks long) to avoid wetter times of year (winter and early spring) and avoiding work after rain or when soils are saturated for smaller scale (days long) or maintenance activities to avoid or reduce the risk of soil compaction.
- Avoiding clearing operation during critical nesting periods for sensitive birds (generally April – August and as early as February where Barred Owls are present) or periods of bat roosting (April – November and possibly earlier depending on species presence).
- Minimizing disturbance to wetland buffers, specifically vernal pools, in February – May during peak amphibian breeding
- Avoiding certain activities, like mowing along forest edges and wetlands, during times of day when wildlife is most active (typically morning and evening hours and after rainfalls)
- Maintaining aspects of wildlife cover throughout the year through a rotational mowing program. Patches in the rotation should consider the following no-mow periods when planning the rotation:
 - Nesting and brooding for most wildlife: April to mid-August
 - Early season pollinator habitat: March to May

- Overwintering habitat and forage: August – April
- Old cover (dormant mature stems from last season) for beneficial stem nesting insects and pollinators: no-mow for 2 years – late summer to fall through the next late summer to fall.

In addition to restricting park operations and management activities, restricting public access to certain areas for any of the reasons above may also support resource management, conservation, and recovery objectives.

Note that there is no ideal time to disturb sensitive areas, but planning can minimize the risk to vulnerable species and resources and provision for beneficial habitat.

Protecting Trees

During project planning, considering the extent of impact to tree roots and branches is equally or more important than protecting the tree trunk alone. To minimize the impact of construction and other land disturbing activities on tree resources, including their root systems, standard tree protection practices should be applied in accordance with International Society of Arboriculture guidelines. Some general guidelines include:

Establishing Tree Protection Zones (TPZs):

TPZs are areas established around trees to protect their roots and soil. The size of the TPZ is determined by a calculation based on the tree's trunk diameter and tolerance to construction – generally 1-1.5 feet for every inch of the trunk diameter.

Using Temporary Barriers: Temporary tree protection fencing, often chain link or other sturdy materials, should be installed around the TPZ to prevent construction equipment, vehicles, and workers from entering the area. Wooden planking wrapped around the trunk should also be used on trees where potential damage from equipment or vehicles could occur.

Avoiding Soil Compaction: Minimizing soil compaction is crucial, as it restricts oxygen flow to the roots. Measures include using mulch, plywood, and geotextile fabric under construction equipment.

Conducting Root Pruning: In some cases, root pruning by a certified arborist may be necessary to protect the roots during construction. Heavy equipment tears roots so clean cuts should be made prior to ground disturbance within the TPZ. No more than 30% of the TPZ should be impacted by root pruning.

Providing Irrigation: Maintaining proper hydration is essential, especially during construction when trees may experience increased stress. This is especially true during hot & dry summer months or when the natural site hydrology has been drastically modified.

Conducting Necessary Pruning: Any necessary branch or limb pruning should be done according to ANSI A300 standards and by an ISA certified arborist. It is recommended that less than 30% of a trees canopy should be removed at any one time.

Controlling Construction Traffic: Construction traffic should be restricted to designated areas to avoid root zones. If root zones are unavoidable, utilize mulch, plywood, and geotextile fabric to reduce impact.

Managing Soil Storage: Soil should be stored away from tree roots. No more than 3" of soil should be permanently placed within the root zones without mitigating measures to prevent root decline or death.

Monitoring: Regular monitoring of the site by an arborist is essential to identify and address any potential issues.

Post-Construction Care: After construction, trees may require additional care, such as watering during dry periods and monitoring for pests and diseases.

Managing Operational Stressors

The implementation of operational best management practices (BMPs) are a means of managing the stressors induced by park operations. While necessary, many routine maintenance activities can be vectors for the spread of NNI, compact soils, remove vegetation, disturb sensitive areas, and cause erosion that can hinder progress toward resource recovery goals. The following sections identify some common operational stressors and general considerations for developing BMPs to address the stressor from each activity. In developing BMPs it is recommended that park staff performing the activities are involved in establishing the practices. There is no substitute for their knowledge and experience and even though something makes sense on paper, it does not mean it translates to the field.

As part of each BMP, training programs with processes for continued improvement are also recommended. Training may be undertaken seasonally prior to the start of an activity. Training should be developed and led or closely coordinated with the staff and stakeholders involved in the BMP development. Training is also an opportunity to recalibrate methods based on feedback and questions from staff during the training. Additionally, formal means of soliciting feedback such as regular check-ins or post-season debriefs should be incorporated to improve processes and procedures for the coming season.

Coordinating Projects

Land Disturbing Activities are any planned projects or routine maintenance projects that involve soil disturbance or clearing of vegetation (removal of above ground stems and roots). Land disturbance at any scale can directly impact resources, such as sensitive plants, trees, animals, wetlands, streams and riparian areas and make areas more vulnerable to invasion. When engaging in land disturbing activities, coordination is critical to protect resources and ensure consistency with management objectives across departments. Formalizing a process for coordinating land disturbing activities could

involve weekly coordination meetings to review planned work, a review process with a simple review and signoff form by key parties, ad hoc pre-disturbance meetings, or some combination of the three. Regardless of the preferred approach the process should include:

- Advance notice of the land disturbing activity and the anticipated limits of work.
- An opportunity for all stakeholders to provide input relative to their programs and consistency with resource management framework and associated management objectives.
- A review and delineation of all sensitive resources, including trees and tree roots, and discussion of best practices to avoid and minimize impacts
- Coordination with DCR or staff knowledgeable of site-specific element occurrences for sensitive or vulnerable species if project is within a natural heritage area.
- Project debrief opportunity to support continual improvement.

In developing the process for coordination, the scale of the project may also be a consideration. For example a large capital project on Belle Island may require more lead time and coordination than a drainage upgrade on a trail.

Mowing Responsibly

Mowing is a vegetation management practice that can support objectives related to user experience and ecological recovery when implemented in a controlled manner. Specifically, mowing can maintain vegetation height to make areas compatible with recreational uses, disrupt ecological succession to support meadow development, suppress NNI, and establish a sense of place and cues for park users. Mowing out of context can also threaten ecological recovery by facilitating the spread of NNI, destroying habitat, or disrupting desirable succession. Developing a mowing BMP should consider the following:

Why is mowing being performed?

Define the purposes for mowing within JRPS. It may be necessary to develop a BMP for each purpose identified. Examples of purposes include:

- **Turf management** – mowing to sustain turf for recreational activities
- **Establish sense of place** – mowing around park amenities and trail heads to cue users and enhance experience
- **Meadow management** – mowing to arrest establishment of woody species and NNI
- **NNI Control** – Mowing to suppress NNI invasions

Where is mowing being performed?

Delineate where mowing is being performed for each purpose. Consider if the purpose is compatible with the designated recreational use category.

When is mowing performed?

The timing of mowing activities should be aligned with its purpose and the stressors you are trying to manage. Examples include:

Turf management – Mowing for turf management is an ongoing activity throughout the growing season, so the BMP may be more about how you mow; however, the timing and extents of where you mow could be adapted to support early season pollinator habitat (e.g., no mow May).

Sense of Place – The timing of mowing for sense of place purposes may be varied and is likely to align with broader mowing strategies – e.g., turf or meadow management.

Meadow Management – Mowing for meadow management should consider providing winter cover, nesting and brooding seasons, and patch size. Often a 2-4 year rotational mowing strategy with a winter (January – February) mowing is suitable once the meadow is established. To minimize impacts to wildlife, preserving patches of standing cover that are greater than 100 ft by 100 ft in extent will offer some form a year-round cover and refuge for any displaced species. More

frequent mowing at margins to suppress NNI and promote recreation access may be beneficial, depending on the life cycle of the plants to be managed.

NNI Control – Mowing to prevent the spread of NNI is all about the timing. Winter mowing, similar to meadow management should be sufficient to suppress woody NNI and vines. Severe invasions of woody NNI could be mowed in spring or summer prior to seeding. For herbaceous NNI species, once seeding starts, typically mid-summer, it is important to understand the specific species that are being managed and whether the benefits of mowing outweigh the risks of spreading seeds. Another consideration is whether mowing can help mitigate that risk of spread; depending on species phenology, a consistent mowing management regime can suppress NNI populations over multiple years. This may or may not have to be combined with other NNI management methods, depending on the species and the severity of the invasion.

How should mowing be performed to meet objectives?

The equipment and means of mowing is an important consideration in controlling the spread of NNI. Mowing activities can efficiently blow seeds and clippings into unwanted areas on-site and equipment, clothing, and footwear can transport seeds and vegetative material from site to site. Best practices should consider the following:

Align with park use category – consider more stringent practices for Resource Conservation and controlled areas within other resource management categories

Order of operations – plan mowing activities to progress from areas of low invasion to higher invasion, which may require some advance planning to determine the best strategy for a given park section or VMA.

Control mower discharge – always set mower to mulch or blow into areas with similar level of invasion. Bagging clippings may not be practical, but could be considered to control certain species.

- **Decontamination between sites** – thoroughly wash down equipment (tires, decks, etc.), clothing, and footwear between sites
- **Dedicated equipment** – Using dedicated equipment for problem areas or low levels of invasion could reduce decontamination time.
- **Consider vegetation moisture** – wet vegetation sticks better than dry vegetation, so avoiding mowing activities in early morning or after a rainfall could reduce decontamination efforts.

Managing Coarse Woody Debris

Coarse wood in natural environments provides beneficial wildlife habitat, promotes soil health and recovery, and redirects surface flows. Consequently, presence of coarse wood is an important component of ecological health and is compatible with resource management objectives. In some cases, excessive amounts of coarse wood can be unsightly or become hazardous (e.g., fuel sources for wildfires) and for these reasons it needs to be managed.

Overall, coarse wood should generally be removed from trails in accordance with the strategies and guidance for the designated trail classification and resource management framework category. Coarse wood falling outside of trails may remain unless it presents a hazard or nuisance. Strategies for managing coarse wood accumulations where they cannot naturally decay on the landscape include:

- **Placing cut logs so they are in contact with soil** to promote decay and soil building. Soil moisture and wood density influence the rate of decay. Drilling holes into the wood can accelerate decay and provide beneficial habitat for insects. Placing logs on contours can also be an effective strategy to disrupt flow and control erosion.
- **Stacking cut logs and branches provides habitat**, specifically for insects and reptiles. Stacked wood decays slower than wood in contact with the ground, but stacking wood can be used to manage larger accumulations where it is not practical to redistribute it more naturally. When stacking is necessary target areas where the stacked wood could provide other beneficial uses, such as closing a trail or preventing erosion.
- **Adaptively reuse wood in support of other management objectives in the park.** Coarse wood can be used for trail closures, to create cues, and rebuild soils.

Controlling Erosion

Implementation of an erosion control plan is a critical component of any planned earth disturbing activity and should be performed in compliance with the City’s Erosion and Sediment Control Ordinance.

Erosion is also a concern anywhere flow concentrates on the landscape. This often occurs where water flows along trails, in stream

channels, or soils are compacted due to high recreational use intensity. The overall strategy for managing erosion on the landscape is to provide surface protection (vegetation, matting, straw, leaf duff, etc.) and disrupt flow paths; however, it is important to explore the causes before treating the symptoms. For example, heavy flow eroding a trail on a slope may be justification for closing or rerouting the trail rather than trying to defend it. Some strategies to reduce surface erosion include:

Water Diversion – Installing water bars on trail (e.g., coarse wood placed across the grade to divert flow from the trail) or culverts under a trail to convey water to a naturally stabilized area may prevent flow from concentrating and flowing along unprotected trail surfaces. Water can also be diverted with coarse wood placed on the landscape (e.g., logs placed on a grade to divert flow around a switchback).

Water capture – Capturing water before it gets to the trail often involves manipulating grades to promote storage. A minimally invasive approach is to place logs and other organic debris on a grade and choke with soil – see Hügeltkultur discussion in the Soil recovery section of Facilitating Recovery.

Surface protection – Protecting trail surfaces may mean upgrading the tread to make it more resistant to erosion and use intensity, whereas, the methods discussed below in soil stabilization may be more applicable to establish vegetation as surface protection.

Stabilizing Soil

Following land disturbances, including NNI control activities, soils are susceptible to erosion and vulnerable to invasion in high-risk areas. The following can be used alone or in combination in order of increasing risk:

Temporary seed – use of cover crop to provide temporary cover. Best for sites with a native seed bank and low erosion risk. See soil recovery for more information on cover crops.

Native permanent seed – provides permanent stabilization where native seedbank is lacking.

Should be combined with cover crop and mulch. Refer to section “Reinforce with native seed” above and the list of commonly available seed for revegetation guidance.

Mulch – straw or wood mulch applied to provide surface protection while temporary or permanent seeding establishes.

Erosion control blanket – loose woven degradable coir blanket placed along slope. Performs when in contact with soil. Application in naturalized areas may be enhanced when combined with a layer of straw or wood mulch below.

Coir fiber rolls and coarse wood/logs – Coir fiber rolls are densely packed coir fibers contained in a degradable twine netting that area 12-, 16-, or 20-inches in diameter. Coir fiber rolls are flexible and fairly light to transport opposed to coarse wood/logs, which are heavy and rigid. Coir fiber rolls and coarse wood/logs can be placed on grade and on top of erosion control blankets to assist in stabilizing soil where concentrated flows are contributing to the problem. Once placed they are staked down so they are firmly in contact with the ground.

When using coir fiber rolls and logs for this purpose it is important to slightly angle them with the slope to redirect water and help elongate flow paths and prevent flow from concentrating.

Limiting Pesticide Use

Use of pesticides may be necessary in support of park management and resource management objectives, but their use may harm beneficial insects and other wildlife. Use should be limited, justified, and targeted in accordance with a pest management plan. When pesticide application is necessary, systemic pesticides (e.g., neonicotinoids) should generally be avoided when possible because they have a long residence time in plant tissues, including nectar and pollen that beneficial impacts rely on. Use of non-systemic pesticides is more targeted but should consider timing of applications to minimize harm to beneficial insects.



Adaptive reuse of wood at DE Botanical Garden. Credit: Biohabitats

Engaging Park Users and Volunteers

Outreach and volunteer engagement will be critical components of plan implementation. Specifically, outreach is necessary for park managers to better understand park use that is contributing to problem areas (e.g., why is a social trail there) and educate public on the strategies being implemented and why. Volunteer engagement provides two benefits – First it helps with outreach and second it can increase your capacity to implement certain plan recommendations related to NNI control, resource recovery, and even outreach.

Due to the importance of outreach and volunteer support in the implementation of the plan, it may be beneficial to designate or hire a full or part-time outreach/volunteer coordinator to free up other staff time for other activities.

Outreach – Recreation Use/Intensity

User Surveys (via QR code linked to a form, staff/volunteers posted at trail heads, etc.) help park managers understand specific needs, desires, and behaviors of park users to inform closure of social trails and focal points, provisioning for amenities, and strategies for managing other behaviors underlying the recreational use stressors.



Image Credit: Bill Draper

Volunteer Support – NNI Control

Host recurring events – establishing recurring events builds a foundation for gathering with purpose. Potential volunteers know where and when to gather and if they enjoyed their first event they may recruit friends.

Establish a qualification program to build crew leaders – Staff time may be a limiting factor implementing the plan, so building a network of qualified volunteer crew leads can help with leading recurring events, breaking into groups, or breaking new ground. Participation in recurring events and/or training programs could be used to qualify emerging volunteer crew leads. There could be a range of skills where volunteers could be qualified, for example volunteers could be qualified for one or more of the following:

- **Community organizer** – responsible for coordinating and implementing events
- **Team captain** – responsible for leading a team in a specific activity – cutting, pulling, bagging
- **Naturalist** – someone interested and capable of supporting annual assessment activities and working in more sensitive areas.

Example volunteer training programs include:

Baltimore City Weed Warriors – Baltimore City Recreation and Parks in collaboration with Tree Baltimore – <https://www.treebaltimore.org/weed-warriors-1>

Invasive Area Management Program– Fairfax County Parks Authority – <https://www.fairfaxcounty.gov/parks/invasive-management-area>

Delineate VMAs by risk – resource quality/ level of invasion coding is a good means of delineating VMAs where horsepower is more important than knowledge and skill. Volunteer only crews can be assigned to VMAs low quality/ high invasion (e.g., 1A/B or 2A/B) areas to advance the front or maintain the line. For this approach clear expectations should be set (e.g., must be tended regularly/ once a week/every other week, debris bagged and taken to specified location, groups supply their own equipment, at least one naturalist must be present when working in plot).

The Watershed Institute in Pennington, NJ, runs a successful Adopt a Plot Program (<https://thewatershed.org/become-a-steward-of-the-watershed-reserve/> – accessed 5/19/2025) that could be used as a model.

Advertise opportunities – Get the word out and target specific groups you want to engage with – professional networks, nearby schools and universities, public volunteer events.

Managing White-tailed Deer

Managing white-tailed deer will become increasingly important as sections of the park progress toward recovery. Since JRPS is an open system where deer can freely move in and out, an overall deer management strategy will be an ongoing effort. While both non-lethal (e.g., repellants, fencing, contraception) and lethal (managed hunting) approaches each serve a purpose, the high fecundity and lack of natural population controls for deer, combined with the open boundaries to the park, make non-lethal methods less effective. As a result, lethal means to cull herd size are recommended as the primary strategy to control population size, while non-lethal means can be used to mitigate conflicts (e.g., deer browse on planted vegetation).

Developing a park specific strategy is beyond the scope of this plan, but planning efforts should consider the following:

Understanding the scope of the deer problem in the park

– Hiring a qualified consultant or partnering with a university or resource agency to conduct a deer census and apply scientific principles to determine the carrying capacity for the park. This scope of this census may also consider areas adjacent to the park since controlling the park populations may just create opportunities for deer from other areas to move in.

Conducting interviews with other jurisdictions regarding their programs

– Drawing on the experience of others will help inform the development of JRPS’s program. These interviews should be structured to provide insight on a range of topics including:

- Public perceptions and frequently asked questions to help with outreach regarding the plan
- Means of methods for identifying and qualifying processes for hunters
- The efficacy of their program and challenges they have experienced

Developing a deer management plan – The deer management plan should clearly state the management objectives and sustainable herd size, which will be the basis of the plan. In addition, the management plan should outline the means and methods of management combined with a monitoring and adaptive management strategy. Specific considerations include:

- Who will administer the plan? Administration will involve establishing programs to qualify hunters, issuing notices of park closures and enforcing them, and coordinating the monitoring and adaptive management program.
- What agencies or departments will need to be engaged to support for the plan implementation?
- What methods will be used for culling and by whom? – Managed archery or firearms hunting by qualified private citizens, sharpshooting by law enforcement or wildlife control agents, etc.

- Where is it practical and safe to conduct culling in the park?
- Will the plan be effective if areas adjacent to the park are not managed?
- How will deer population be monitored? This may involve developing methods to monitor success by tracking metrics like resource quality or more comprehensive census.

Interim measures – Developing and implementing a deer management plan may take several years. As a result, interim measures such as fencing and exclosures may be necessary to protect active restoration areas from deer-related stressors until the population can be managed. Refer to Enhancing and Managing Forest for more information on planting exclosures.



Image Credit: Mike Trumbauer

FACILITATING RECOVERY

Facilitating recovery begins when stressors and threats are managed to a level where the resource recovery process (natural or facilitated) can begin and reasonably sustain on a trajectory toward the established recovery objective. The strategies and actions for facilitating recovery will be specific to the impairments and the attainable level of recovery as determined by the rapid assessment. **Table 1** (In Chapter 3) can be used to inform selection of appropriate management actions.

Enhancing and Managing Forest

Forest enhancement and management strategies are undertaken to correct impairments in species, age class diversity, or structure. Forest enhancements should be site specific and may consist of:

Forest thinning

Forest thinning refers to selective tree/understory removal to improve species and age class diversity, allow more light to penetrate and release suppressed understory trees or new plantings. Forest thinning activities should have clear objectives and be performed under the direction of a licensed forester. This strategy may be applicable to managing dense paw-paw stands or systematically removing Norway maple or other invasive canopy species.

Supplemental plantings

Planting of shade tolerant and understory species can improve diversity and structure when the natural regeneration potential is limited. In general supplemental plantings should consider species that are associated with the existing or targeted natural plant community, or based on reference communities and the current JRPS Native Plant List, which is a living document that is adaptively managed based on plant availability and performance. Two planting strategies to support recovery objectives include:

Pod planting – The pod planting is a strategy that uses supplemental tightly spaced, fenced in clusters or “pods” in lieu of traditional restoration planting design methods (e.g., passive and

plantation methods). This method, described in academic literature as “applied nucleation,” can be used as a reforestation strategy in more open areas, using a mix of trees and shrubs, or to revegetate and diversify the understory using only shrubs or herbaceous plants. Tight spacing of plants encourages rapid growth by fueling competition, and the combination of the spacing and fencing keeps deer out of enclosures. It is recommended to mulch the entire ground area of the enclosure to suppress weeds and retain moisture.

These types of plant clusters tend to quickly form dense and multi-layered vegetation patches which serve as valuable structural habitat and seed sources for the surrounding area. Fencing should be at least 4’ tall welded wire, anchored by hardwood stakes or T-posts, and the clusters should not exceed 20’ in any direction. Planting pods can vary in shape, but smaller clusters will be more likely to prevent deer from jumping over the fence. **Figure B-3** shows two possible iterations of pod planting.

Edge enhancements – Dense supplemental plantings along forest edges can reduce reduce light penetration, reduce the susceptibility to invasion by NNI, protect interior core habitats.






Deer Exclosure Pods – Interim strategies such as deer exclosure pods use fencing to reduce deer pressure in discrete areas to facilitate natural regeneration processes in support of recovery objectives while a broader management strategy is underway. Deer exclosure pods can increase/ maintain diversity and structure; individual pods can be laid out discretely or in groups to create “stepping stones” of functioning habitat within the forest interior. Layout of exclosure fencing can follow the guidance in the pod planting detail, and wood stakes and coarse woody debris can be used to breakup interior spaces to discourage deer from jumping over the fence. This strategy will require periodic inspection, maintenance of fencing, and NNI removal. As a long term strategy, a rotational management plan for deer exclosure pods can be developed for a VMA. The rotation would regularly (e.g., annually, bi-annually)

FIGURE B-3: POD PLANTING DETAILS

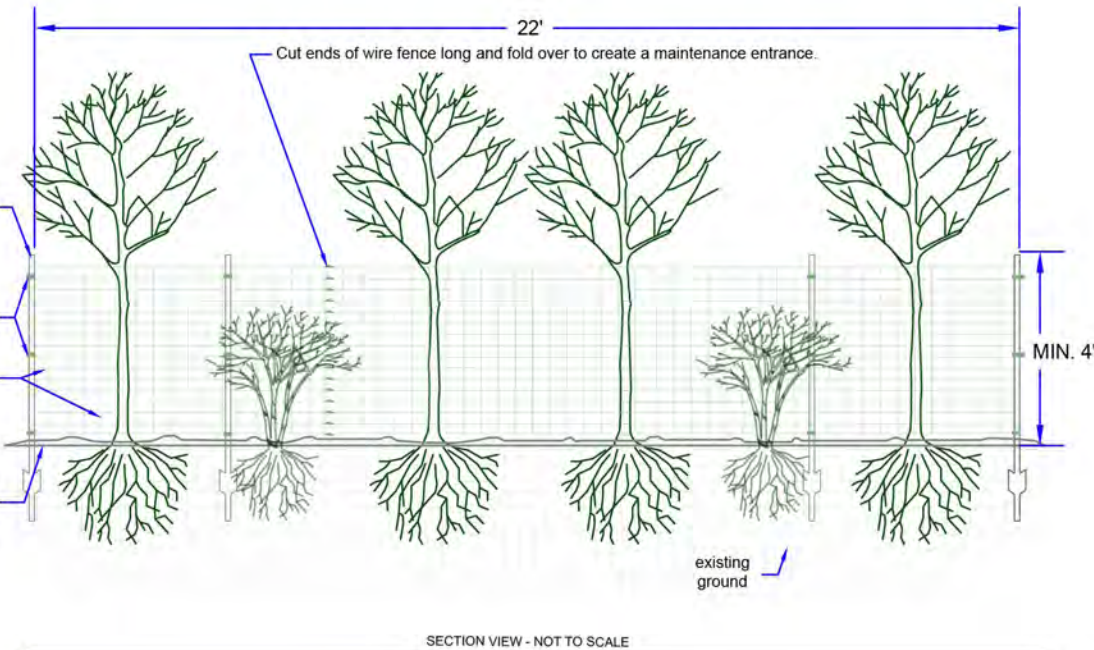
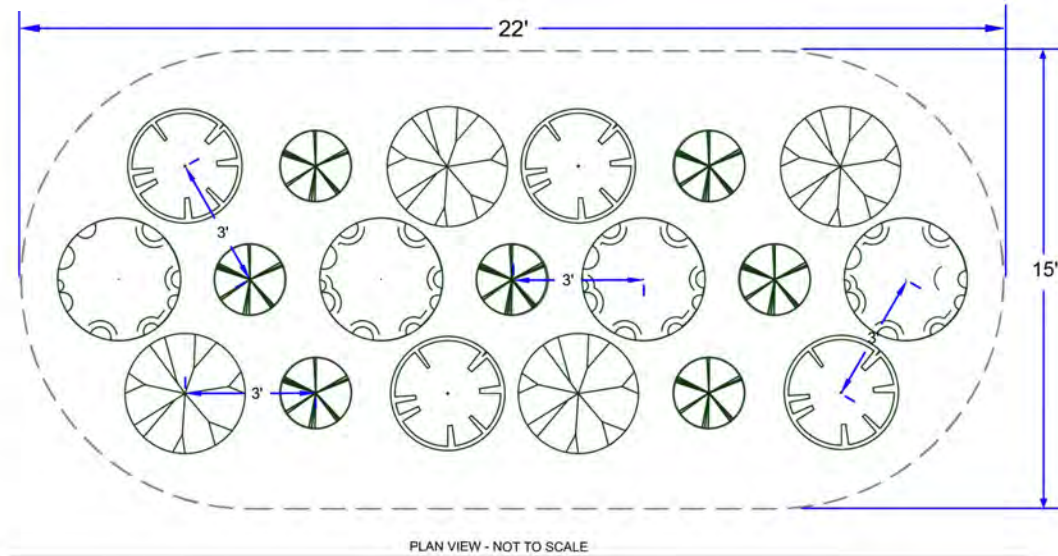
FOREST PODS

Forest pods can be used for reforestation, and as supplemental plantings to enhance structural and species diversity in resource recovery areas.

LEGEND - POD PLANTINGS

-  Late successional tree species
-  Early successional tree species
-  Understory tree species
-  Mixed Shrubs
-  Fencing



All notes listed here also apply to shrub pods.

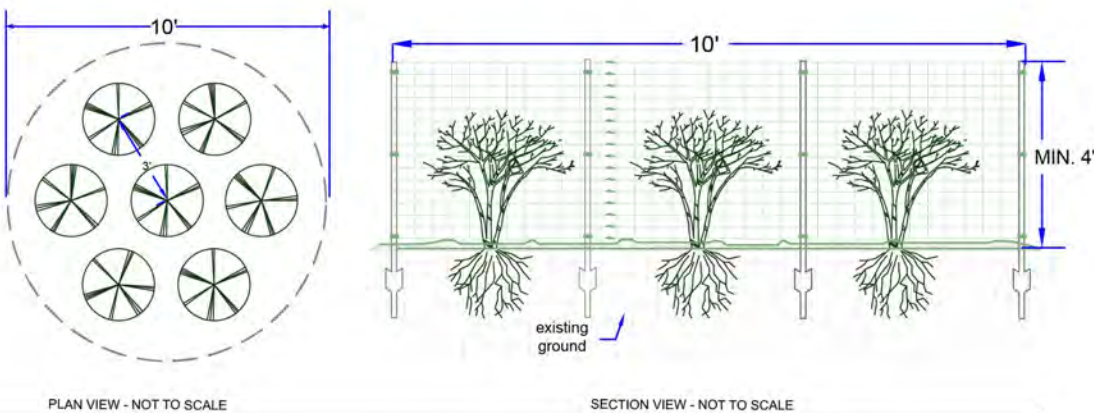


SHRUB PODS

Shrub pods can be used to enhance ground plane and mid-layer structural and species diversity in resource recovery areas.

LEGEND - SHRUB POD PLANTINGS

-  Mixed Shrubs
-  Fencing



establish new pods as a means of creating the “stepping stones” and infilling between “stepping stones” to expand the ecological impact. As pods mature fencing would be removed. The strategy can be adapted to the pace and success of recovery of pods within the respective VMA.

As a complementary effort, the deer exclosure pod strategy can also be adopted as a strategy to manage the level of invasion. NNI would be cleared from the pod and its immediate vicinity and maintained. As a pod reaches its recovery objective, the “advance” strategy could be applied with pods function as mini VMAs and the VMA function as a park section. Alternatively, the pods could be laid out in a series and infilling could occur with a rotational strategy.

BENEFICIAL COVER CROPS

Beneficial cover crops are non-invasive annual plants that establish quickly to prevent erosion and promote soil health. Common cover crops for restoration include:

Rye (*Secale cereale*) - Aug-Dec

Grain oats (*Avina sativa*) - Jan-Jul

Other cover crops like clover can fix nitrogen in the soil and radishes and turnips can help break up soil and add organic matter. Checking for invasive potential is always prudent when considering the use of any non-native seed for erosion control. Cover crops are also recommended to be combined with native seed mix as a first step towards native meadow establishment.

Resetting Recovery Trajectories

Resetting trajectories is a non-selective strategy that involves removing all or most of the existing vegetative cover to reset the successional state of a VMA. This strategy is best applied in VMAs with overall resource quality ratings of 1 or 2 where there is limited potential for natural recovery and a low risk of long-term damage or loss of the resource. Resetting trajectories may involve managing towards the original cover type (e.g., forest to forest) or another more compatible cover type (e.g., forest to meadow).

Reforestation/Afforestation

Reforestation and afforestation strategies establish forest in areas that were cleared or did not previously support trees. Since forest is the dominant land cover in the James River Park System, this strategy is best applied in areas where forest was suppressed or lost to the NNI threat and areas where increasing tree canopy is a priority to provide beneficial shade (e.g., riparian areas, heat islands). Prior to engaging in reforestation/afforestation strategies, NNI should be well controlled since tree planting can make NNI control more challenging.

For reforestation/afforestation, a mix of early and later successional species that are tolerant of the more harsh open growing conditions should be used. Plant selection should consider species that are associated with the targeted natural plant community or based on reference communities and the current JRPS Native Plant List. The pod planting strategy referenced above is also applicable to reforestation/ afforestation areas.

Establishing meadow - Successional landscapes in this region tend toward forested conditions and functioning patches of native warm season grasses/forbs are increasingly rare. Meadows can provide high-quality wildlife forage and shelter in areas where tree canopy cannot be sustained, and are easier to establish adjacent to NNI hotspots where mowing and broad herbicide applications are prescribed.

The Mid-Atlantic Native Meadows: Guidelines for Planning, Preparation, Design, Installation and Maintenance (Sturm and Frischie 2020) prepared by the Xerces Society for Invertebrate Conservation is a comprehensive resource for meadow establishment and management and covers many different landscape scenarios. Establishing meadows in buffer areas adjacent to mid to high quality forested areas and allowing ecological succession to take place over time can also be a long-term reforestation strategy.

Recovering Soil

Soils can be damaged by trampling, compaction, and loss of organic material. This is common in high use intensity areas and along trails and access points. Standard best practices for soil recovery include deep tilling into the subsoil for decompaction with implements like a chisel plow and shallow tilling of surface soils with more conventional tillers to loosen and amend them with organic material. These practices are very disruptive, best applied at larger scales, and not applicable to steep slopes or areas under tree canopy due to impacts to critical root zones. The following less intrusive means of rest and recovery are recommended to promote soil recovery in the more sensitive areas of the park:

Recovering Uplands – Closed trail sections, focal points, and other trampled areas should be made inaccessible as discussed in managing stressors. Soil can be gently loosened by hand and amended with compost or wood chips. Beneficial cover crops may be added to scarified soil to protect soil from erosion, increase organic content, and suppress weed growth during recovery. Permanent seed may also be beneficial, but could be slow to establish. Additional woodchips or straw mulch can be added to the surface to protect soils and increase organic content in disturbed spots, and seed and supplemental coarse wood can be placed to discourage foot traffic and disrupt flow paths to prevent erosion. Soil recovery interventions may need to occur for a few seasons until positive signs of recovery are observed and natural regeneration is detected. If determined suitable,

supplemental native seeding and plantings such as shrubs and understory trees may be added once a site is showing positive trends toward recovery. Supplemental planting of woody species should not be prioritized in locations where the soil is already highly compacted; planting should follow soil recovery.

Recovering Riparian areas – Riparian areas will follow a similar process to uplands, but coarse wood, seed, and mulch are subject to washing away. For this reason, the soil recovery process can be enhanced by adding erosion control blankets to protect organic matter, seed and straw mulch. Additionally, coarse wood can be staked in place with hardwood opposing stakes.

Resetting Trajectories – In some cases, soil conditions may not be supportive of high quality forest cover and resetting the trajectory may be the best strategy. Early successional forest, meadows and grasslands can help repair soils and provide habitat as an interim measure to achieving high quality forest cover as a successional endpoint.

Alternative Approaches – Hügelkultur

–Hügelkultur is a German term for mounded beds constructed from layers of downed wood that are choked with organic materials (leaves, compost, etc.) and capped with soils. Over time the mounds shrink as they decompose and enrich the soil. Hügelkulturs can vary in size and shape to meet site specific constraints and objectives, such as discouraging foot traffic, directing water flows, and rebuilding soils. Furthermore, hügelkulturs can be constructed with park waste materials using volunteer labor.

Further description of Hügelkultur applications and construction is provided in Sustainable Landscapes: Creating a Hügelkultur for Gardening with Stormwater Management Benefits (Luo, et. al. 2020) prepared by the Oklahoma State University Extension.

Monitor and Maintain

Monitoring and adaptive management are means of ensuring the ongoing recovery of the park by using the monitoring results to inform future actions. A simple assessment form that characterizes the Recreational Use/Intensity, Resource Quality (forest and meadow/non-forest), Level of Invasion, and other stressors (Deer Browse, Soil Condition, and Adjacency) is provided in Appendix B.

The rapid assessment should be used to qualitatively assess the status and track the trajectory of all active VMAs annually. Each active VMA should show continual improvement for the parameters that are actively managed in accordance with the recovery objectives and the targets established by the resource management framework category (see **Chapter 3**). Should a VMA not track toward its target, the following action thresholds have been set.

- Overall resource quality rating or any individual stressor rating (e.g., level of invasion, recreational use/intensity) degrades by one category (e.g., functioning at risk to compromised) in a monitoring year.
- Any individual assessment parameter (e.g., diversity, cover, complexity) shows a degrading trend from baseline for two or more consecutive assessment years (e.g., rating slides from functioning at risk to compromised).
- Overall resource quality rating and individual stressor ratings (e.g., level of invasion, recreational use/intensity) show no improvement after 5 years of management.

If an action threshold is exceeded, the management practices should be evaluated to determine what remedial actions are needed to correct the trajectory.

